Student Alignment with Expert Knowledge as a Predictor of Problem Solving Performance

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Abstract

Engineering education is intended to equip students with such skills as analysis and design that are necessary for success in the engineering profession even while universities are under pressure to increase the depth, breadth, and scope of material taught to students. Without drastically changing the structure of the engineering degree, teaching with efficiency is an option that ensures students receive the necessary relevant instruction. To ensure that instruction is cognitively appropriate, a first step is determining the student's current knowledge level. The purpose of this study is to determine if the degree to which a student's problem-solving method aligns with that of experts predicts student ability to solve those problems.

Participating students completed a survey derived from a cognitive task analysis of three engineering design experts. Those responses were analyzed, and a linear regression run to determine if the responses predicted a student's performance on classroom design problems. Results were mixed. The results from the freshmen students demonstrated no correlation between their score on the survey and their scores on classroom design problems. However, the sophomore students did find a predictive relationship, although not completely in the direction anticipated.

The inverse nature of the predictive relationship is worthy of further research to determine if that relationship is indicative instructional procedures tailored to specific classroom objectives or if it is the result of teaching potentially maladaptive skills. Additionally, more research is necessary to determine if the nature of the predictive relationship changes throughout the engineering degree program.

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APPROVAL OF THE DISSERTATION

This dissertation, Student Alignment with Expert Knowledge as a Predictor of Problem Solving Performance, has been approved by the Graduate Faculty of the Curry School of Education in partial fulfillment of the requirements for the degree of Doctor of Philosophy.

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Dedication

This work is dedicated to my loved ones, friends and family who have supported me throughout the long process. My brother, Ray, my sisters Sandra and Cindy, and my father, Ray, have all been instrumental in this endeavor. I also hope my nephew, Michael, knows that his academic journey is unlimited.

Finally, I want to dedicate this paper to the memory of my mother, Mary Eleanor Mitchell. I still miss her every day.

Acknowledgements

As is my tendency, I'll keep the acknowledgements brief.

The University of Virginia faculty and staff provided me with great academic and scholarly role models. I feel privileged for having the opportunity to learn from them.

Dr. David Feldon at Utah State University has been instrumental in this work. He is a generous scholar and a man of integrity. I am grateful for his guidance, and I respect him. Those are high compliments indeed coming from someone who is not an effusive person by nature.

Without the generous participation of extraordinary professors, I would simply have an idea and no results. As if they did not have enough to do, they took on the extra tasks that permitted my collection of data, answered my questions, and were all around good sports. They know who they are; I have omitted their names here to protect student privacy.

Dr. Sherri Messimer at the University of Alabama at Huntsville shared a story in class years ago. She spoke of a construction company that had one man who could accurately predict how much it would cost to complete a project. Unfortunately, he was nearing retirement and was unable to tell anyone just how he arrived at his estimates. This story stayed with me; it was the starting point for the line of inquiry held in this paper. Recently, I was able to thank Dr. Messimer for that story and let her know how she unknowingly guided my academic career.

Last, but certainly not least, I want to thank Dr. Caroline Crawford, Associate Professor at the University of Houston – Clear Lake. Without her encouragement, I would never have considered a doctoral program. She has been my instructor, my advisor, my mentor, and my friend. My mind, my spirit, and my life have all been greatly enriched by her kindness, integrity, and generosity. Needless to say, whenever I count my blessings, Caroline is always on that list.

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Chapter 1: Introduction

Engineering education is intended to equip students with such skills as analysis and design that are necessary for success in the engineering profession. Analysis requires the understanding of each component, subsystem, and system within a product, the associated interactions, and the ability to represent them numerically (Kosky, Wise, Balmer, & Keat, 2006). Design requires the engineer to envision and create a product as well as analyze the suitability of its performance. The engineer must be able to quantify and represent all relevant parameters throughout the product, from component to whole product function. Analyzing each portion of a design prior to hardware development helps to avoid costly and time-consuming hardware, product, and production mistakes by ensuring that the product meets the end-users' needs.

Users' needs are typically analyzed and a solution product (hardware or software) described through *specifications* which are provided to an engineer. The specifications quantify the product's important functions and define hardware or software limitations

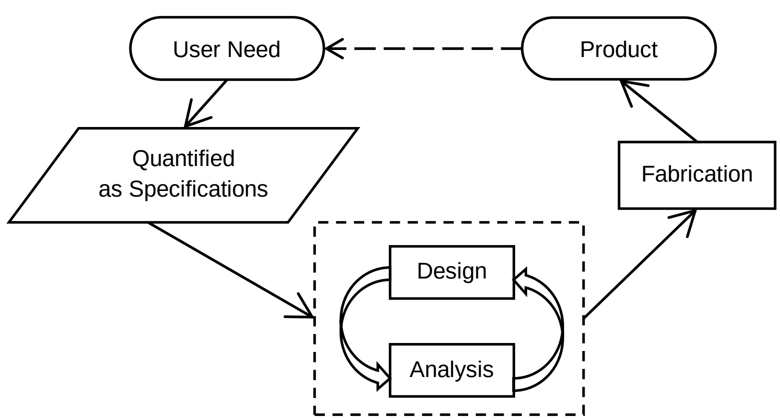

Figure 1. Engineering Cycle

and requirements (Kosky et al., 2006). Throughout the design process, engineers return to analysis to ensure the design meets relevant specifications. Analysis, therefore, is a necessary skill for engineers and is utilized in subsequent higher-level tasks, such as design and troubleshooting—the tasks that make engineers vital in an economy and society. (See Figure 1.)

Engineering Education

> … [T]he issue is *not* simply a need for more educational innovations. The issue is a need for more educational innovations that have a *significant impact* [emphasis in original] on student learning and performance, whether it is through widespread and efficient implementation of proven practices or scholarly advancements in ideas, methods, or technologies. (Jamieson & Lohmann, 2012, p. 5)

Changes in Engineering Education

Universities are under pressure to increase the depth, breadth, and scope of material taught to students, even while some universities are reducing the total number of hours required for graduation (Jamieson & Lohmann, 2012). Either factor will result in an “overcrowded” curriculum for colleges of engineering. To alleviate this overcrowding, some academics recommend a major change in the engineering education process: making the bachelor’s degree the “pre-engineering degree” and requiring a master’s degree to practice, much like other professions (National Academy of Engineering, 2005). In absence of such a change, a university’s choices are limited. Increasing the content while maintaining current teaching methods risks student failure and higher attrition. Maintaining current levels or decreasing the content risks reducing the value of the degree. Fortunately, another option exists: increasing content coverage while increasing the efficiency with which it is taught.

A report from the American Society of Engineering Education (Jamieson & Lohmann, 2012) strongly encouraged the engineering community as a whole to utilize the educational practices that have already been proven effective – not only from educational research in general, but also in research and practices developed for engineering education specifically. With so much educational research already being performed, taking advantage of known principles permits engineering educational advancements without spending resources on overlapping original research. This utilization allows sufficient resources for educational innovation in specific engineering content areas while making advances in pedagogy that will allow instructors to efficiently equip engineers with the skills necessary to address the complex problems with which they are faced (Litzinger, Lattuca, Hadgraft, & Newstetter, 2011). The study of expertise is one such area from which engineering education can benefit, especially if one considers engineering education to be the starting point for achieving engineering expertise.

In recent years, universities have been under pressure to increase the output of engineers in response to a perceived engineering shortage, a situation that apparently goes back almost a century (Bauer, 1918). More recently, *Rising Above the Gathering Storm* suggested critical action was necessary to prevent the United States from losing economic and military standing due, primarily, to other nations drastically out-producing engineers (Augustine, 2005). However, there is doubt about the accuracy of the numbers reported (Bracey, 2006; Gereffi, Wadhwa, Rissing & Ong, 2008), which in turn casts doubt on the report's conclusions. If universities provide a rapid increase in engineering graduates, it must be done with caution to assure that such an increase will not come at the cost of educational quality. Either way, high quality and efficient engineering education is necessary.

Statement of the Problem

As students learn, their instructional needs vary. Optimal instruction for novices can interfere with learning for more proficient students (Kalyuga, Ayres, Chandler & Sweller, 2003). This expertise reversal effect occurs when scaffolding and explanations in instructional materials that benefit novices impose unnecessary burdens on the working memory of more advanced students, imposing extraneous cognitive load. However, if insufficiently supportive instruction is provided, students may fail to learn necessary content or fail to learn it efficiently. For maximal instructional efficiency, instructional content should be as closely tailored to the student's learning needs as possible. Unfortunately, most learning environments do not have access to appropriate real-time assessments necessary for measuring cognitive load (Kalyuga, 2007).

To determine what an appropriate assessment tool would be, we must take into account three facts regarding engineering education. First, the primary goal of engineering education is to produce workers who can practice the complex task of engineering, defined as "the application of science, mathematics, and technology to the design, fabrication, and use of practical devices and systems" (Gross & Roppel, 2012, p.3). These workers are able to use broad, adaptable knowledge in addressing complex and often novel problems (Litzinger et al., 2011).

Second, the student is a novice, and the undergraduate engineering degree program is the “foundation upon which expert engineering practice can be built” (Litzinger et al., 2011, p. 124). Third, novices and experts differ in their approaches to solving problems. Experts tend to be fast, make few mistakes, and spend more time analyzing a problem qualitatively before solving it – comparing the features of a problem to an existing schema, determining salient features, and planning a solving strategy. Experts view problems from a higher-level perspective of the domain, while novices sort problems based on superficial characteristics (Glaser & Chi, 1988). For example, given a problem involving a block on an inclined plane, the expert may classify the problem as a “conservation of energy” problem, whereas the novice may classify it as an “inclined plane” problem (Larkin, McDermott, Simon, & Simon, 1980). Because the purpose of engineering education is to advance students further along the expertise continuum, an assessment tool could be devised to examine how closely the novice’s (student’s) approach to a problem aligns with experts’ approach. Understanding how closely a student’s strategies align with an expert process could guide instructors in selecting appropriate levels of explanation and scaffolding to efficiently meet their students’ learning needs.

Purpose of the Study

The purpose of this study is to determine if the degree to which a student’s problem-solving method aligns with that of experts predicts student ability to solve those problems. This assessment strategy focuses on the degree to which a student's *approach* aligns with that of experts to determine the state of students' process knowledge more quickly and more precisely than evaluating their problem-solving performance. Previous studies (e.g., Kalyuga & Sweller, 2005; Kalyuga, 2006) have demonstrated the advantages of measuring the learners' approach for assessment. Those researchers were able to provide insight into the cognitive structures of learners with the primary purpose of providing cognitively appropriate instruction. By analyzing the student's first step toward solving a problem viewed for a brief time, the researchers determined participants' knowledge levels relevant to that particular problem. By assessing how a student starts a problem, it is possible to determine how much a student knows about the domain, because "[d]ifferent first-step responses would reflect different levels of acquisition of the corresponding schematic knowledge in the learner's long-term memory" (Kalyuga, 2006, p. 739).

The focal assessment in the current study attempts to gain insight into students' knowledge structures as well, but it targets students' approaches to multiple aspects of design and then compares those approaches to known expert approaches. The assessment instrument is derived from a cognitive task analysis (CTA) from three expert engineers who were interviewed regarding their approach to design, testing, and troubleshooting to assess students on the same constructs (Holmes & Feldon, 2014). See Appendix C for the full Cognitive Task Analysis Product. Student responses to survey items are compared by regression analysis to the scores on course-based design problems to assess its predictive validity.

Research Question

This study was designed to answer the following research question:

Given an assessment based on expert Cognitive Task Analysis, is student alignment with experts' approaches associated with stronger classroom performance on relevant problems as measured by the scores on short design problems?

Significance of the Study

Whether there is truly a national shortage of engineers (Augustine, 2005) or not (Teitelbaum, 2008), the fact remains that engineering skills are important for a nation's economy — for innovation and adding value to raw materials (Duderstadt, 2007) — and its security – for utilizing changing technology in defense of the nation (Coffey, 2008). With such significant impact, engineering schools are obligated to provide appropriate, high-quality preparation for engineering students, preferably in greater numbers, while avoiding the mistake of increasing the quantity of engineering graduates by sacrificing educational quality (Gereffi et al., 2008). Unfortunately, implementing high-quality programs is becoming more difficult with recent changes, particularly the broadening of engineering curricula (Jamieson & Lohmann, 2012). Through the process suggested in this study, there is potential to increase the efficiency of teaching through the use of diagnostic assessment thereby reducing the potential negative impacts of automating incorrect procedures and the expertise reversal effect. Additionally, it could provide a model for rapid assessment and tailoring instruction for training, thus providing institutions or corporations a route for reducing training costs or increasing instructional efficiency.

Limitations

The university where this study was performed is a research extensive, public university with a relatively homogenous population; therefore, the student participants may not be representative of engineering students across the United States or in other types of institutions. However, expertise is a shared trait distributed unequally among the population; therefore, the testing should provide valuable insight. Additionally, studies of expertise are applicable to a variety of fields, and studies of rapid assessment with expertise may prove useful to other learning domains and learning environments.

There are further limitations. As with all voluntary surveys, response rate may impact results. Those who choose to respond may have different abilities or traits that could impact the constructs of interest. Also, there is some risk that a respondent's actual behavior differs from reported behavior, though that risk is lower in novice populations (Berry & Broadbent, 1984; Broadbent, Fitzgerald, & Broadbent, 1986). These limitations are present in most surveys, but the potential for improved understanding outweighs the risks.

Definitions of Key Terms. This study is based on the theoretical framework of cognitive psychology. There are several key terms that are used to discuss and develop the theory. For clarity, those key terms will be defined here.

Short term memory. Short term memory is a simple mental buffer for information that can be kept for a brief time before fading occurs (Baddeley, 2012). Short term memory is further limited by the number of items that can stored, ranging from around four (Cowan, 2000) to around seven (Miller, 1956).

Working memory. Working memory is similar to short term memory in storage capacity and duration, but unlike short term memory, allows for calculation, comparison, and manipulation of items. Unless information is pulled into working memory, it is not consciously known (Sweller, van Merriënboer & Paas, 1998).

Chunking. Chunking is a method for allowing more information to be stored in working memory (Cowan, 2000). Consider, for example, a person wants to remember the numbers 2, 0, 1, and 6. The individual numbers could take up four slots in working memory, or could be chunked into "20" and "16" or "2016". By grouping items in such a manner, working memory capacity is improved.

Long term memory. Long term memory is effectively the permanent memory storage in humans. Information held in long term memory is not conscious unless it is pulled into working memory.

Schema. Schemas are "abstract structure[s] of information" (Anderson, 1984, p. 5) stored in long term memory which enable the organization, storage, and retrieval of knowledge. Additionally, they serve to increase working memory because, as a single element in working memory, they increase the complexity and amount of information accessible (Sweller et al., 1998).

Declarative knowledge. Declarative knowledge consists of "facts about objects, events and situations" (Chao & Salvendy, 1994, p. 222).

Procedural knowledge. Procedural knowledge consists of "information about courses of action" (Chao & Salvendy, 2994, p. 222).

Cognitive load. Cognitive load is total the burden imposed on working memory by learning from instruction (Paas & van Merriënboer, 1994)

Intrinsic cognitive load. Intrinsic cognitive load is the load imposed by the task itself, including number of elements, calculations, manipulations and other interactions (Paas, Renkl, & Sweller, 2003).

Extraneous cognitive load. Extraneous cognitive load is ineffective additional cognitive load imposed by poor instructional design that inhibits learning and schema construction (Paas et al., 2003).

Germane cognitive load. Germane cognitive load is cognitive load imposed by instructional design that actually promotes learning and schema construction (Paas et al., 2003).

Chapter 2: Literature Review

The purpose of this literature review is to examine the relevant variables and constructs of cognitive task analysis and expertise to inform the study described in Chapter 1. The primary literature of interest is from the field of cognitive psychology and cognitive task analysis, with an emphasis on how each is related to performance in general and classroom performance in particular.

First, the literature on cognitive load theory and its importance in an educational setting will be reviewed. Second, the literature relating to how skills and knowledge are acquired will be examined. Third, I will discuss the construct of expertise and why it impacts both performance and education. Finally, I will review cognitive task analysis and its potential benefits for learners.

Cognitive Load Theory

Cognitive psychology operates under the premise that humans have a severely limited amount of conscious memory (i.e. short-term memory) available with which to work, an almost unlimited long-term memory, and an organizational memory system that permits the different types of memory to function together to permit problem-solving and learning. The severe limits to conscious memory dictate that instructional material should be delivered in an appropriate manner to avoid cognitive overload, which is detrimental to learning by hindering schema formation and elaboration (Sweller et al., 1998).

Short-term memory (STM) functions as a "temporary storage of information" (Baddeley, 2012, p. 4), a mental buffer, or a place where unprocessed input is held for a limited amount of time. According to CLT, humans have limited STM, and are only able to hold a limited number of things, or "chunks", in STM at a given time, without rehearsal, before the information fades (Cowan, 2000). The exact size of this buffer is still debatable. Miller's (1956) "magical number seven, plus or minus two" is often referenced, even in popular culture. Cowan (2000) argued that the number is closer to four.

Closely related to (and often used interchangeably with) STM is working memory. Working memory is referred to as one's focus, attention, or "consciousness" (Sweller, van Merriënboer & Paas, 1998). This memory is where the mental work is done; it acts like STM with the enhancement of manipulation or the ability for calculation. Working memory capacity is reduced whenever information is manipulated because the manipulation itself requires working memory. Chunking is one way to expand working memory.

A chunk (or element) is that which requires a slot in working memory (Cowan 2000). Probably different for each person, chunks vary in the amount of information they hold. This amount is a function of an individual's acquired knowledge in the form of schemas, with one schema taking up a single chunk in working memory. More complex and better-elaborated schemas contain and integrate more information into a single chunk that can be used to recognize and retain knowledge in meaningful ways. Consider, for example, a chessboard set at the starting position, except that the white King and Queen have been place-switched. For someone who has never seen a chessboard, that information could easily overload available working memory if each piece location occupied one chunk. For someone well acquainted with the game, many or all of the piece locations could occupy a single chunk (Chase & Simon, 1973). This increase in the information held in each chunk is possible because of the way it is stored in long term memory.

Long term memory (LTM) allows permanent storage of information. Because working memory is where one's focus or consciousness is, one is unaware of information in LTM until it is retrieved into working memory. Within LTM, the information is stored in schemas, complex structures that organize knowledge and change as learning occurs.

Schema Construction and Automation

Information in LTM is organized in structures called schemas. As learning occurs, schemas are changed and become more complex. Consider the example of reading. The very complex schema for reading allows not only the recognition of letters, words, and phrases, but also allows for reading different fonts and handwriting. This complex schema has been constructed and modified with years of learning (Sweller et al., 1998). If this information existed as individual elements, it would overwhelm working memory (van Merriënboer & Sweller, 2010). But stored as a schema, it can be utilized in working memory as a single element.

After extensive practice, a schema can become automated so that "familiar tasks are performed accurately and fluidly" (Sweller et al., 1998, p. 258) without occupying the limited space in working memory, thereby freeing valuable room to consciously address more complex or unfamiliar tasks. These processes of schema construction and automation allow learning, efficient performance of tasks, and complicated problem solving. Therefore, instructional content should be designed to maximize schema construction and automation (van Merriënboer & Sweller, 2010). To do so, the learner's cognitive load must be considered a priority when presenting instructional content.

Cognitive considerations in instructional design

Cognitive load is the amount of effort required to perform a task in working memory (Paas & van Merriënboer, 1994). If learning is to occur, the cognitive load imposed on the learner cannot exceed the learner's WM capacity (Sweller et al., 1998). In other words, if WM capacity is exceeded, *none of the effort expended by students actually contributes to learning*. Given this simple fact, cognitive load considerations during instruction must not be overlooked.

To fully address the cognitive load of instructional content, one must consider the various types of cognitive load. There are at least three distinct types of cognitive load in instructional content: intrinsic, extraneous, and germane (Sweller et al., 1988). First, *intrinsic cognitive load* is imposed by a problem itself, and it is dependent upon the level of interactivity between the problem's elements. For example, learning individual vocabulary words in a language has few interactive elements and imposes a low cognitive load, while learning the grammar constructs of a language requires more interactivity and therefore imposes a higher cognitive load.

Second, *extraneous cognitive load* is unnecessary and unproductive load imposed by instructional design, which inhibits learning. Consider a geometry problem with an illustration and a written problem statement. If the information necessary to solve the problem is divided between the two sources, the learner must integrate the information prior to solving the problem, therefore increasing extraneous cognitive load. Because extraneous cognitive load also occupies working memory, schema development is inhibited, contrary to the purpose of instruction. The third type of cognitive load, *germane* cognitive load "is related to processes that directly contribute to learning, in particular to schema construction and rule automation" (Kirschner, 2002, p. 206). Germane cognitive load can be increased by having the learner solve problems in a random manner, answer questions relevant to readings, or offering examples in a completion format. Each of these tasks requires the learner to interact with or manipulate the material, and therefore assist in the development of schemas (Sweller et al., 1998). It is vital to remember that all sources of cognitive load are additive, and exceeding working memory capacity is detrimental to learning and schema growth.

As a learner's schema develops, more information is stored in long-term memory and the learner's cognitive load is reduced (Sweller et al., 1998) because the information in the schema functions as a single element in working memory (Paas et al., 2004). The instructional design of materials can create cognitive load that either contributes or detracts from learning: germane cognitive load contributes to schema construction whereas extraneous cognitive load inhibits schema construction (Paas, Renkl, & Sweller, 2003). For example, germane cognitive load may be induced by requiring a learner to perform calculations, where extraneous cognitive load may be induced by poorly written instructional text.

Instructional design should appropriately handle the intrinsic cognitive load, enhance germane cognitive load, and reduce extraneous cognitive load. If learning (schema construction) is to occur, all three types of cognitive load cannot exceed WM capacity. Because all learners' schemas develop differently, it is difficult to achieve this balance, as the expertise reversal effect occurs when instructional features that provide germane cognitive load for novices cause extraneous cognitive load for more advanced learners (Kalyuga et al., 2003). For example, consider a course delivered via computer. Pop-up windows that provide detailed explanations of calculations may help a novice, but could hinder the learner who already understands those steps. When teaching students with widely varying abilities, the expertise reversal effect may severely impact student learning. Ideally, cognitive load would be measured during instruction, but doing so is inexact, potentially distracting, and generally unfeasible for most college courses.

The type of instruction provided also impacts cognitive load. Some material is so complex that learning the process as a series of partial tasks would result in cognitive overload when the attempting to integrate the parts (van Merriënboer, Clark, & de Croock, 2002). Whole-task learning reduces this risk. For example, training for air traffic controllers may start with a single runway and a single departing aircraft. As that whole task is mastered, a single landing aircraft is added. By building complexity of the whole task, training can ultimately include multiple runways and aircraft. Other material may require the use of scaffolds as learning aids. As the student progresses, the scaffold use fades to avoid the expertise reversal effect (Kalyuga et al., 2003).

Furthermore, instruction and practice should be utilized to help a learner develop more expert-like skills for commonly occurring tasks. As such, the skills will be executed more efficiently and occupy less space in working memory. Therefore, learners can then work on developing controlled (not automated) schemas for unusual or effortful tasks (Kester, Kirschner, van Merriënboer, & Baumer, 2001).

Cognitive Skill Acquisition

Stages of Skill Acquisition

In the discussion of skill acquisition, it is imperative to differentiate between declarative and procedural knowledge. Declarative knowledge consists of facts; it is the knowledge "that something is…." Procedural knowledge consists of knowledge regarding how to perform tasks; it is the knowledge "how to …." Procedural knowledge utilizes declarative knowledge as well as a set of rules, guidelines, or motions to accomplish a given goal (Chao & Salvendy, 1994).

Acquiring cognitive skills can be likened to the three phases of acquiring physical skills described by Fitts (1964). The three steps are referred to as the *early*, the *intermediate*, and the *final* phases (VanLehn, 1996) or the *declarative stage*, *knowledge compilation*, and *procedural stage* (Anderson, 1982). VanLehn and Anderson agree that the first stage involves acquiring declarative knowledge with no attempt to apply it. Both authors agree that problem-solving begins in the second phase, when declarative knowledge slowly converted to procedural knowledge. VanLehn posits that learning continues through the second phase allowing greater depth and breadth of abilities, while the third phase primarily consists of practice intended to improve speed and accuracy and develop automaticity. Anderson, however, states that knowledge compilation is a transition, and that the final, procedural stage involves further learning and differentiation as well as practice.

With practice and experience, learners can skip steps in solving problems (Blessing & Anderson, 1996). When the rules or procedures for a type of problem are new, the learner will execute each step in order. As they develop experience, they begin to compile new rules for problems by using their solutions as examples. At first, the steps may be skipped *overtly*, meaning that they are not writing all the steps out, but are performing them mentally. With experience, they begin to skip steps *covertly* by not even performing the steps mentally. As this process continues, learners' schemas develop, and with sufficient subsequent practice, the solution procedure will become automated.

Transfer of Learning

Bransford and Schwartz (1999) discuss two types of transfer "sequestered problem solving", and "preparation for future learning" (p. 68). In sequestered problem solving (SPS), tasks require far-transfer, direct applicability, and the subject is allowed no external resources. In preparation for future learning (PFL), original content serves as a foundation. From the PFL perspective, one does not need to rely solely on prior knowledge to solve a problem. Instead, one uses prior knowledge as a basis for acquiring further knowledge to solve the new problem. Hereafter in this paper, the more generous PFL perspective of transfer will be used.

Problems typically addressed by engineers tend to be complex and/or novel (Litzinger et al., 2011). Addressing these problems requires creative (Jamieson &

Lohmann, 2012) use of mathematic and scientific principles, a process which requires engineers to readily transfer prior knowledge (Litzinger et al., 2011). To transfer knowledge to a variety of situations, superficial comprehension and a novice's approach to problem solving are insufficient (Kalyuga, 2009). Instead, one must possess deep structural knowledge (Barnett & Ceci, 2002), self-regulation performance strategies, and metacognitive skills (Kalyuga, 2009). In other words, experts' knowledge structures are far more suitable for transfer than novices' knowledge structures. The more expert-like the knowledge, the more likely transfer is to occur because greater depth of knowledge and decreased load on working memory due to automaticity allow more working memory to be available to manipulate information and search solution spaces.

Deep learning occurs when schema development is encouraged through careful instruction. To encourage deep learning, WM load should be balanced between germane and intrinsic load. Whole-task instruction and worked examples can help foster deep task understanding for novices, and this deep understanding is required for transfer. As a learner's problem-solving skills improve, worked can limit gain. Greater gains can be made by using completion problems or other types of faded scaffolding, ultimately transitioning to unguided problem solving (Kalyuga, 2009).

Expertise

Authors are still debating the definitions of "expert" and "expertise" (Feldon, 2007b; Hoffman, 1998), but throughout the literature, there are recurring traits or characteristics that describe an expert and expert performance, particularly in relation to novices. First, experts tend to excel primarily within their own domain. For example, medical expertise does not automatically transfer to architectural expertise: the expert has superior *domain* knowledge, not necessarily superior thinking. Experts perceive large patterns and can make interconnections within their domain, primarily as a result of the organization of the expert's knowledge as opposed to his or her perceptual ability (Glaser & Chi, 1988). Given a set of circumstances, the expert can perceive a variety of stimuli, recognize it as a pattern, and be able to utilize the pattern by understanding how it relates to other information in regards to the domain. This expert pattern recognition allows large amounts of information to be perceived and processed so quickly that it may give an outside observer the impression of intuition (Glaser, 1985).

Experts represent domain problems at a deeper, more principled level (Glaser, 1985). For example, an expert and a novice were given a physics problem consisting of a block on an inclined plane. The expert deemed it a mechanics problem utilizing the conservation of energy and Newtonian force laws. The novice, however, deemed it an inclined plain problem. The former classification was based on the principles necessary to solve the problem, whereas the latter classification was superficial.

When given a problem, experts spend a substantial amount of time qualitatively analyzing the problem prior to developing a solution. During this phase, experts will question their understanding of the problem features and attempt to make sense of the problem, creating a mental representation that includes complex relationships and constraints. After building the mental representation, experts then solve the problem more quickly and with fewer errors than novices. This speed stems from extensive practice that allows experts to a) have more mental resources to solve problems, or b) to recognize the problem from previous experience. Additionally, the expert is adept at self-monitoring, being more aware of when they make mistakes, how difficult a problem actually is prior to solving, and the amount of time it will take to reach a solution.

Expert performance, especially in cognitive tasks, is not due to innate ability, but is acquired through deliberate practice (Ericsson, Krampe, & Tesch-Römer 1993). Deliberate practice must (a) be specifically tailored to current performance and knowledge level, (b) offer immediate feedback to performance, and (c) be repeated on the same (or very similar) task (Ericsson et al.,1993). Through deliberate practice, performance increases according to the power law (Anderson, 1982) as illustrated in Figure 2. Deliberate practice requires conscious, focused exertion with the intent to improve performance, and is so fatiguing (Ericsson, 2009) that it is of limited duration, therefore slowing the rate at which a person can attain expertise. Further limitations come from the type and timing of feedback; the feedback must be sufficiently tailored to the performance to suggest specific improvements. In trying to answer the question of exactly how long it takes to become an expert, Simon and Chase (1973) suggested that it takes approximately ten years to attain expert status; even Bobby Fischer took nine years to attain such status. Ericsson is often credited with authoring the 10,000-hour rule, but he denies ownership of the concept and insists that expertise depends on deliberate practice as opposed to merely engaging in an activity (Ericsson, 2013). Therefore, the correct answer would be, “It depends.”

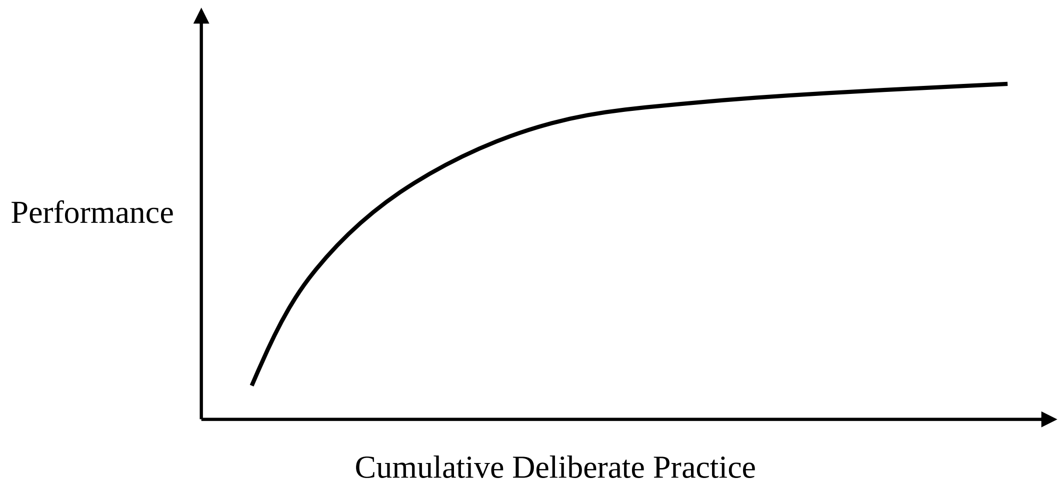

Figure 2. Sample Power Law Curve

Finally, experts limit the solution set in which they search. This "extreme adaptation to task constraints" (Ericsson & Lehmann, 1996, p. 291) is evidenced by experts' processes prior to performance: the qualitative analysis, perception of salient cues, ignoring less efficient possibilities, and logical formation of a solution plan.

Cognitive Perspective on Expertise

Expertise can be explained through the perspective of cognitive psychology. Doing so provides a framework around which the nature of expertise can be readily grasped.

Automaticity.

Automaticity occurs when a specific stimulus – whether perceptual (Schneider & Shiffrin, 1977) or goal-based (Bargh & Ferguson, 2000) – prompts a cognitive response without requiring an individual's control or utilizing cognitive resources such as working memory (Schneider & Shiffrin, 1977; Feldon, 2007a), typically as the result of extensive, consistent practice or repetition (Anderson, 1982; Logan 1988). Automaticity is described as a process that (a) is unintentional and unconscious; (b) continues through to completion with little additional input; and (c) is faster than processes requiring conscious attention (Moors & de Houwer, 2006). Behaviors or actions completed through automaticity are, therefore, more efficient than those requiring cognitive processing within working memory, but they are also more difficult to modify (Feldon, 2007b). In fact, deliberately monitoring automated processes increases the likelihood of failure in what is known as the explicit monitoring theory of "choking" (underperforming when under pressure) (Beilock, Bertenthal, McCoy, & Carr, 2004).

Discrimination in attending to germane stimuli and disregarding extraneous cues is necessary if automated processes are to be appropriate and serviceable, as opposed to dysfunctional. The automated processes may need to run sequentially, after attending to relevant environmental cues, or the automated procedures may eventually be refined to the point that necessary decision points are also automated (Feldon, 2007a).

Strategies and decision points.

Expert knowledge tends to be procedural (Glaser, 1985), and can be represented by If-Then productions which pair a decision with action(s) (Anderson, 1982). These decision points are vital to an expert's problem-solving skills. If the procedural knowledge is automated but eliminates the decision points, routine expertise develops (Hatano & Inagaki, 1986). With no conscious decision points, routine expertise can be maladaptive or counter-productive. On the other hand, adaptive experts either automate their decision points, make decisions then perform automated procedures in a series, or do both in parallel (Feldon, 2007a). Discrimination in attending to germane stimuli and disregarding extraneous cues is necessary if automated processes are to be appropriate and serviceable, as opposed to dysfunctional. The automated processes may need to run sequentially, after attending to relevant environmental cues, or the automated procedures may eventually be refined to the point that necessary decision points are also automated. Adaptivity can be achieved through careful instruction in both the procedural and declarative knowledge necessary for the task, as well as emphasizing the importance of the decision points throughout the task. Faulty automation of decision points will almost certainly result in less adaptable expertise.

Experts use different strategies than novices for solving problems (Glaser, 1985). Using forward reasoning supported by highly developed domain schema, experts understand problems based upon domain principles, use deductive reasoning, and conceptually manipulate problems' relevant elements to determine a theoretically sound solution (Feldon, 2007b). Novices, however, reason backward, overestimate the importance of surface features, and underestimate the importance of domain principle.

Limitations of expert self-report.

Automated skills operate outside of conscious working memory and are therefore difficult to monitor (Moors & de Houwer, 2006) or verbalize (Feldon, 2010). The feature of effortless performance found with automaticity, often considered a hallmark of expertise, impede experts' ability to deliver accurate, full-featured descriptions of their cognitive processes (Feldon, 2007b). Johnson (1983) discusses how neither the diagnosing physician nor the improvising jazz master can share his own process, but each performs expertly on demand. When such experts do give explanations it is often inaccurate; they either omit steps or fabricate a reasonable explanation because they *do not know* how their performance is generated (Feldon, 2010). As Lewicki, Hill, and Czyzewska (1992) stated, "In hardly any experimental procedure do cognitive researchers assume that they can directly learn how humans process information by simply asking them to report the contents of the procedural knowledge they follow" (p. 796). It is not until performance information is elicited through a more structured method, such as cognitive task analysis, that the expert is sufficiently prompted to pull knowledge into working memory so it can be consciously accessed for complete discussion (Feldon, 2007b).

Dissociation of procedural and declarative knowledge.

In addition to procedural knowledge that is inaccessible through automaticity, some portion of procedural knowledge remains hidden because it was *acquired* unconsciously (Lewicki et al., 1992). Consider Maier's (1931) classic experiment involving problem solving. Participants were asked to determine four different methods of grasping two cords hung from the ceiling at some distance apart, and tying them together. If participants were not able to determine one particular method, the researchers walked through the laboratory and subtly brushed against one of the cords causing it to swing. Participants then were able to quickly solve the problem, but typically had no recollection of the cord's motion or how they were able to come up with the solution.

One participant who did not remember the motion reported that he thought of "monkeys swinging from trees" (Maier, 1931, p.189) and was then suddenly aware of his solution.

Further studies (e.g., Berry & Broadbent, 1984; Lewicki, Hill & Bizot, 1988) discuss the differences between procedural knowledge and verbalizable, declarative knowledge – performance improvements are not reflected in self-report. This trend holds true in cognitively normal people as well as those suffering from some types of amnesia, which suggests that the memory systems for procedural and declarative knowledge operate independent of each other, and that procedural knowledge does not necessarily have to process through conscious working memory (Cohen, Eichenbaum, Deacedo, & Corkin 1985).

Cognitive Task Analysis

Overview

Cognitive Task Analysis (CTA) is a general name for a variety of techniques that are used to elicit the information, knowledge, and method of performing a given task (Chipman, Schraagen & Shalin, 2000) from experts. As an extension of time and motion studies of manual labor, CTA addresses an observable action by determining the procedural and declarative knowledge, decision points, and strategies necessary for its appropriate completion (Feldon, Warren, & Rates, 2015).

General process

Several authors describe a general procedure for CTA that encompasses roughly the same steps (Clark, Feldon, van Merriënboer, Yates, & Early, 2008, Clark, 2006, Chipman et al., 2000). These steps assume that a preliminary needs analysis has been performed and indicates a need for the type of in-depth knowledge garnered from CTA. Once that need has been established, the CTA proceeds in roughly the following manner:

1. Preliminary Phase
2. Identify Knowledge Representations
3. Elicit Knowledge
4. Analysis and Verification of Data
5. Formatting and Use

Preliminary phase. Beginning with the preliminary phase, those who will perform the CTA on experts should gather enough information to have a general knowledge about the field (Clark et al., 2008), especially learning the vernacular of the field – the vocabulary, the acronyms, and the idioms used by the experts (Chipman et al., 2000). Additionally, it is necessary to select the experts who will provide the information. To gather a complete and unbiased comprehension of the domain, at least two and preferably three experts should be utilized as knowledge resources (Chao & Salvendy, 1994, and Clark et al., 2008) because a single expert may have an idiosyncratic understanding of the domain, and can only provide between 21 and 53 percent of the knowledge base (Chao & Salvendy, 1994). Adding additional experts increases the breadth and depth of information, as well as providing balance for any idiosyncrasies given by only one expert (Chao & Salvendy, 1994; Acton, Johnson & Goldsmith, 1994).

Identify knowledge representations. At this point, the analyst should develop a basic understanding of the nature of the knowledge to be provided, e.g., procedural, declarative, conceptual (Chipman et al., 2000). Also, the primary task that is of interest should be mapped by dividing it into subtasks and identifying the type of information necessary to perform each. As the CTA develops, this initial representation may change in an iterative fashion. Once these have been developed, the analyst should take time to determine the type of CTA that will produce optimal results for this particular set of knowledge structures (Crandall, Klein, & Hoffman, 2006).

Elicit knowledge. The actual CTA will be performed to elicit the knowledge from the experts. This elicitation is typically in the form of structured or semi-structured interviews, live and/or recorded observation, self-report through surveys or journals, autonomic response, or automated capture of computer data, or some combination of these techniques. The knowledge is captured in response to the performance or discussion of a task, whether it is an actual on-the-job task, a simulation, a past event, or in response to a specific scenario.

Analysis and verification. To facilitate accurate analysis and verification, recording with subsequent transcription of interviews is superior to attempting to take detailed notes during the interview. Such note taking risks disruption or loss of data (Clark et al., 2008). Depending upon the particular approach used, the analyst will format the data and have the product verified by one or more of the experts. Using this process in an iteratively, the analyst modifies the product until it fully represents the task in a manner agreeable to all participating experts. The resulting document should include procedural knowledge for the task and subtasks, the decision points necessary throughout performance, the cues and inputs that drive those decisions, and the declarative knowledge that provides the basis for making those decisions (Feldon et al., 2015; Clark et al., 2008).

Format for use. When the CTA has been completed, the information must then be formatted for its intended use. This may mean that it is the primary source document during the instructional design of a class or training session, or it may be used as the basis for a checklist or questionnaire for an evaluation or assessment.

Classifications. There are many different types of and uses for CTA, and many are classified by the type of knowledge structure gathered, e.g., Learning Hierarchy Analysis and Critical Decision Method. Unfortunately, these classifications are insufficient for allowing general comparisons across and between studies (Tofel-Grehl & Feldon, 2013). It has been suggested (Yates & Feldon, 2011) that effort should be invested in developing a taxonomy that will allow users to pick, based on empirical evidence, the most appropriate elicitation and analysis techniques for a given task.

Evidence of complete procedures.

When describing the procedures necessary for a task, experts omit up to 70% of the decisions and vital information required for successful completion of the task (Chao & Salvendy, 1994; Clark et al., 2012). However, through the iterative interviews, compilation of procedures, and expert feedback, the procedural knowledge gathered through CTA far exceeds that of individual free recall (Clark et al., 2012).

Evidence of effective procedures.

From an instructional viewpoint, the completeness of the procedures is irrelevant unless those procedures can be utilized to provide students with higher quality instruction. From the cognitive perspective, the instruction developed using CTA-derived information *should* lead to improved performance: when learners are given more complete information, their cognitive resources are available for developing schemas and learning instead of being expended filling in the instructional gaps and struggling to grasp the content (Tofel-Grehl & Feldon, 2013).

In multiple studies comparing CTA-based instruction and traditional instruction, students receiving CTA-based instruction have demonstrated superior performance to those receiving traditional instruction in medicine (Campbell et al. 2011; Velmahos et al., 2004), radar system troubleshooting (Schaafstal, Schraagen, & van Berl, 2000), landmine detection (Staszewski, 2004) and computer spreadsheet usage (Merrill, 2002), and have demonstrated some improvements in undergraduate biology coursework (Feldon, Timmerman, Stowe, & Showman 2010). Additionally, a meta-analysis (Tofel-Grehl & Feldon, 2013) found that, overall, instruction based on CTA offers improvement over traditional instructional methods with an overall value of Hedge's g=0.871 (SD=0.0846), representing a large effect size. The same meta-analysis also found that studies in military and university settings found CTA-based instruction very highly effective.

Assessment

There is precedent for using the approach described above. Acton and colleagues (Acton et al., 1994) studied the predictive relationship between the similarity of cognitive structures and grades. They used several referent cognitive structures: the instructor, five separate experts, and the highest scoring students in the class. They found that the best predictor of class grade was, in fact, the aggregated expert structure as opposed to either the student or instructor structure. The major drawback with this study, however, is that the cognitive structures examined were strictly declarative knowledge. Because the engineering principles of interest here require declarative and procedural knowledge, a different method for developing the expert referent point must be utilized. This necessity brings us back to cognitive task analysis.

CTA has been used as the basis for assessment (e.g., see Campbell et al., 2011; Clark et al., 2012; Velmahos et al., 2004; Feldon et al., 2010), typically in the form of a checklist to measure procedural knowledge. Using information gathered from by CTA and measuring students' approaches to solving problems may also be an acceptable use of CTA for assessment. Kalyuga and Sweller (2004, 2005) found that a student's approach to solving a problem is highly correlated with actual performance. In these studies, students were given algebra problems and asked to determine the next step toward solution (e.g., separate a variable; divide both sides by an integer, etc.). By utilizing rapid assessment, an instructor or computer program can tailor the instructional content to the individual student. Doing so avoids the expertise reversal effect found when unnecessary instructional content begins to impose extraneous cognitive load onto learners (Kalyuga & Sweller, 2004; Kalyuga & Sweller, 2005; Kalyuga, 2006).

A major drawback for Kalyuga and Sweller's rapid assessments, thus far, is that many problems have more than one correct next step. In these cases, the rapid assessment may become cumbersome or worse yet, interfere with the student's current schema for solving problems (Kalyuga, 2006). Another method of measuring student knowledge against expert knowledge consists of comparing novice to expert concept maps (e.g., Acton et al., 1994; Schvaneveldt et al., 1985). However, the use of concept maps in a classroom can be time-consuming and frustrating for the students.

To overcome these obstacles, it is possible to use an assessment based on CTA generated content presented to the student in a type of survey with a wide selection of Likert-scale answers. A student would indicate the amount of agreement (or disagreement) with a particular statement. This approach would permit a rapid assessment while making allowances for multiple approaches and solution strategies. It is such an approach that is recommended here. Once the student provides responses to the CTA-based assessment, its ability to predict classroom performance can then be measured to determine if this approach offers promise of utility.

Hypothesis

The value of CTA-based information for engineering student performance is still unknown. Although the evidence suggests that a stronger alignment with expert knowledge structures should correspond to the better classroom performance (e.g., Acton et al., 1994), that relationship is yet unexplored. It is hypothesized that greater student alignment with expert procedural knowledge will predict higher class scores for closely related problems.

Chapter 3: Method

Experts solve problems differently than novices, and they utilize cognitive efficiencies not yet developed by novices (Glaser & Chi, 1988). Throughout the development of this expertise, instructional needs vary: instructional methods appropriate at one point may be either too challenging or too simplified at another point (Kalyuga et al., 2003). Either situation impedes schema development, learning, practice, and by definition, expertise growth. To provide efficient instruction, students' current states of expertise must be ascertained, but such measurement can be cumbersome and overly burdensome for students and professors (Kalyuga, 2006). Rapid assessment can streamline this process. This study investigates just such an assessment. It tests the hypothesis that greater student alignment with expert procedural knowledge will predict higher class scores for closely related problems. As described in the following sections, student alignment with expert knowledge will be assessed through completion of a questionnaire derived from a cognitive task analysis of expert electrical engineers, and performance scores will be obtained from student performance on classroom assessments of relevant skills.

Participants and Context

This study received Institutional Review Board approval from two universities: the researcher's university (University of Virginia, SBS Project # 2015-0062-00) and the university from which data were collected. Data collection followed the procedures as approved. See Appendix G for approval notifications.

Participants were student volunteers from a prestigious public university who have enrolled in a section of either Digital Circuits (referred to as Class A) or Electrical Circuits 2 (Class B) taught during the Spring 2015 term. The courses are required for the electrical engineering bachelor's degree, and are optional for other engineering degrees. Digital Circuits introduces Boolean logic, designing circuits using Boolean logic, and datapath components (Class A Syllabus). Typically taken in the spring of the freshman year, it is often the first electrical engineering course for these engineering students. Electrical Circuits 2 is the second electrical circuits class in the curriculum, stressing AC steady-state circuits and analysis using Laplace Transforms and Bode Diagrams (Class B Syllabus). Typically taken in the spring of the sophomore year, it is the electrical engineering course for most students.

The electrical engineering department has 387 students, with 92.8% male and 5.2% described as "minority" (University Office of Analysis, Assessment, and Accreditation, 2015). See Table 1 for the university's demographics for 2015, compared with the latest available national data from 2013 (U. S. Department of Education, 2015).

Table 1. Demographic Information for University

	University	Universities Nationwide
Hispanics of any race	5.72%	15.17%
Am. Ind./AK Native	1.82%	0.80%
Asian	1.07%	5.88%
Black/African American	0.90%	14.10%
Native Hawaiian/ Pac Islander	0.31%	0.30%
White	79.89%	56.88%
Two or More	1.70%	2.75%
Race/Ethnic Unknown	5.51%	
Non-resident Alien	3.08%	4.12%

Students were notified about the questionnaire through electronic mail addresses provided by instructors of the target courses. Specific messages varied slightly throughout the notification and data collection process. However, the primary features included were the nature of the questionnaire, its potential value to engineering education, privacy information, and the link to the survey on a survey-hosting site.

A total of 47 students completed the survey, with 51 total respondents. One student completed the survey twice, so the second submission was deleted. For Class A, 26 out of 59 students responded, and 21 completed the survey for a participation rate of 44.1. For Class B, 25 out of 63responded and completed the survey for a participation rate of 39.7%. As seen in Table 2, the mean score on the survey for all respondents was 86.74, S. D. = 12.29. For class A, the mean score on the survey was 88.71, S. D. = 11.0. For class B, the mean score on the survey was 85.08, S. D. = 13.27. The mean Major GPA for all respondents was 3.57, S. D. = 0.33. For class A, the mean Major GPA on was 3.60, S. D. = 0.34. For class B, the mean Major GPA was 3.55, S. D. = 0.33. All respondents but one (who was enrolled in class A) indicated that the course was required for their major. Only two respondents (both enrolled in class A) provided SAT Math scores, therefore no mean or standard deviation was calculated. It was subsequently determined that most students in the state where the data were collected take the ACT, rather than the SAT test, but an ACT item was not included in the original survey.

Table 2. Descriptive Statistics

	Number of Students	Respondents	Participation Rate	Mean Score	S. D.	Major GPA	S. D.
Total	122	51	41.8%	86.74	12.29	3.57	0.33
Class A	59	26	44.1%	88.71	11.00	3.60	0.34
Class B	63	25	39.7%	85.08	13.27	3.55	0.33

Notification and Request for participation

To improve response rate, several steps were taken. First, the director of the STEM education center at the university served as a point of contact for students having questions and concerns about the study. Because the director is senior faculty in the university, it was assumed his messages were likely to increase participant response rate (Edwards et al., 2002). This approach also preserved the anonymity of participants for the primary researcher.

Approximately one week prior to data collection, students received a message informing them of an upcoming survey and requesting their participation (Traugott, Groves, & Lepkowski, 1987). That correspondence informed students of the nature of the questionnaire, its importance to engineering education, and the assurance that participation was voluntary. (See Appendix G for student recruitment correspondence.) Because multiple attempts to induce participation increases response rate, students received several messages over the course of data collection. Approximately one week later, students received a second message that elaborated on the nature of the study and provided the link to the questionnaire on the hosted survey site. After approximately four days, a third message was sent. It contained slightly different wording and emphasized the value of participation. Approximately one week later, a fourth email was sent to non-responders, and a fifth was sent two days prior to survey closure. Allowing two weeks for participation permitted students a satisfactory window for participation (Groves et al., 2009). When students navigated to the survey site (Qualtrics™) to complete the questionnaire, a detailed information and consent form was presented electronically before items were made available. (See Appendix G for the consent form presented to participants.)

Incentives

Offering a lottery or chance of winning a monetary or non-monetary prize may not increase participation in postal surveys (Warriner, Goyder, Gjertsen, Hohner, & McSpurren, 1996). However, for surveys delivered on the internet, a lottery or drawing can increase participation (Tuten, Galesic, & Bosnjak, 2004). To that end, there was a random drawing from among those who completed the questionnaire, and the two students selected were given Amazon gift cards worth $20.00 each.

Instrument Design

Cognitive task analyses were performed on three engineering experts regarding the way each expert approaches design, testing, and troubleshooting. These CTAs were performed as part of a separate grant (NSF #1137021), and the experts were selected for experience, talent, and success in engineering design. A faculty member at the University of Virginia who is a cognitive psychologist with extensive experience conducting CTAs interviewed the experts, and the interviews were recorded. Upon completion of all three interviews, a rough draft decision tree was developed of the overall approach to design, testing, and troubleshooting. That rough draft was then separately distributed to the three experts who made some minor corrections. Once those corrections were incorporated, the final draft was distributed to the experts for independent review; the experts reviewed the final version and each agreed that the process was described accurately in the decision tree. (See Appendix C for the Cognitive Task Analysis.)

Using the decision tree, a questionnaire was developed with iterative review from the cognitive task analyst. The questionnaire and the decision tree were provided to an expert in design, troubleshooting, and testing to determine that questions accurately describe the process in the decision tree. This expert was an engineer in industry who has over 15 years of experience in all phases of engineering design. This design expert suggested no further changes.

In addition to the CTA-based items, additional items elicited participants' SAT mathematics scores, cumulative grade point average (GPA), and status of the course as required or elective for a participant's program of study. Math scores on the SAT have been shown to positively predict engineering graduation rate (Zhang, Anderson, Ohland, & Thorndyke, 2004), as has cumulative (as opposed to single-term) grade point average (Hackett, Betz, Casas, & Rocha-Singh, 1992). Additionally, it is to be expected that student performance could be affected by whether the relevant course is required for degree completion or an elective.

After approval, the survey was disseminated for cognitive interviews to three students similar to those for whom the survey was to be administered, i.e., electrical engineering majors, at approximately same completion level in their coursework, but who were not part of the data collection sample, and who were attending a separate university. During unstructured interviews, survey items were evaluated for issues such as syntax complexity, wording, technical jargon, and question clarity (Groves et al., 2009). In separate unstructured interviews, the researcher explained to the students that the purpose of the review was to determine the clarity of the questions. They were asked to read the items with the following questions in mind:

1) Can I understand this question?
2) Does the question make sense to me?
3) Would I be able to answer this question in a survey?
4) Is there a better way to word this question?

It is important to make the distinction between these cognitive interviews and the cognitive task analysis. The purpose of these interviews was to ensure that the survey was clear and comprehensible to the target audience. The students interviewed indicated that the survey was both clear and easy to understand.

The survey was loaded onto Qualtrics™, an online survey hosting site and tested for functionality, readability, and robustness of the interface to user error (Groves et al., 2009). The full survey, including all questions and scoring, is presented in Appendix A.

The students were presented a Letter of Information that served as a consent form. Once they acknowledged that form, they were permitted to view the survey.

One survey item asked students to indicate whether or not the class from which they were recruited as participants was required for their major; another asked their SAT math score. Cole and Gonyea's (2010) review found that self-reported SAT scores are highly correlated with the actual scores, in the range of 0.85 to 0.95. Accuracy of self-report increases with test scores, so engineering students, overall a high-scoring group, will tend to provide more accurate self-reported scores (College Board, 2014).

Subsequent items were content-focused and derived from the CTA (presented in Appendix C). Five items presented were presented in a multiple-choice format, two items were presented in a true/false format, and 15 items utilized a 7-point Likert scale. All items are shown in Table 3

Table 3. All Content-focused Items

1	When given a design task, I first identify and review the product/product requirements. *Always* to *Never*
2	If design requirements are unclear or directly contradict each other, I contact the customer/client/instructor. *Always* to *Never*
3	In a design, I treat all requirements as having equal priority. *Always* to *Never*
4	If a functional component receives Boolean inputs, I test both cases. *Always* to *Never*
5	Consider product testing… If a component or system receives discrete, finite inputs (e.g., 5, 10, or 15 ohms, 'a', 'b', 'c', or 'd'), I test all input values. *Always* to *Never*
6	Consider product testing… If a component or system receives a specified range of inputs (e.g., any value between 100 and 1,000 mA), I do not test the upper and lower boundaries. *Always* to *Never*

7 Consider product testing… If a component or system receives a specified range of inputs (e.g., any value between 100 and 1,000 mA), I test values slightly outside that range (e.g., 90 mA and 1010 mA).
Always to *Never*

8 Consider product testing… If a component or system receives a specified range of inputs (e.g., any value between 100 and 1,000 mA), I do not test values far outside that range, (e.g., 0 mA and 1600 mA).
Always to *Never*

9 I only test inputs for which I explicitly know the predicted output or correct result.
Always to *Never*

10 If multiple functions operate in parallel, I test them in parallel prior to testing them individually.
Always to *Never*

11 If, during testing, an error occurs, I try to identify the value range of inputs that produce the error, even if it requires generating additional tests cases.
Always to *Never*

12 I try to characterize the nature of the error in relation to target performance (e.g., it is too high, too low, too slow, etc.)
Always to *Never*

13 If all my troubleshooting efforts fail to determine the cause of the error, I refer back to the specifications to see if my design failed to address a specification or requirement.
Always to *Never*

14 During troubleshooting, if parallel operations produce an error, I review the specifications to see if they should have run in series instead of parallel.
Always to *Never*

15 You are testing a product. Between the last known correct value and the first known incorrect value, there are a large number of operations. Approximately where would you take your next measurement?
Immediately after the last known correct value to *Immediately before the first known incorrect value*

16 You are given a lengthy set of requirements for a project. Upon reading the list of requirements, you find several items that do not make sense. For example, one particular measurement is required to be 5 Amps, but it should clearly state a value in volts. You would:
a. Take the measurement in voltage, and assume they meant 5 volts
b. Request clarification from the customer
c. Find a measurement that should be 5 Amps and assume that was the one they wanted.
d. Take no measurements and treat is as a mistake in the requirements

17 You are working on a complex project: create a working design for a new cell phone. The specifications call for maximizing screen resolution, brightness, reception, and battery life while reducing weight. All these goals probably cannot be met in one single device. You would:
a. Meet as many goals as you could, documenting design rationale.

b. Ask the customer to provide you with prioritized requirements and specifications request
c. Create your own prioritized specification matrix and submit it to the customer for feedback or approval
d. Design the product using cost and schedule as the primary factors to decide the specifications.

18 You are testing a component within a fairly complicated system. It retains information from prior runs, and the initial state of each run is dependent on some factor of the last state of the prior run. This is the first time the system has been run or tested, so all memory conditions are clear. The test run is successful. You would:
a. Note the successful test and move on to the next component for testing.
b. Note the success and test the component once more.
c. Note the success and test the component several more times.

19 Q1You are testing a system that has four processes running in parallel. For the first system test you would:
a. First test the four processes running in parallel, then test the four processes individually.
b. First test the four processes individually, then test them while running in parallel.
c. Test the processes in the order which minimizes testing cost.
d. Test the processes in the order that minimizes schedule impacts.

20 You are testing a system that, when in operation, is able to safely receive inputs between 0.500 and 0.700 mA. How do you determine the inputs that you will test?
a. Test the full range in small increments.
b. Test the full range in large increments.
c. Test the full range AND values slightly beyond in small increments.
d. Test the full range AND values slightly beyond in large increments.
e. Check the requirements or ask the customer.

21 You are testing a system that should receive inputs between .200 and 1.400 mA. You have generated a set of input values to test. For each and every input value, you calculate the appropriate output value.
True or *False*

22 You do not test a system outside its boundary conditions of temperature range, operational voltage, current, duration, etc.
True or *False*

Data Collection

Performance Data

Instructors from the targeted courses provided scores on relevant assignments (design problems that were assigned from the class) to the facilitating faculty member, who assigned unique identifiers to match performance and survey data. This established an anonymized data set for subsequent analysis. *Performance* scores were determined by the number of the points earned by a student on design problem questions jointly selected as relevant to the design verification and validation process (addressing requirements, testing, and troubleshooting) by the researcher and course instructors. All design problems are presented in Appendix B. Scores were computed as a simple ratio:

$$\text{performance} = \frac{\text{earned relevant points}}{\text{total relevant points possible}}$$

The problems given to class A were graded using a rubric with that gave full credit for a specific correct answer and varying amounts of partial credit for attempting the problems. The problems given to class B were graded using a rubric with specified points for various aspects of the problems, but the instructor permitted some flexibility within the rubric for partial credit. (See Appendix B for details of both rubrics.)

Analysis

The first step in analysis was to score participant questionnaire responses, summing them to create an *expertise* score. Next, three response rates were calculated: overall response rate (number of participants divided by the sum of total students in both classes) and the response rate for each separate section of the course.

Using *expertise* and *Major GPA* as independent variables and *performance* as the dependent variable, a multiple regression analysis was performed to determine the extent to which the independent variables predicted the dependent variable. When performing regression analyses, one must include a sufficient number of variables to create an accurate model while still being theoretically sound (Pedhazur, 1997). To account for maximum variance in performance, data for two additional independent variables were collected, *required* and *SATMath*. However, insufficient variability in *required* and insufficient response to *SATMath* prohibited those variables from being useful in the regression analysis. Appropriate diagnostics were used to assess the suitability of the data and to detect potential collinearity problems, as detailed in the following section.

Linear Regression Diagnostics.

When a linear regression is performed, one must perform diagnostics to ensure that the assumptions for linear regressions have not been violated. Aside from the obvious, that is, the relationship of predictor to criterion is linear, Pedhazur (1997) lists the following assumptions:

a) Dependent variables are measured without error
b) The residuals (i.e., difference between observed dependent value and predicted dependent value) are normally distributed with a constant variance across the predictor values
c) The values are not collinear

To test the linearity of the relationship, bivariate scatterplots with a dependent variable on the y-axis and dependent variable along the x-axis were generated. The resulting scatterplot received visual inspection to determine approximate linearity. This is an approximation inspection, but can detect parabolic or other obviously nonlinear trends.

To test for constant variance of the residuals, a scatterplot with standardized residuals on the y-axis and predicted values along the x-axis were generated. The resulting scatterplot received visual inspection to confirm the residuals appeared approximately constant (see Appendix D). This is an approximation inspection, but can detect obvious differences.

Variance inflation factors (VIF) and condition indices were used to test for collinearity. VIF “indicates the inflation of the variance … as a consequence of the correlation between two independent variables” (Pedhazur, 1997, p. 296). Consider the following equation:

$$\mathrm{VIF_i} = \frac{1}{1 - \mathrm{R}^2_{1,2\ldots k}}$$

The correlation between the two variables ranges from 0 to 1, with 0 being no correlation and 1 being perfect correlation. As the correlation between two variables increases, the value of the VIF increases, becoming undefined at perfect correlation. So, in short, the more highly correlated the variables are, the higher the VIF. VIF not only impacts the regression coefficients’ standard errors, but also rounding errors. To address that, *tolerance* is tested. The concept of *tolerance* is defined as:

$$\mathrm{Tolerance} = 1 - \mathrm{R}^2_{\mathrm{i}} = \frac{1}{\mathrm{VIF_i}}$$

and higher tolerance values causing greater rounding errors. Also notice that this equation only accounts for correlations between two variables, and therefore has limited usefulness (Pedhazur, 1997). Tolerance values for all items were acceptable and are reported as part of the Results.

For determining multicollinearity, the condition index quantifies the variance associated with the eigenvalue. If the value of the condition index exceeds 50, a collinearity problem is suspected. If a large condition index also has two or more large (greater than 0.50) variance components, it is a very strong indicator of collinearity. Attained condition indices are presented as part of the Results. All index values were less than 50, indicating that collinearity was not problematic for this data set.

An outlier is a data point that is markedly different from the others, either substantially larger or substantially smaller (Boslaugh, 2012). As such, it may (or may not) have “undue influence on the results” (Pedhazur, 1997, p. 43). The first investigation was to verify that the data point was an actual outlier and not an unrelated error, e.g., human error or equipment failure. The residuals of those that were, in fact, outliers were further investigated by three additional tests. The first test for an outlier was to determine the standardized residuals. A major drawback of this test, however, is that it assumes homoscedasticity, i.e., that the “variance of errors is the same at all levels” (Pedhazur, 1997, p. 33) of the independent variable.

$$\text{Standardized residual} = \frac{Y_i - \hat{Y}_i}{S.E.E.}$$

The second test was to determine the studentized residuals; this test does not assume homoscedasticity.

$$\text{Studentized residual} = \frac{Y_i - \hat{Y}_i}{SD_{\varepsilon_i(x_{i)}}}$$

The final diagnostic was the studentized deleted residual. This calculation is the same as the studentized residual, except that the data point in question is removed prior to calculating the standard deviation. This step is taken because the inclusion of the data point may cause increase the standard deviation sufficiently to mask it as being an outlier.

A special case of the outlier, the influential data point (Pedhazur, 1997), exerts greater influence on the calculations. To determine influential data points, the leverage, Cook's D statistic, DFBETA, and Standardized DFBETA were calculated and assessed. Leverage (h) measures influence based solely on the independent variable, not on the dependent variable. For each data point, *i*, leverage is measured by:

$$h_i = \frac{1}{N} + \frac{(X - \bar{X}^2)}{\Sigma \mathrm{x}^2}$$

Values for h vary between 1/N, meaning no influence, to 1, meaning maximum influence. According to Hoaglin and Welsch (1978), high influence values are:

$$h_i > \frac{2(k+1)}{N}$$

Leverage does not detect influence based on the dependent variable, so I also used Cook's D statistic. Cook's D determines data points with high influence on either the independent or the dependent variable.

$$D_i = \left[\frac{SRESID_i^2}{K+1}\right]\left[\frac{h_i}{1-h_i}\right]$$

The analysis for Cook's D is relative – the values are extreme if there are "relatively large gaps between D for a given observation and D's for the rest of the data" (Pedhazur, 1997, p. 51). Finally, the DFBETA and ZDFBETA scores indicate the size and direction of change in either the slope or intercept when an observation is removed. As a general guideline, ZDFBETA scores exceeding $2/\sqrt{N}$ are considered large (Belsley, Kuh, & Welsch, 1980).

$$ZDFBETA_{(i)} = \frac{DFBETA_{(i)}}{\sqrt{MSR_i}\left[\frac{\Sigma X^2}{N\Sigma X^2 - (\Sigma X)^2}\right]}$$

Subscales and Total Score

The items on the survey addressed three separate facets of engineering design: dealing with requirements, testing design, and troubleshooting. Because the sample size was too small, factor analysis could not be performed (O'Rourke & Hatcher, 2013). However, analysis was performed on the presumptive factors. This analysis was performed by summing the appropriate items into three subscales: *Requirements*, *Testing*, and *Troubleshooting*. The *Requirements* subscale consisted of survey items 1, 2, 3, 16, and 17. The *Testing* subscale had the most items of the three subscales, and consisted of survey items 4, 5, 6, 7, 8, 9, 10, 18, 19, 20, 21, and 22. The Troubleshooting subscale consisted of survey items 11, 12, 13, 14, and 15.

To be completely thorough in the investigation and analysis, analysis was also performed on the total score, which was simply the sum of the score for all items. For the subscales and the total score, regression diagnostic and outlier analyses were performed in much the same manner as the individual item diagnostics.

Item Analysis

Each survey item was subjected to item analysis to determine characteristics unique to each question, correct answer and distractor. Characteristics tested were level of difficulty and item discrimination. Analyses were performed as a preliminary step to establishing reliability and validity, which will be further developed in a subsequent study outside the scope of this project. Differential item functioning (DIF) analyses were also to have been performed, but the sample size was too small (Stark, Chernyshenko, & Drasgow, 2006).

Item difficulty. Item difficulty was a simple and straightforward calculation. For each individual item, the difficulty, *p*, "is defined as the proportion of examinees who get that item correct" (Allen & Yen, 1979, p. 120). By definition, a more difficult item has a lower item difficulty score. This test is a criterion-referenced test, i.e., concerned primarily with students' ability in the domain as opposed to students' abilities relative to each other, so we want to see a broad range of item difficulty scores (Thorndike & Thorndike-Christ, 2010). Obviously, the calculated difficulty is contingent solely upon those taking the test, so fluctuation is a concern, especially with small samples or populations.

Item discrimination. In terms of tests and measurements, *discrimination* refers to the separation or dispersion of test-takers of varying ability (Thorndike & Thorndike-Christ, 2010; Allen & Yen, 1979). Although in common usage, discrimination often carries negative connotations, it is desirable in tests. In fact, it is the primary purpose of achievement-measuring tests (Glaser, 1963).

Statistical Control. Prior to analysis, four independent variables were anticipated: expertise, required, prior knowledge, and math proficiency. However, three of those variables, required, prior knowledge, and math proficiency were not used in analysis because of insufficient data. As a result, the anticipated statistical control analyses were not performed.

Chapter 4: Results

The results are reported in the following manner: descriptive statistics for both Class A and Class B are presented first. Second, results for Class A, including regression diagnostics, reliability, missing data, and survey item analysis are reported. Third, the same types of results are reported for Class B.

Descriptive Statistics

Class A Results for Each Item

Linear Regression Diagnostics.

Data were tested to ensure linear regression was statistically appropriate, and that the data did not violate the assumptions made by linear regression analysis. Specifically, data were tested for linearity, homoscedasticity, normality, and collinearity.

Linearity, Normality, and Homoscedasticity

The data were inspected for linearity and normality by visual inspection of plots. The data did not appear to violate linearity and appeared normally distributed. The data were analyzed to ensure homoscedasticity visual inspection of the standardized, the studentized, and the studentized deleted residual plots (see Appendix D). Survey Items 1 and 2, violated homoscedasticity throughout all imputations (see Figures 3 and 4).

Collinearity

The VIF for all IVs were below the threshold of 10. The tolerance of all IVs exceeded 0.10. See Table 4 for all VIF results for class A. No Condition Index exceeded 50. See Table 5 for all Condition Indices for Class A. These results suggest collinearity or multicollinearity is not present (Lomax & Hahs-Vaughn, 2012).

Table 4. VIF Results for Class A

Coefficients

Model		Correlations			
		Partial	Part	Tolerance	VIF
1	(Constant)				
	Q1	-.345	-.239	.384	2.604
	Q2	-.338	-.233	.582	1.717
	Q4	.472	.347	.320	3.127
	Q7	.054	.035	.623	1.605
	Q9	-.399	-.283	.474	2.111
	Q11	-.073	-.047	.359	2.783
	Q13	-.018	-.011	.457	2.187
	Q14	.477	.352	.505	1.979
	Q16	-.428	-.307	.355	2.820
	Q20	.212	.141	.201	4.984

Table 5. Collinearity Diagnostics for Class A

Collinearity Diagnostics

Model	Dimension	Eigenvalue	Condition Index	Variance Proportions (Constant)	Q1	Q2	Q4	Q7	Q9	Q11	Q13	Q14	Q16	Q20
1	1	9.831	1.000	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
	2	.385	5.056	.00	.00	.01	.00	.03	.09	.00	.00	.03	.00	.06
	3	.207	6.889	.00	.00	.01	.00	.38	.11	.01	.00	.00	.07	.00
	4	.184	7.307	.00	.00	.07	.00	.02	.30	.05	.00	.00	.02	.06
	5	.142	8.324	.00	.00	.03	.00	.22	.01	.08	.00	.15	.08	.00
	6	.120	9.040	.02	.01	.07	.00	.03	.02	.08	.01	.21	.01	.00
	7	.064	12.431	.00	.00	.67	.01	.04	.20	.09	.00	.06	.02	.13
	8	.043	15.174	.01	.01	.06	.03	.17	.01	.10	.02	.48	.36	.11
	9	.009	32.235	.55	.17	.03	.18	.01	.01	.29	.18	.06	.11	.19
	10	.009	32.827	.41	.01	.01	.77	.04	.22	.28	.00	.00	.32	.40
	11	.006	41.931	.01	.80	.03	.00	.05	.01	.02	.79	.00	.01	.04

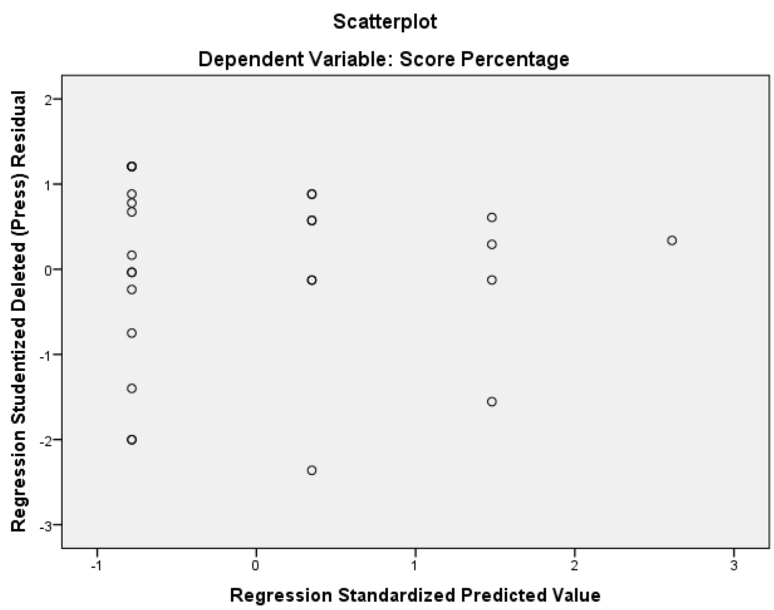

Figure 3. Survey Item 1 Residual Plot

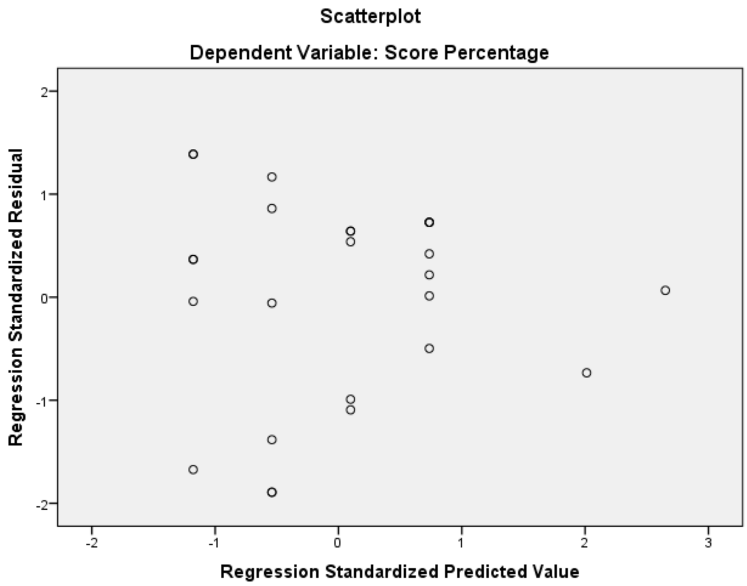

Figure 4. Survey Item 2 Residual Plot

Outliers and Influential Data Points

I selected a residual threshold of 1.96 to account for 95% of normally distributed residuals, and I used this value as one factor in comprehensive approach to detecting outliers and influential data points as suggested by Pedhazur (1997). Refer to Appendix F for residuals, leverages, and Cook's Distance values for all items and cases. In Class A, four students (identified solely as case numbers) met criteria for exclusion. Case 1 standardized residuals, studentized residuals, and/or studentized deleted residuals exceeded the threshold value of $z = \pm1.96$ for all survey items. Case 2 standardized residuals, studentized residuals, and/or studentized deleted residuals exceeded the threshold value of $z = \pm1.96$ for all survey items except Item 22 and Major GPA. Case 3 standardized residuals, studentized residuals, and/or studentized deleted residuals exceeded the threshold value of $z = \pm1.96$ for survey items 1, 3, 4, 5 and 6, and only answered the first 6 items. Therefore, these three cases were omitted from further analysis as obvious outliers. Case 5 had a ZDFBETA score that exceeded $2/\sqrt{N}$ for item 1, which is considered extreme (Belsley et al., 1980). Because the respondent only replied to three items total, Case 5 was considered inappropriately influential and omitted from further analysis.

All remaining cases had standardized residuals, studentized residuals, and studentized deleted residuals that fell within the threshold value of $z = \pm 1.96$ for all or the majority of items. The ZDFBETA scores did not exceed $2/\sqrt{N}$ for any items. By using Pedhazur's (1997) holistic approach to determining outliers, all remaining cases were determined not to be outliers or unduly influential and were used in subsequent analyses. Again, see Appendix F for residuals, leverages, and Cook's Distance values for all items and cases.

Missing Data

Little's (1988) Missing Completely at Random (MCAR) test was performed to determine if the data was missing completely at random. The null hypothesis is that the data are missing completely at random. The results were chi-square = 57.754, (df = 55, p = .374), therefore we fail to reject the null hypothesis. Because the data appear to be missing completely at random, listwise deletions during analysis should not introduce bias, and therefore further procedures to fill in missing data are unnecessary (Rubin, 1977).

Reliability

All 22 survey items were tested for reliability. All survey items achieved a Cronbach's alpha score of .308. The analysis included Cronbach's alpha for the survey if an item was deleted, and items were deleted singly until the maximum Cronbach's alpha was achieved. Items 10, 17, 18, 22, 15, 19, 21, 3, 8 and 6 were omitted from reliability calculations in that order. The final Cronbach's alpha was 0.785, and included items 1, 2, 4, 5, 7, 9, 11, 12, 13, 14, 16, and 20. See Table 6 for a summary.

Table 6. Item-Total Statistics for Class A

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Q1	46.333	106.633	.563	.769
Q2	47.762	99.890	.437	.769
Q4	46.810	105.962	.449	.772
Q5	47.714	93.014	.681	.744
Q7	48.286	94.414	.493	.763
Q9	49.381	100.848	.427	.770
Q11	47.857	101.129	.408	.772
Q12	47.238	108.790	.272	.783
Q13	46.571	110.057	.379	.779
Q14	47.762	94.790	.502	.762
Q16	46.667	94.733	.415	.774
Q20	47.524	90.062	.401	.784

Regression Analysis Based on Reliability

A multiple linear regression was used to determine the ability of the highest reliability survey items to predict the classroom Score Percentage. A nonsignificant regression equation was found ($F(10, 10) = 0.920$, $p = 0.551$) with an R^2 of .479). See Table 7 for regression results for Class A.

Table 7. Regression Results for Class A

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	101.560	63.001		1.612	.138
	SQ1	4.220	17.210	.105	.245	.811
	SQ2	-10.000	6.461	-.498	-1.548	.153
	SQ4	14.902	10.741	.478	1.387	.195
	SQ5	6.823	10.878	.336	.627	.545
	SQ7	-4.442	7.736	-.264	-.574	.579
	SQ9	-1.471	6.991	-.071	-.210	.838
	SQ13	-13.432	15.238	-.316	-.881	.399
	SQ14	3.454	5.560	.199	.621	.548
	SQ16	-6.956	5.442	-.458	-1.278	.230
	SQ20	-1.154	4.723	-.092	-.244	.812

Item Analysis

Survey Items 1, 2, 4, 7, 11, 13, and 14 were Likert Scale items with seven options ranging from “Always” to “Never”; “Always” was worth 6 points, and “Never” was worth zero points. Item 1 had an overall difficulty of 5.500, and a discrimination of 0.2395, and the last three options were not selected by any respondents in Class A. Survey Item 2 had an overall difficulty of 3.8889, with a discrimination of -0.0088. Item 4 had an overall difficulty of 5.00, with a discrimination of .2193, with no respondents choosing the last three options. Item 7 had an overall difficulty of 3.333 and a discrimination of .5751. Item 11 had an overall difficulty of 3.7778 and a discrimination of .1222. Item 13 had an overall difficulty of 5.2778 with a discrimination of .2587, and no respondents chose the last 4 options. Item 14 had an overall difficulty of 3.8889, with a discrimination of .0597.

Item 9 was a Likert scale item with options ranging from “Always” to “Never” with seven options; “Always” was worth 0 points, and “Never” was worth 6 points. It had an overall difficulty of 2.333 with a discrimination of .5393.

Item 16 was a multiple-choice item with the second option worth 6 points; the three distractors were worth zero points. It had an overall difficulty of 5.0000 and a difficulty of .2582. No respondent selected the third distractor. Item 20 was a multiple-choice item with five options. The third option was worth 6 points, the fourth was worth three points, and the three distractors were worth zero points. No respondent selected the second distractor. Detailed analysis for the more reliable items and each answer option follows in Table 8. Detailed item analysis for all items is included in Appendix E.

Table 8. Class A Item Analysis

Item	Option	Score	Difficulty	Std. Dev.	Discrimin.
q1	Overall		5.5000	0.8575	0.2934
	1.0	6.0	0.6667	0.4851	0.2132
	2.0	5.0	0.2222	0.4278	-0.1517
	3.0	4.0	0.0556	0.2357	0.1388
	4.0	3.0	0.0556	0.2357	-0.4962
	5.0	2.0	0.0000	0.0000	NaN
	6.0	1.0	0.0000	0.0000	NaN
	7.0	0.0	0.0000	0.0000	NaN
q2	Overall		3.8889	1.7112	-0.0088
	1.0	6.0	0.2222	0.4278	-0.0266
	2.0	5.0	0.1667	0.3835	-0.2990
	3.0	4.0	0.1667	0.3835	0.2052
	4.0	3.0	0.3333	0.4851	0.2132
	5.0	2.0	0.0000	0.0000	NaN
	6.0	1.0	0.0556	0.2357	-0.0444
	7.0	0.0	0.0556	0.2357	-0.4962
q4	Overall		5.0000	1.0847	0.2193
	1.0	6.0	0.4444	0.5113	0.1653
	2.0	5.0	0.2222	0.4278	-0.0266
	3.0	4.0	0.2222	0.4278	-0.0266
	4.0	3.0	0.1111	0.3234	-0.3916
	5.0	2.0	0.0000	0.0000	NaN
	6.0	1.0	0.0000	0.0000	NaN
	7.0	0.0	0.0000	0.0000	NaN
q7	Overall		3.3333	2.0292	0.5751
	1.0	6.0	0.1667	0.3835	0.4352
	2.0	5.0	0.1667	0.3835	0.1058
	3.0	4.0	0.2222	0.4278	0.2146
	4.0	3.0	0.1111	0.3234	-0.1126
	5.0	2.0	0.0000	0.0000	NaN
	6.0	1.0	0.2778	0.4609	-0.6333
	7.0	0.0	0.0556	0.2357	-0.1582
q9	Overall		2.3333	1.6450	0.5393
	1.0	0.0	0.1111	0.3234	-0.4728
	2.0	1.0	0.3333	0.4851	-0.3717
	3.0	2.0	0.0556	0.2357	-0.2035
	4.0	3.0	0.2222	0.4278	0.2917
	5.0	4.0	0.1667	0.3835	0.4063
	6.0	5.0	0.1111	0.3234	0.1040
	7.0	6.0	0.0000	0.0000	NaN
q11	Overall	3.7778	1.6290	0.1222	
	1.0	6.0	0.1667	0.3835	0.5224
	2.0	5.0	0.2222	0.4278	-0.0391
	3.0	4.0	0.1667	0.383	-0.2990
	4.0	3.0	0.2222	0.4278	-0.4956

	5.0	2.0	0.1111	0.323	0.2556
	6.0	1.0	0.1111	0.323	-0.0296
	7.0	0.0	0.0000	0.0000	NaN
q13	Overall		5.2778	0.7519	0.2587
	1.0	6.0	0.4444	0.5113	0.2621
	2.0	5.0	0.3889	0.5016	-0.1841
	3.0	4.0	0.1667	0.3835	-0.2576
	4.0	3.0	0.0000	0.0000	NaN
	5.0	2.0	0.0000	0.0000	NaN
	6.0	1.0	0.0000	0.0000	NaN
	7.0	0.0	0.0000	0.0000	NaN
q14	Overall		3.8889	1.9670	0.0597
	1.0	6.0	0.2778	0.4609	0.1340
	2.0	5.0	0.1667	0.3835	-0.2576
	3.0	4.0	0.1667	0.3835	0.0916
	4.0	3.0	0.1667	0.3835	0.3485
	5.0	2.0	0.1111	0.323	-0.3590
	6.0	1.0	0.0000	0.0000	NaN
	7.0	0.0	0.1111	0.3234	-0.2773
q16	Overall		5.0000	2.3009	0.2582
	1.0	0.0	0.1111	0.3234	-0.3590
	2.0	6.0	0.8333	0.3835	0.4207
	3.0	0.0	0.0000	0.0000	NaN
	4.0	0.0	0.0556	0.2357	-0.2940
q20	Overall		4.0000	2.7225	0.4781
	1.0	0.0	0.2778	0.4609	-0.6554
	2.0	0.0	0.0000	0.0000	NaN
	3.0	6.0	0.6111	0.5016	0.5820
	4.0	3.0	0.1111	0.3234	-0.0794
	5.0	0.0	0.0000	0.000	NaN

Negative Discrimination Items

In Class A, there were 6 items that had negative discrimination: Items 2, 3, 10, 15, 17, and 19. Of those six items, only item 2 was scored in a Likert scale format where “Always” had the highest value and “Never” scored zero. Two items, 3 and 15, were

Likert scale items where the middle choice had the highest possible score with “Always” and “Never” having equally low scores. Items 17 and 19 were multiple-choice items.

Regression Analysis Based on Item Analysis

A multiple linear regression was used to determine the ability of the survey items with positive discrimination to predict the classroom Score Percentage. A statistically significant regression equation was found ($F(17, 3) = 11.015$, $p = 0.036$) with an R^2 of .984). See Table 9 for regression results for Class A.

Table 9. Regression Results for Class A Items with Positive Discrimination

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	269.943	86.700		3.114	.053
	SQ1	28.449	12.047	.708	2.362	.099
	SQ4	-9.156	7.772	-.294	-1.178	.324
	SQ5	22.019	5.734	1.085	3.840	.031
	SQ6	16.269	3.292	.702	4.942	.016
	SQ7	-32.115	5.120	-1.906	-6.272	.008
	SQ8	-2.257	2.462	-.130	-.917	.427
	SQ9	-5.078	3.279	-.244	-1.549	.219
	SQ11	3.634	4.349	.178	.836	.465
	SQ12	11.360	5.693	.405	1.995	.140
	SQ13	-46.895	14.019	-1.103	-3.345	.044
	SQ14	-1.613	2.696	-.093	-.598	.592
	SQ16	-3.658	2.981	-.241	-1.227	.307
	SQ18	-14.341	2.400	-.944	-5.975	.009
	SQ20	1.760	3.045	.141	.578	.604
	SQ21	4.444	2.087	.356	2.129	.123
	SQ22	14.250	2.892	.787	4.927	.016
	Major GPA	-41.155	19.728	-.429	-2.086	.128

Collinearity

Survey items 1, 4, 5, 7, 13, and 20 had VIF values in excess of 10 and the corresponding tolerance values were below 0.10. The condition indices for items 20, 21, and 22 exceeded 50. These results suggest collinearity was a problem (Lomax & Hahs-Vaughn, 2012). See Tables 10 and 11 for VIF results and Collinearity Diagnostics.

Table 10. VIF Results Class A Items with Positive Discrimination

		Collinearity Statistics	
Model		Tolerance	VIF
1	(Constant)		
	SQ1	.058	17.116
	SQ4	.084	11.839
	SQ5	.066	15.177
	SQ6	.260	3.844
	SQ7	.057	17.573
	SQ8	.260	3.843
	SQ9	.212	4.708
	SQ11	.116	8.587
	SQ12	.128	7.839
	SQ13	.048	20.680
	SQ14	.218	4.593
	SQ16	.136	7.331
	SQ18	.210	4.751
	SQ20	.089	11.258
	SQ21	.188	5.321
	SQ22	.206	4.855
	Major GPA	.124	8.041

Table 11. Collinearity Diagnostics for Class A Items with Positive Discrimination

Model		Eigenvalue	Condition Index
1	(Constant)	15.513	1.000
	SQ1	.887	4.181
	SQ4	.364	6.529
	SQ5	.297	7.230
	SQ6	.250	7.876
	SQ7	.186	9.139
	SQ8	.148	10.252
	SQ9	.119	11.407
	SQ11	.080	13.964
	SQ12	.048	18.000
	SQ13	.035	21.177
	SQ14	.027	23.808
	SQ16	.022	26.594
	SQ18	.014	33.307
	SQ20	.007	46.683
	SQ21	.002	82.273
	SQ22	.001	120.099
	Major GPA	.000	231.116

Class A Results for Subscales and Major GPA

Linear Regression Diagnostics.

Data were tested to ensure linear regression was statistically appropriate, and that the data did not violate the assumptions made by linear regression analysis. Specifically, data were tested for linearity, homoscedasticity, normality, and collinearity.

Linearity, Normality, and Homoscedasticity

The data were inspected for linearity and normality by visual inspection of plots. The data did not appear to violate linearity and appeared normally distributed. The data were analyzed to ensure homoscedasticity visual inspection of the standardized, the studentized, and the studentized deleted residual plots (see Appendix D). No items violated the assumptions homoscedasticity.

Collinearity

The VIF for all IVs were below the threshold of 10. The tolerance of all IVs exceeded 0.10. See Table 12 for VIF results for class A. No Condition Index exceeded 50. See Table 13 for all Condition Indices for Class A. These results suggest collinearity or multicollinearity is not present (Lomax & Hahs-Vaughn, 2012).

Table 12.VIF Results for Class A Subscales and Major GPA

Coefficients

Model		Collinearity Statistics	
		Tolerance	VIF
1	(Constant)		
	Spec Subscale	.967	1.034
	Test Subscale	.951	1.052
	Trb Subscale	.996	1.004
	Major GPA	.956	1.046

Table 13. Collinearity Diagnostics for Class A Subscales and Major GPA

Collinearity Diagnostics

				Variance Proportions				
Model	Dimension	Eigenvalue	Condition Index	(Constant)	Spec Subscale	Test Subscale	Trb Subscale	Major GPA
1	1	4.905	1.000	.00	.00	.00	.00	.00
	2	.043	10.709	.00	.06	.67	.16	.00
	3	.033	12.146	.00	.28	.02	.71	.00
	4	.017	17.103	.02	.50	.15	.11	.15
	5	.002	47.015	.97	.15	.16	.02	.84

Outliers and Influential Data Points

I selected a residual threshold of 1.96 to account for 95% of normally distributed residuals, and I used this value as one factor in comprehensive approach to detecting outliers and influential data points as suggested by Pedhazur (1997). Refer to Appendix F for residuals, leverages, and Cook's Distance values for all items and cases. In Class A, two students (identified solely as case numbers) met criteria for exclusion. Cases 1 and 2 had standardized residuals, studentized residuals, and/or studentized deleted residuals exceeded the threshold value of z = ±1.96 for the subscales

All remaining cases had standardized residuals, studentized residuals, and studentized deleted residuals that fell within the threshold value of z = ±1.96 for all or the majority of subscales. The ZDFBETA scores did not exceed $2/\sqrt{N}$ for any items. By using Pedhazur's (1997) holistic approach to determining outliers, all remaining cases were determined not to be outliers or unduly influential and were used in subsequent analyses. Again, see Appendix F for residuals, leverages, and Cook's Distance values for all items and cases.

Regression Analysis

A multiple linear regression was used to determine the ability of the subscales and the Major GPA to predict the classroom Score Percentage. A regression equation was found (F (4, 14) = 11.922, p = 0.000) with an R^2 of .773). See Table 14 for regression results for Class A Total Score with Major GPA.

Table 14. Regression Results for Class A Subscales and Major GPA

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	-.678	.518		-1.310	.211
	SpecSubScore	-.012	.008	-.198	-1.528	.149
	TestSubScore	-.008	.003	-.327	-2.502	.025
	TrbSubScore	.034	.007	.592	4.643	.000
	Major GPA	.392	.108	.472	3.622	.003

Class A Results for Total Score and Major GPA

Linear Regression Diagnostics.

Data were tested to ensure linear regression was statistically appropriate, and that the data did not violate the assumptions made by linear regression analysis. Specifically, data were tested for linearity, homoscedasticity, normality, and collinearity.

Linearity, Normality, and Homoscedasticity

The data were inspected for linearity and normality by visual inspection of plots. The data did not appear to violate linearity and appeared normally distributed. The data were analyzed to ensure homoscedasticity visual inspection of the standardized, the studentized, and the studentized deleted residual plots (see Appendix D). No items violated the assumptions homoscedasticity.

Collinearity

The VIF for all IVs were below the threshold of 10. The tolerance of all IVs exceeded 0.10. See Table 15 for all VIF results for class A. No Condition Index exceeded 50. See Table 16 for all Condition Indices for Class A. These results suggest collinearity or multicollinearity is not present (Lomax & Hahs-Vaughn, 2012).

Table 15. VIF Results for Class A Total Score and Major GPA

Coefficients

		Collinearity Statistics	
Model		Tolerance	VIF
1	(Constant)		
	Total Score	.904	1.106
	Major GPA	.904	1.106

Table 16. Collinearity Diagnostics for Class A Total Score and Major GPA

Collinearity Diagnostics

				Variance Proportions		
Model	Dimension	Eigenvalue	Condition Index	(Constant)	Total Score	Major GPA
1	1	2.982	1.000	.00	.00	.00
	2	.016	13.812	.00	.51	.19
	3	.002	34.753	1.00	.48	.81

Outliers and Influential Data Points

I selected a residual threshold of 1.96 to account for 95% of normally distributed residuals, and I used this value as one factor in comprehensive approach to detecting outliers and influential data points as suggested by Pedhazur (1997). Refer to Appendix F for residuals, leverages, and Cook's Distance values for all items and cases. In Class A, one students (identified solely as case numbers) met criteria for exclusion. Case 1 had standardized residuals, studentized residuals, and/or studentized deleted residuals exceeded the threshold value of $z = \pm 1.96$ for the subscales

All remaining cases had standardized residuals, studentized residuals, and studentized deleted residuals that fell within the threshold value of $z = \pm 1.96$. The ZDFBETA scores did not exceed $2/\sqrt{N}$ for any items. By using Pedhazur's (1997) holistic approach to determining outliers, all remaining cases were determined not to be outliers or unduly influential and were used in subsequent analyses. Again, see Appendix F for residuals, leverages, and Cook's Distance values for all items and cases.

Regression Analysis

A multiple linear regression was used to determine the ability of the highest reliability survey items to predict the classroom Score Percentage. A statistically significant regression equation was found ($F(2, 17) = 8.793$, $p = 0.002$) with an R^2 of .508). See Table 17 for regression results for Class A Total Score with Major GPA.

Table 17. Regression Results for Class A Total Score with Major GPA

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-1.094	.785		-1.393	.182
	Total Score	-.003	.005	-.110	-.617	.546
	Major GPA	.581	.155	.671	3.753	.002

Class B Results for Each Item

Linear Regression Diagnostics.

Data were tested to ensure linear regression was statistically appropriate, and that the data did not violate the assumptions made by linear regression analysis. Specifically, data were tested for linearity, homoscedasticity, normality, and collinearity.

Linearity, Normality, and Homoscedasticity.

The data were inspected for linearity and normality by visual inspection of plots. The data did not appear to violate linearity and appeared normally distributed. The data were analyzed to ensure homoscedasticity visual inspection of the standardized, the studentized, and the studentized deleted residual plots. The data were analyzed to ensure homoscedasticity by visual inspection of the standardized, the studentized, and the studentized deleted residual plots. All plots are included in Appendix D.

Collinearity

The VIF for all IVs were below the threshold of 10. See Table 18 for all VIF results for Class B. The tolerance of all IVs exceeded 0.10. No Condition Index exceeded

50. See Table 19 for all condition indices for Class B. These results suggest collinearity or multicollinearity is not present (Lomax & Hahs-Vaughn, 2012).

Table 18. VIF Results for Class B

Coefficients

Model		Correlations Partial	Part	Tolerance	VIF
1	(Constant)				
	Q1	.587	.411	.417	2.396
	Q2	-.738	-.620	.260	3.850
	Q4	-.194	-.112	.382	2.616
	Q5	-.276	-.163	.378	2.644
	Q11	.166	.096	.260	3.847
	Q12	-.508	-.335	.505	1.981
	Q13	-.219	-.127	.264	3.794
	Q14	.519	.345	.204	4.900

Table 19. Collinearity Diagnostics for Class B

Collinearity Diagnostics

Model	Dimension	Eigenvalue	Condition Index	Variance Proportions (Constant)	Q1	Q2	Q4	Q5	Q11	Q12	Q13	Q14
1	1	8.639	1.000	.00	.00	.00	.00	.00	.00	.00	.00	.00
	2	.111	8.833	.00	.00	.04	.14	.05	.00	.02	.00	.03
	3	.075	10.748	.00	.20	.00	.05	.00	.00	.11	.01	.07
	4	.050	13.137	.26	.04	.02	.00	.07	.03	.06	.02	.02
	5	.045	13.884	.09	.05	.10	.02	.01	.00	.43	.00	.03
	6	.032	16.446	.01	.00	.02	.00	.19	.30	.12	.07	.03
	7	.028	17.501	.02	.39	.00	.18	.32	.15	.02	.00	.06
	8	.015	24.253	.00	.22	.33	.61	.28	.05	.10	.14	.11
	9	.006	38.945	.61	.10	.49	.00	.08	.46	.15	.76	.66

Outliers and Influential Data Points

Again, I selected a residual threshold of 1.96 to account for 95% of normally distributed residuals, and I used this value as one factor in comprehensive approach to detecting outliers and influential data points as suggested by Pedhazur (1997). Refer to Appendix F for residuals, leverages, and Cook's Distance values for all items and cases.

In Class B, two students (identified solely as case numbers) met criteria for exclusion. Case 22 had standardized residuals, studentized residuals, and/or studentized deleted residuals that exceeded the threshold value of ±1.96 for the majority of survey items, and therefore qualifies as an outlier. Case 23 standardized residuals, studentized residuals, and/or studentized deleted residuals that exceeded the threshold value of ±1.96 for several items, plus it had values of Cook's D that was considered large for several items – i.e., noticeably larger than others (Pedhazur, 1997), and a ZDFBETA score for exceeded $2/\sqrt{N}$ which is considered extreme (Belsley et al., 1980), indicating that case 23 was either influential or an outlier, and qualifies to be removed from analysis.

All remaining cases had standardized residuals, studentized residuals, and studentized deleted residuals that fell within the threshold value of $z = \pm 1.96$ for all or the majority of items. The ZDFBETA scores did not exceed $2/\sqrt{N}$ for any items. By using Pedhazur's (1997) holistic approach to determining outliers, all remaining cases were determined not to be outliers or unduly influential and were used in subsequent analyses. Again, refer to Appendix F for residuals, leverages, and Cook's Distance values for all items and cases.

Missing Data

Little's (1988) MCAR test was performed to determine if the data was missing completely at random. The results were chi-square = 59.082, (df = 65, p = .683), therefore we fail to reject the null hypothesis. Because the data appear to be missing completely at random, listwise deletions during analysis should not introduce bias, and therefore further procedures to fill in missing data are unnecessary (Rubin, 1977).

Reliability

All 22 survey items were tested for reliability. All survey items achieved a Cronbach's alpha score of .493. The analysis included Cronbach's alpha for the survey if an item was deleted, and items were deleted singly until the maximum Cronbach's alpha was achieved. Items 15, 10, 18, 8, 19, 22, 20, 21, 9, 3, 16, 18, 7, and 6were omitted from reliability calculations in that order. The final Cronbach's alpha was .873, and included items 1, 2, 4, 5, 8, 11, 12, 13, and 14. See Table 20 for a summary.

Table 20. Item-Total Statistics for Class B.

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Q1	31.429	50.457	.627	.858
Q2	31.619	53.248	.587	.861
Q4	31.571	52.757	.505	.872
Q5	31.476	50.862	.640	.856
Q11	31.476	48.462	.797	.838
Q12	31.857	53.229	.582	.862
Q13	31.333	54.533	.698	.854
Q14	31.905	50.490	.657	.854

Regression Analysis Based on Reliability

A multiple linear regression was used to determine the ability of the highest reliability survey items to predict the classroom Score Percentage. A significant regression equation was found ($F (8, 12) = 3.157$, $p = 0.036$) with an R^2 of .678. Items 1, 2, 12, and 14 were significant predictors of ScorePercentage. See Table 21 for regression results for Class B. The regression equation for class b was:

ScorePercentage = 7.285Q1 – 16.030 Q2 – 6.165 Q12 + 9.085 Q14 + 94.045

Table 21. Regression Results for Class B

Model		Unstandardized Coefficients		Standardized Coefficients			Correlations
		B	Std. Error	Beta	t	Sig.	Zero-order
1	(Constant)	94.045	17.859		5.266	.000	
	Q1	7.285	2.904	.636	2.509	.027	-.172
	Q2	-16.030	4.236	-1.216	-3.784	.003	-.659
	Q4	-2.067	3.016	-.182	-.685	.506	-.119
	Q5	-3.166	3.180	-.265	-.996	.339	-.325
	Q11	2.297	3.928	.188	.585	.570	-.408
	Q12	-6.165	3.014	-.472	-2.045	.063	-.386
	Q13	-4.147	5.345	-.248	-.776	.453	-.265
	Q14	9.085	4.314	.764	2.106	.057	-.385

Class B Significant Items

The following items were statistically significant for Class B:

1. When given a design task, I first identify and review the product/product requirements.
2. If design requirements are unclear or directly contradict each other, I contact the customer/client/instructor.

12. I try to characterize the nature of the error in relation to target performance (e.g., it is too high, too low, too slow, etc.)
14. During troubleshooting, if parallel operations produce an error, I review the specifications to see if they should have run in series instead of parallel.

Item Analysis

Survey Items 1, 2, 4, 5, 11, 12, 13, and 14 were Likert Scale items with seven options ranging from “Always” to “Never”; “Always” was worth 6 points, and “Never” was worth zero points. The difficulty and discrimination of each is as follows: Item 1: 4.6667, .3761; Item 2: 4.762, .2648; Item 4: 4.5238, .5229; Item 4: 4.6190, .4674; Item 11: 4.6190, .6060; Item 121: 4.62381, .2735; Item 13: 4.7619, .4749; and Item 14: 4.1905 and .2892. Detailed analysis for the more reliable items and each answer option follows in Table 22. Detailed item analysis for all items is included in Appendix E.

Table 22. Item Analysis for Class B.

Item	Option	Score	Difficulty	Std. Dev.	Discrimin.
q1	Overall		4.6667	1.5275	0.3761
	1.0	6.0	0.3810	0.4976	0.2098
	2.0	5.0	0.2857	0.4629	0.0854
	3.0	4.0	0.1429	0.3586	-0.0556
	4.0	3.0	0.0476	0.2182	-0.0383
	5.0	2.0	0.0952	0.3008	-0.2652
	6.0	1.0	0.0476	0.2182	-0.4377
	7.0	0.0	0.0000	0.0000	NaN
q2	Overall		4.4762	1.3274	0.2688
	1.0	6.0	0.2381	0.4364	0.3943
	2.0	5.0	0.3333	0.4830	-0.2351
	3.0	4.0	0.1905	0.4024	-0.1857
	4.0	3.0	0.1905	0.4024	0.1315
	5.0	2.0	0.0000	0.0000	NaN
	7.0	0.0	0.0000	0.0000	NaN
q3	Overall		4.4286	0.8701	-0.1070
	1.0	3.0	0.0476	0.2182	0.2741
	2.0	4.0	0.1905	0.4024	0.1015
	3.0	5.0	0.2857	0.4629	0.0333
	4.0	6.0	0.0952	0.3008	0.0919
	5.0	5.0	0.0952	0.3008	-0.1600
	6.0	4.0	0.1905	0.4024	-0.4581
	7.0	3.0	0.0952	0.3008	0.0786
q4	Overall		4.5238	1.5368	0.5229
	1.0	6.0	0.2857	0.4629	0.4732
	2.0	5.0	0.3333	0.4830	-0.0797
	3.0	4.0	0.1905	0.4024	-0.0774
	4.0	3.0	0.0952	0.3008	-0.1337
	5.0	2.0	0.0476	0.2182	-0.4377
	6.0	1.0	0.0000	0.0000	NaN
	7.0	0.0	0.0476	0.2182	-0.3293
q5	Overall		4.6190	1.4655	0.4674
	1.0	6.0	0.2857	0.4629	0.2339
	2.0	5.0	0.3333	0.4830	0.1861
	3.0	4.0	0.2857	0.4629	-0.1898
	4.0	3.0	0.0000	0.0000	NaN
	5.0	2.0	0.0476	0.2182	-0.4377
	6.0	1.0	0.0000	0.0000	NaN
	7.0	0.0	0.0476	0.2182	-0.3293
q11	Overall		4.6190	1.4310	0.6060
	1.0	6.0	0.2857	0.4629	0.5001
	2.0	5.0	0.3333	0.4830	0.0028
	3.0	4.0	0.2381	0.4364	-0.2228
	4.0	3.0	0.0952	0.3008	-0.3176
	5.0	2.0	0.0000	0.0000	NaN
	6.0	1.0	0.0000	0.0000	NaN

	7.0	0.0	0.0476	0.2182	-0.4377
q12	Overall		4.2381	1.3381	0.2735
	1.0	6.0	0.1905	0.4024	0.2623
	2.0	5.0	0.2381	0.4364	0.0227
	3.0	4.0	0.3333	0.4830	-0.2351
	4.0	3.0	0.1429	0.3586	0.1118
	5.0	2.0	0.0476	0.2182	-0.0383
	6.0	1.0	0.0476	0.2182	-0.4377
	7.0	0.0	0.0000	0.0000	NaN
q13	Overall		4.7619	1.0443	0.4749
	1.0	6.0	0.1905	0.4024	0.3433
	2.0	5.0	0.5714	0.5071	-0.0853
	3.0	4.0	0.0952	0.3008	0.1989
	4.0	3.0	0.0952	0.3008	-0.3568
	5.0	2.0	0.0476	0.2182	-0.4377
	6.0	1.0	0.0000	0.0000	NaN
	7.0	0.0	0.0000	0.0000	NaN
q14	Overall		4.1905	1.4703	0.2892
	1.0	6.0	0.1429	0.3586	0.4287
	2.0	5.0	0.3810	0.4976	-0.1525
	3.0	4.0	0.1905	0.4024	-0.1759
	4.0	3.0	0.1905	0.4024	0.0516
	5.0	2.0	0.0476	0.2182	0.0349
	6.0	1.0	0.0000	0.0000	NaN
	7.0	0.0	0.0476	0.2182	-0.4377

Negative Discrimination Items

In Class B, five items had negative discrimination: items 3, 10, 15, 17, and 21. None of those items was scored in a Likert scale format where “Always” had the highest value and “Never” scored zero. Two items, 3 and 15, were Likert scale items where the middle choice had the highest possible score with “Always” and “Never” having equally low scores. Item 17 was a multiple-choice item; item 21 was a True/False item.

Regression Analysis Based on Item Analysis

A multiple linear regression was used to determine the ability of the highest reliability survey items to predict the classroom Score Percentage. A nonsignificant regression equation was found (F (18, 1) = 3.604, p = 0.395) with an R^2 of .985). See Table 23 for the regression results.

Table 23. Regression Results for Class B Based on Item Analysis

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	36.588	230.306		.159	.900
	SQ1	6.314	5.715	.470	1.105	.468
	SQ2	-.313	13.880	-.019	-.023	.986
	SQ4	20.301	10.709	1.685	1.896	.309
	SQ5	-6.623	5.877	-.516	-1.127	.462
	SQ6	-18.330	9.575	-.860	-1.914	.306
	SQ7	-7.157	6.759	-.861	-1.059	.482
	SQ8	-2.409	2.049	-.309	-1.176	.449
	SQ9	2.626	6.050	.263	.434	.739
	SQ11	20.268	9.459	1.138	2.143	.278
	SQ12	-16.230	5.673	-1.053	-2.861	.214
	SQ13	-12.530	7.188	-.607	-1.743	.332
	SQ14	4.114	4.704	.267	.874	.543
	SQ16	-1.417	3.959	-.215	-.358	.781
	SQ18	-14.519	8.016	-1.107	-1.811	.321
	SQ19	2.536	1.891	.441	1.341	.408
	SQ20	4.788	2.769	.833	1.729	.334
	SQ22	-6.079	2.440	-1.014	-2.491	.243
	Major GPA	34.724	50.677	.662	.685	.618

Collinearity

Survey items 1, 4, 5, 9, 11, 16, 18, 20, 22, and Major GPA had VIF values in excess of 10 and the corresponding tolerance values were below 0.10. The condition indices for items 18, 19, 20, 22, and Major GPA exceeded 50. These results suggest collinearity was a problem (Lomax & Hahs-Vaughn, 2012). See Tables 24 and 25 for VIF results and Collinearity Diagnostics.

Table 24. VIF Results for Class B Based on Positive Discrimination

		Collinearity Statistics	
Model		Tolerance	VIF
1	(Constant)		
	SQ1	.084	11.898
	SQ2	.021	48.617
	SQ4	.019	52.041
	SQ5	.072	13.817
	SQ6	.075	13.286
	SQ7	.023	43.557
	SQ8	.220	4.549
	SQ9	.041	24.143
	SQ11	.054	18.574
	SQ12	.112	8.931
	SQ13	.125	7.980
	SQ14	.163	6.142
	SQ16	.042	23.673
	SQ18	.041	24.589
	SQ19	.140	7.130
	SQ20	.065	15.285
	SQ22	.092	10.914
	Major GPA	.016	61.528

Table 25. Collinearity Diagnostics for Class B Based on Positive Discrimination

Collinearity Diagnostics

Model	Dimension	Eigenvalue	Condition Index
1	(Constant)	16.532	1.000
	SQ1	.687	4.904
	SQ2	.415	6.312
	SQ4	.370	6.681
	SQ5	.349	6.884
	SQ6	.240	8.291
	SQ7	.130	11.296
	SQ8	.083	14.113
	SQ9	.056	17.257
	SQ11	.038	20.818
	SQ12	.031	23.001
	SQ13	.021	27.920
	SQ14	.018	30.416
	SQ16	.016	32.232
	SQ18	.006	50.962
	SQ19	.004	63.250
	SQ20	.002	83.085
	SQ22	.001	163.688
	Major GPA	4.774E-5	588.478

Class B Results for Subscales and Major GPA

Linear Regression Diagnostics.

Data were tested to ensure linear regression was statistically appropriate, and that the data did not violate the assumptions made by linear regression analysis. Specifically, data were tested for linearity, homoscedasticity, normality, and collinearity.

Linearity, Normality, and Homoscedasticity

The data were inspected for linearity and normality by visual inspection of plots. The data did not appear to violate linearity and appeared normally distributed. The data were analyzed to ensure homoscedasticity visual inspection of the standardized, the studentized, and the studentized deleted residual plots (see Appendix D). No items violated the assumptions homoscedasticity.

Collinearity

The VIF for all IVs were below the threshold of 10. The tolerance of all IVs exceeded 0.10. See Table 26 for all VIF results for class B Subscales. No Condition Index exceeded 50. See Table 27 for all Condition Indices for Class B Subscales. These results suggest collinearity or multicollinearity is not present (Lomax & Hahs-Vaughn, 2012).

Table 26. VIF Results for Class B Subscales and Major GPA

Coefficients

Model		Collinearity Statistics	
		Tolerance	VIF
1	(Constant)		
	SpecSubScore	.739	1.353
	TestSubScore	.856	1.169
	TrbSubScore	.712	1.405
	MajorGPA	.777	1.288

Table 27. Collinearity Diagnostics for Class B Subscales and Major GPA

Collinearity Diagnostics

				Variance Proportions				
Model	Dimension	Eigenvalue	Condition Index	(Constant)	Spec Subscale	Test Subscale	Trb Subscale	Major GPA
1	1	4.898	1.000	.00	.00	.00	4.898	1.000
	2	.058	9.175	.00	.00	.67	.058	9.175
	3	.027	13.408	.01	.06	.11	.027	13.408
	4	.015	18.308	.00	.85	.21	.015	18.308
	5	.002	52.167	.99	.08	.00	.002	52.167

Outliers and Influential Data Points

I selected a residual threshold of 1.96 to account for 95% of normally distributed residuals, and I used this value as one factor in comprehensive approach to detecting outliers and influential data points as suggested by Pedhazur (1997). Refer to Appendix F for residuals, leverages, and Cook's Distance values for all items and cases. In Class B, three students (identified solely as case numbers) met criteria for exclusion. Cases 1, 9, and 22 had standardized residuals, studentized residuals, and/or studentized deleted residuals exceeded the threshold value of $z = \pm 1.96$ for the subscales. The ZDFBETA scores for two additional students, Cases 21 and 23 exceeded $2/\sqrt{N}$ and were excluded from further analysis.

All remaining cases had standardized residuals, studentized residuals, and studentized deleted residuals that fell within the threshold value of $z = \pm 1.96$ for all or the majority of subscales. The ZDFBETA scores did not exceed $2/\sqrt{N}$ for any remaining items. By using Pedhazur's (1997) holistic approach to determining outliers, all remaining cases were determined not to be outliers or unduly influential and were used in subsequent analyses. Again, see Appendix F for residuals, leverages, and Cook's Distance values for all items and cases.

Regression Analysis

A multiple linear regression was used to determine the ability of the highest reliability survey items to predict the classroom Score Percentage. A statistically significant regression equation was found ($F (4, 14) = 13.410$, $p = 0000$) with an R^2 of .793). See Table 28 for regression results for Class B Subscales with Major GPA.

Table 28. Regression Results for Class B Subscales and Major GPA

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	-1.149	.358		-3.211	.006
	SpecSubScore	-.006	.006	-.140	-.991	.339
	TestSubScore	.000	.002	.010	.077	.940
	TrbSubScore	6.515E-5	.006	.002	.011	.991
	Major GPA	.451	.074	.840	6.086	.000

Class B Results for Total Score and Major GPA

Linear Regression Diagnostics.

Data were tested to ensure linear regression was statistically appropriate, and that the data did not violate the assumptions made by linear regression analysis. Specifically, data were tested for linearity, homoscedasticity, normality, and collinearity.

Linearity, Normality, and Homoscedasticity

The data were inspected for linearity and normality by visual inspection of plots. The data did not appear to violate linearity and appeared normally distributed. The data were analyzed to ensure homoscedasticity visual inspection of the standardized, the studentized, and the studentized deleted residual plots (see Appendix D). No items violated the assumptions homoscedasticity.

Collinearity

The VIF for all IVs were below the threshold of 10. The tolerance of all IVs exceeded 0.10. See Table 29 for all VIF results for class B using Total Score. No Condition Index exceeded 50. See Table 30 for all Condition Indices for Class B using Total Scores. These results suggest collinearity or multicollinearity is not present (Lomax & Hahs-Vaughn, 2012).

Table 29.VIF Results for Class B Total Score and Major GPA

Coefficients

		Collinearity Statistics	
Model		Tolerance	VIF
1	(Constant)		
	Total Score	.983	1.017
	Major GPA	.983	1.017

Table 30. Collinearity Diagnostics for Class B Total Score and Major GPA

Collinearity Diagnostics

				Variance Proportions		
Model	Dimension	Eigenvalue	Condition Index	(Constant)	Total Score	Major GPA
1	1	2.979	1.000	.00	.00	.00
	2	.018	12.755	.02	.80	.10
	3	.003	32.559	.98	.19	.90

Outliers and Influential Data Points

I selected a residual threshold of 1.96 to account for 95% of normally distributed residuals, and I used this value as one factor in comprehensive approach to detecting outliers and influential data points as suggested by Pedhazur (1997). Refer to Appendix F for residuals, leverages, and Cook's Distance values for all items and cases. Using the Total Scores in Class B, three students (identified solely as case numbers) met criteria for exclusion. Case 1, 9, and 22 had standardized residuals, studentized residuals, and/or studentized deleted residuals exceeded the threshold value of z = ±1.96 for the subscales

All remaining cases had standardized residuals, studentized residuals, and studentized deleted residuals that fell within the threshold value of z = ±1.96. The ZDFBETA scores did not exceed $2/\sqrt{N}$ for any items. By using Pedhazur's (1997) holistic approach to determining outliers, all remaining cases were determined not to be outliers or unduly influential and were used in subsequent analyses. Again, see Appendix F for residuals, leverages, and Cook's Distance values for all items and cases.

Regression Analysis

A multiple linear regression was used to determine the ability of the highest reliability survey items to predict the classroom Score Percentage. A statistically significant regression equation was found (F (2, 18) = 29.167, p = 0.000) with an R^2 of .764). See Table 31 for regression results for Class B Total Score with Major GPA.

Table 31. Regression Results for Class B Total Score with Major GPA

Coefficients

		Unstandardized Coefficients		Standardized Coefficients		
Model		B	Std. Error	Beta	t	Sig.
1	(Constant)	-1.602	.302		-5.303	.000
	Total Score	.000	.002	.030	.263	.796
	Major GPA	.537	.071	.878	7.602	.000

Summary

Class A had 11 items with a Cronbach's alpha score of 0.776, suggesting a reasonable level of reliability (Thorndike & Thorndike-Christ, 2010); however, the regression analysis did not produce a statistically significant model. Class B had eight items with a Cronbach's alpha of 0.873, also suggesting a reasonable level of reliability, and the regression analysis produced a statistically significant model with four statistically significant survey items. Seven of the items were reliable for both classes.

Chapter 5: Conclusions

The purpose of this study was to investigate the degree to which a students' alignment with experts' approach to design problems predicted students' actual design problem-solving performance. It was hypothesized that students with high alignment to the expert approach would have higher scores on closely related problems. Students with more highly developed schemata and a greater understanding of engineering design should be more readily able to solve classroom design problems. The students further along the expertise continuum would be displaying a qualitatively different approach to design problems, measurable through the grades and performance on those problems. In this chapter, conclusions are first presented separately for data from Class A and Class B, respectively. Then, overall findings, instrument properties, and implications for future research and engineering education practice are discussed.

Class A

Class A had 12 items with reasonable reliability; however, the regression analysis did not produce a statistically significant model, indicating that there is no significant predictive relationship between the students' level of expertise and classroom design problem-solving scores.

There could be several explanations for this finding. The first, and most obvious, is that there is no correlation of these two constructs. Another likely reason could be found by looking at the students and the class itself. The students were at the end of their freshman year, and Class A was a course that covers basic Boolean logic for digital circuits. It the first engineering class in the curriculum (University, 2015). At this point in their academic careers, the freshmen probably have very low levels of design and engineering expertise (Altman et al., 2008). Considering that student ability is a factor that impacts the precision of measurement (Thorndike & Thorndike-Christ, 2010), it is possible that the students at this level have not yet achieved sufficient expertise to be measured by the instrument. In other words, for students at this experience level, the instrument is reliable but cannot significantly predict performance. To successfully discriminate between all levels of ability, the instrument would need to be prohibitively long. Because this instrument is new, more data collection and analysis – especially with students of differing ability – is required before we can understand how well it performs across the spectrum of students.

Although Total Score did not yield a statistically significant regression result for class A, the subscales did. It is possible that the students, so early in their engineering program, do not have sufficient knowledge to count on robust responses at the individual item level. However, the pooled knowledge of the subscales – specifications, testing, and troubleshooting, does yield statistically significant results. In other words, a single item is not a predictor, but perhaps the trend of the subject matter is a predictor. In contrast to Class B – further along in the engineering curriculum – the items may be asking questions that are too pointed for the diffuse nature of their current level of knowledge.

Class B

Class B had 8 items with reasonable reliability (Thorndike & Thorndike-Christ, 2010), and the regression analysis produced a model with 4 statistically significant items. Seven of the items were reliable for both classes. Class B is a sophomore level class and is the third electrical engineering class taken by the majority of these students (University, 2015), so these students should have developed more expertise at being engineering students (Nuthall, 2005) as those in class A. They could be more adept at detecting and responding to cues in accordance with the culture of the engineering program. Also, the students in class B could have further developed engineering and design expertise than those in Class A. Thus, it could be that the students have progressed further along the continuum of expertise, and therefore demonstrate a more robust relationship between the approaches that experts use and their own performance. At this point in the curriculum, students have been exposed to more systematic approaches to engineering problems in general, and design specifically; therefore, it could be that they simply have a greater understanding of the terminology used in engineering as well. This finding is consistent with the findings of previous studies of students' expertise in engineering design (Atman et al., 2007; Atman et al., 2008).

Unexpectedly, however, the following two statistically significant items for Class B produced a negative result in the regression analysis (Items 2 and 12), meaning that the less the students answered the items like experts, the better they performed in class:

2) If design requirements are unclear or directly contradict each other, I contact the customer/client/instructor.

12) I try to characterize the nature of the error in relation to target performance (e.g., it is too high, too low, too slow, etc.)

There are numerous potential reasons for these results for both items, but we cannot definitively say without further research. One possibility is that this particular class is not representative of all students and their results are not generalizable. Another potential explanation is that the instrument is flawed.

A third possibility is that students are receiving instruction in their coursework that contradicts the results of the experts' CTA. Assuming the CTA of the three experts is accurate, this possibility would be particularly troubling because it could indicate that students are receiving maladaptive instruction in their coursework. In order perform well in the workplace, students would have to change their approach to design and learn more appropriate methods. We could determine if this is the reason for the unexpected results by observing the classroom and laboratory instruction.

A fourth possibility is that students are receiving instruction specific to the course content and its assessment. That is, instructors are teaching students to solve specific types of problems that have instructional value and are readily assessed. Individual courses take a small portion of an extensive knowledge base and attempt to teach students the necessary basic skills for performing within the domain. Instructors must account for the knowledge level of the students – freshmen and sophomores specifically in this case. Since the expertise level of students at this level is limited, adjustments have to be made to accommodate their cognitive load. One such adjustment is that problems are well-structured and tightly defined. This narrows the students' search space and reduces cognitive load. Another adjustment is that problems may have artificial constraints (e.g., only using resistors for a circuit when capacitors would be more appropriate). These constraints have the advantage of forcing students to consider design alternatives, a necessary skill in engineering design (Cunningham & Carlsen, 2014) and important in "authentic" tasks. By using these constraints, germane cognitive load is increased, and well-structured offer increased learning opportunities.

The types of problems solved by the students were well-structured problems (Jonassen, 1997). Well-structured problems are often a subset of authentic engineering tasks (Jonassen, Strobel & Lee, 2006). Additionally, the skill set necessary for solving well-structured problems is a subset of the skills necessary for solving ill-structured problems (Shin, Jonassen, & McGee, 2006). Therefore, these well-structured problems are a form of scaffolding for learning to solve ill-structured, authentic engineering problems. However, these scaffolds should ultimately be eliminated, and students should progress to more realistic design problems lest they inhibit students' progress toward greater expertise (Kalyuga, 2007).

Complex and authentic problems are time-consuming and difficult to assess (Spector, 2006) and develop. The engineering professors must balance the time spent devoted to teaching with time for research; this can be especially problematic because engineering professors dedicated to teaching quality are sometimes devalued by their institutions (Alpay & Jones, 2012). Additionally, with time constraints, the instructors may be trying to develop a larger number of problems for students to address the full spectrum of topics covered in the course. A single complex problem to cover all facets of any specific course's content would be difficult to design and assess, especially given that individual assessments are expected and these projects are typically group projects. This study cannot determine if the curriculum will address these shortcomings, but can only address what was found by the instrument.

Independently for Item 2, there are several potential explanations. The students who perform less like experts may have higher confidence in their work and assume they will be able to determine what they need to do as they work through a design problem. It could also indicate that the students are under classroom time constraints when they are doing these types of problems that are unlike the typical time constraints in the workplace, and the different situation requires the students to act differently in order to perform. A third possibility is that the students have not yet developed sufficient assertiveness to be willing to ask for clarification. This could be a function of age and experience – the experts are, by definition, older than these typical students (University, 2015).

Independently for Item 12, a potential explanation can be that the students are answering the question inaccurately – that they do, in fact, compare and characterize the degree of difference, but the answers are not in alignment with reality. This could be for two reasons: there is a flaw with the question or they are just unaware that they are doing so (Broadbent et al., 1986). If the question is flawed, it indicates the original cognitive interview for the survey was insufficient either in methodology or number of interviews.

The other possibility could be explained by what is known about automaticity: The better students may have automated this action, and therefore are not even aware that they are performing it. This explanation is supported by what is known about expertise (Glaser & Chi, 1988). It is possible to determine which, if any, is occurring by a relatively straightforward study: First, give students the survey. Then, as they are working on design problems and get unexpected numerical results, simply ask what they know about the results. If they can characterize the difference in the results, ask about how they answered the survey item. From their responses, we may be able to determine if they have automated the process or if there is a problem with the wording of the question.

The subscales did not predict performance for class B. The overall regression analysis was statistically significant, but only the Major GPA coefficient was statistically significant. By this point in their academic careers, the students' knowledge of the content addressed by the individual survey items has progressed and perhaps become more meaningful. As a result, the more expert knowledge may lessen the impacts of pooling and increase the contribution of individual items. Additionally, the students' grades are, by definition, a larger sampling of the students' overall performance and therefore more accurate in predicting performance.

Impact of Sample Size and Scoring

The various regression analyses have mixed results, which could primarily reflect regression instability due to small sample size (Pedhazur, 1997). Additionally, the screening of outliers introduces more variability, potentially amplified by the limited sample size. As suggested below, additional research with a larger sample size might resolve many of these questions and inconsistencies. Additionally, problems were scored with some level of flexibility for partial credit, which may have introduced artificial variability. Stricter adherence to a grading rubric would mitigate this issue. The scoring flexibility could also impact the results of all the regressions performed, adding to the instability of the small sample size. However, the overall results suggest that there is some positive correlation between students' responses on the survey and their performance on classroom problems.

Instrument Properties

Another relevant consideration is the properties of the instrument itself. The items that were reliable for both classes were items numbered 1, 2, 4, 5, 11, 13, and 14, and were all Likert Scale items. There are four potential explanations. The first is based on the content of the reliable items. The reliable items deal primarily with the specifications of a design problem, indicating that the students have a tendency to attempt to fully understand the problem prior to attempting to solve it. This possibility aligns with what is known about expertise – the tendency to spend time qualitatively analyzing a problem prior to solving (Glaser & Chi, 1988).

This possibility could be further explored by student interviews. By learning more about how students approach the design problems, particularly the type of knowledge they feel they need prior to solving a problem, we could determine if the students are performing more like experts with the type of in-depth initial classification and understanding of problems.

The second possibility is that the content addressed by the remaining items, both multiple choice and Likert, is not content these students are yet prepared to respond to in a systematic way. These items were primarily relating to troubleshooting and testing.

Considering that, historically, these skills are substantially different from what many students have experienced – pencil and paper problem solving based on mathematical knowledge, (Dym, Agogino, Eris, Frey, & Leifer, 2005) the students most likely have less experience and therefore less expertise in this area. This cannot be known with the current data, and can be explored by surveying more advanced students to see if these problems are reliable for students with more advanced skills.

An additional method for determining if the troubleshooting and testing skills are likely to lead to a greater reliability is to qualitatively analyze the laboratory experiences of the students to determine if those who spend time in deliberate practice of these skills respond to the survey items differently than those who do not. This process would require an in-depth study into the laboratory practices, paying attention to time allotted for design, troubleshooting, and active manipulation of hardware. It would also require the knowledge of the types of problems that allow rich development of troubleshooting and testing skills. Johnson (1998) studied expert and novice troubleshooting, and his approach could be a subset of the type of study suggested.

A third explanation is that the Likert scale is a more appropriate measure of expertise because expertise is a complex construct that consists not only amount of knowledge (Glaser, 1985), but also of experience solving problems, the cognitive state of automaticity, self-monitoring, in-depth understanding of a domain, and the approach to solving problems (Sternberg, 1998). Therefore, such a construct is probably measured on a continuum and more appropriately measured by the Likert scale. This possibility is supported by the responses to three items in particular. Item 2 is a Likert scale item dealing with the clarity and sometimes contradictory nature of specifications. Items 16 and 17 are multiple-choice items that deal with the same content, but ask about specific scenarios. While Item 2 was reliable, Items 16 and 17 were not.

The fourth possibility is that the questions that were found to not be reliable were not good questions. There is a cluster of questions regarding testing which probably falls into this category. The questions ask about testing a system outside its operational and functional boundaries, particularly temperature and current ranges. Upon reviewing the questions, there is likely too much ambiguity in the items. The questions, although superficially clear and concise, do not give enough detail to the students to permit them to respond appropriately without context. The items should probably be written in a longer format providing the insight that the inputs described are outside anticipated operational ranges, but not so extreme as to risk damage to the circuits. After modification, these items may be usable.

Also of concern is the loss of the two independent variables *required* and *math proficiency*. The IV *required* was eliminated because all respondents but one who answered that item indicated that the respective class was required for their major. With a much larger sample, sufficient data may be collected for analysis. Additionally, choosing a class that is frequently selected as an elective as opposed to a core class could potentially provide sufficient responses for analysis.

The IV *math proficiency* was not used because too few respondents reported their SAT math scores. This lack of reporting was due, in part, to the university's choice of college entrance exams. This particular university relies more heavily on the ACT than on the SAT. For future studies, the question should be modified to ask for math scores from either or both major college entrance exams. Additionally, since a "study should investigate existing sources of information as a first step in the research process to take advantage of information that has already been collected" (Rea & Parker, 2014, p.5), it would be ideal to access this information from within the students' institutional-held data since it would also reduce inaccuracies from self-report. In this case, however, that would have required a different level of institutional buy-in and data access privileges than was accessible for this study. In any case, however, the researcher should tailor the questions to the specific test predominately used in each university. Furthermore, in university settings where both tests are commonly used, there may be a need for some sort of correlation of the two scores to be able to make maximum use of all the given data.

The IV *prior performance* as measured by the students' grade point average in their major was not a reliable indicator of performance. There could be several reasons for this finding. The most obvious reason is that the grade point average in one's major is not, in fact, a predictor of performance. However, we do not have sufficient data at this point to draw that conclusion. Another likely reason is the students' responses were inaccurate. Although self-report is more accurate with higher performers (Cole & Gonyea, 2010), the question asked for grade point average in the major, and not general grade point average. Unless the students stopped the survey to calculate this number, they may have approximated. It would have been more accurate and preferable to gather this information through university records; however, as explained above, that option was not available for this study.

In Relation to Expertise

Items 1 and 2 address the student's initial approach to an engineering design problem. This illuminates the student's willingness to fully understand a problem prior to attempting a solution. One of the basic traits of expertise is the initial qualitative analysis of a problem, and "[p]rotocols show that, at the beginning of a problem-solving episode, experts typically try to "understand a problem, whereas novices plunge immediately into attempting to apply equations and to solve for an unknown" (Glaser & Chi, 1988, p. xix). The students that are already taking the time to ensure that their understanding of a problem is initially sufficient are showing a "maturity" in their work, and are addressing problems in the same manner as experts. This finding is consistent with a previous study that indicates expert designers tend to spend more time on a design, particularly in obtaining more information before and during the design process (Atman et al., 2007). Item 14 suggests a similar tendency – returning to the specifications to be certain that their mental representation of the problem is accurate before continuing to work on problems that have arisen during their work. It also exhibits the expert trait of self-monitoring (Glaser & Chi, 1988). By realizing that their understanding may be at fault, they are demonstrating an awareness of their own abilities and potential limitations.

Item 12 demonstrates a similar self-monitoring strategy, but also includes an aspect of an expert's deeper understanding of their domain (Glaser & Chi, 1988). By spending the time to characterize the nature of the error, they are demonstrating an awareness of the deeper principles. The result is not simply "wrong"; the design is flawed in some manner that follows design principles. It requires a deeper comprehension of the way components work together to make use of the information. The characterization of errors suggests that the student is developing a mental representation of the design, and is comparing how the design should perform with actual performance. This suggests a sufficiently developed schema to simultaneously handle the two representations – otherwise two separate representations would overload the student's WM.

Implications

Here I will elaborate on the implications of the study as they relate to engineering education and for future research. These implications could provide further illumination on the practice, theory, and knowledge base of engineering education and its impact on student performance.

Implications for Further Research and Instrument Development

To further study expertise as a predictor of problem-solving performance, it is suggested to repeat the study with a larger sample. This would strengthen the confidence of the results. Furthermore, with the larger sample, there may be sufficient data to determine if the multiple-choice items are not the most suitable choice for measuring expertise. With a sufficiently large sample, a factor analysis could be performed on the significant items to determine how the factors load, and whether they load along the lines suggested by expertise or engineering education theories.

Further, I recommend reworking the items that discuss testing outside of operational limits. If necessary, these items could be written in more detail, encompassing a short paragraph to give sufficient detail so the respondents can have enough information available to judge whether or not the situation described would damage the electronic circuit. The items, as currently worded, are ambiguous and do not offer sufficient information to be able to make any type of legitimate engineering decision.

It could also be informative to survey students at various points throughout the curriculum. It would be expected to find a strengthening of the relationship as students gain expertise. Also, sampling students' performance with multiple instructors would be enlightening. It would determine whether or not the students' performance with expertise is consistent across different classes. Finally, studying students' progress through the curriculum would also determine if the performance of instrument is consistent. If so, the results could be used to guide the instruction, informed by both theory and empirical data.

The items that were found to be reliable but not statistically significant predictors are of particular interest upon further testing. If more of these items become significant predictors as student ability increases, one particularly interesting explanation is suggested. It is possible that there is a gap between the academic world and the world of engineering practice. In particular, there exists the potential that industry's experts have skills that are not being taught in undergraduate engineering courses. A likely reason could be that misalignment exists because the instrument was derived from industry experts, while the student assessments were designed – and the courses were taught – by academics. If this proves to be the case, these findings should inform a cohesive approach to teaching engineering design. Particularly, we know that there should be emphasis on fully understanding a problem before attempting a solution – the time taken to gather sufficient information is well spent. Also, troubleshooting should be taught using cognitively sound instructional practices. By grounding these approaches in cognitive load theory, the courses utilize students' time more efficiently.

With the additional research described here, we should be able to make informed decisions about the extent to which students approaching design like experts can predict their classroom design performance. This insight can further inform both engineering education and our understanding of expertise.

As mentioned above, it could be beneficial to perform additional studies to further examine some of the current findings. By investigating the reasons high-performing students answer item 12 in contradiction to expert performance, we could either, a) improve the instrument, or b) gain insight into the automaticity of engineering students.

Implications Relating to Engineering Education

The purpose of engineering education is to produce functional engineers (Altman et al., 2008). Since customer satisfaction increases with the amount of time an engineer spends gathering information prior to initiating a design (Jain & Sobek, 2006), those students (and designers) who develop this skill should have better overall customer satisfaction. This aspect of design, therefore, should be a priority for engineering educators.

The characterization of errors is a fundamental aspect of troubleshooting. It is naïve to think that all designs will function correctly on the first attempt, so troubleshooting is a vital step in developing a correct design. Performing this complex task is something that should be addressed through careful instructional design.

Additionally, if it is determined that students are receiving instruction that is counter to the CTA as suggested by survey items 2 and 12, it could be beneficial to prevent this from recurring. The students would have to rearrange their schemas to perform in the manner of experts. This effort would have to occur in the workforce, and could be effortful and effectively wasteful. Students who have instruction in line with expert performance would be able to progress in their design careers without this rearrangement.

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Appendix A: Survey Questions and Scoring

Q1 When given a design task, I first identify and review the product/product requirements.

- Always (6)
- (5)
- (4)
- (3)
- (2)
- (1)
- Never (0)

Q2 If design requirements are unclear or directly contradict each other, I contact the customer/client/instructor.

- Always (6)
- (5)
- (4)
- (3)
- (2)
- (1)
- Never (0)

Q3 In a design, I treat all requirements as having equal priority.

- Always (3)
- (4)
- (5)
- (6)
- (5)
- (4)
- Never (3)

Q4 If a functional component receives Boolean inputs, I test both cases.

- Always (6)
- (5)
- (4)
- (3)
- (2)
- (1)
- Never (0)

Q5 Consider product testing… If a component or system receives discrete, finite inputs (e.g., 5, 10, or 15 ohms, ‘a’, ‘b’, ‘c’, or ‘d’), I test all input values.

- ❍ Always (6)
- ❍ (5)
- ❍ (4)
- ❍ (3)
- ❍ (2)
- ❍ (1)
- ❍ Never (0)

Q6 Consider product testing… If a component or system receives a specified range of inputs (e.g., any value between 100 and 1,000 mA), I do not test the upper and lower boundaries.

- ❍ Always (0)
- ❍ (1)
- ❍ (3)
- ❍ (4)
- ❍ (4)
- ❍ (5)
- ❍ Never (6)

Q7 Consider product testing… If a component or system receives a specified range of inputs (e.g., any value between 100 and 1,000 mA), I test values slightly outside that range (e.g., 90 mA and 1010 mA).

- ❍ Always (6)
- ❍ (5)
- ❍ (4)
- ❍ (3)
- ❍ (2)
- ❍ (1)
- ❍ Never (0)

Q8 Consider product testing… If a component or system receives a specified range of inputs (e.g., any value between 100 and 1,000 mA), I do not test values far outside that range, (e.g., 0 mA and 1600 mA).

- ❍ Always (6)
- ❍ (5)
- ❍ (4)
- ❍ (3)
- ❍ (2)
- ❍ (1)
- ❍ Never (0)

Q9 I only test inputs for which I explicitly know the predicted output or correct result.

- ❍ Always (0)
- ❍ (1)
- ❍ (2)
- ❍ (3)
- ❍ (4)
- ❍ (5)
- ❍ Never (6)

Q10 If multiple functions operate in parallel, I test them in parallel prior to testing them individually.

- ❍ Always (0)
- ❍ (1)
- ❍ (2)
- ❍ (3)
- ❍ (4)
- ❍ (5)
- ❍ Never (6)

Q11 If, during testing, an error occurs, I try to identify the value range of inputs that produce the error, even if it requires generating additional tests cases.

- ❍ Always (6)
- ❍ (5)
- ❍ (4)
- ❍ (3)
- ❍ (2)
- ❍ (1)
- ❍ Never (0)

Q12 I try to characterize the nature of the error in relation to target performance (e.g., it is too high, too low, too slow, etc.)

- Always (6)
- (5)
- (4)
- (3)
- (2)
- (1)
- Never (0)

Q13 If all my troubleshooting efforts fail to determine the cause of the error, I refer back to the specifications to see if my design failed to address a specification or requirement.

- Always (6)
- (5)
- (4)
- (3)
- (2)
- (1)
- Never (0)

Q14 During troubleshooting, if parallel operations produce an error, I review the specifications to see if they should have run in series instead of parallel.

- Always (6)
- (5)
- (4)
- (3)
- (2)
- (1)
- Never (0)

Q15 You are testing a product. Between the last known correct value and the first known incorrect value, there are a large number of operations. Approximately where would you take your next measurement?

- ❍ Immediately after the last known correct value (0)
- ❍ (2)
- ❍ (4)
- ❍ (6)
- ❍ (4)
- ❍ (2)
- ❍ Immediately before the first known incorrect value (0)

Q16 You are given a lengthy set of requirements for a project. Upon reading the list of requirements, you find several items that do not make sense. For example, one particular measurement is required to be 5 Amps, but it should clearly state a value in volts.You would:

- ❍ Take the measurement in voltage, and assume they meant 5 volts. (0)
- ❍ Request clarification from the customer (6)
- ❍ Find a measurement that should be 5 Amps and assume that was the one they wanted. (0)
- ❍ Take no measurements and treat is as a mistake in the requirements. (0)

Q17 You are working on a complex project: create a working design for a new cell phone. The specifications call for maximizing screen resolution, brightness, reception, and battery life while reducing weight. All these goals probably cannot be met in one single device. You would:

- ❍ Meet as many goals as you could, documenting design rationale. (0)
- ❍ Ask the customer to provide you with prioritized requirements and specifications request. (3)
- ❍ Create your own prioritized specification matrix and submit it to the customer for feedback or approval (6)
- ❍ Design the product using cost and schedule as the primary factors to decide the specifications. (0)

Q18 You are testing a component within a fairly complicated system. It retains information from prior runs, and the initial state of each run is dependent on some factor of the last state of the prior run. This is the first time the system has been run or tested, so all memory conditions are clear. The test run is successful. You would:

- ❍ Note the successful test and move on to the next component for testing. (0)
- ❍ Note the success and test the component once more. (0)
- ❍ Note the success and test the component several more times. (6)

Q19 You are testing a system that has four processes running in parallel. For the first system test you would:

- First test the four processes running in parallel, then test the four processes individually. (0)
- First test the four processes individually, then test them while running in parallel. (6)
- Test the processes in the order which minimizes testing cost. (0)
- Test the processes in the order that minimizes schedule impacts. (0)

Q20 You are testing a system that, when in operation, is able to safely receive inputs between 0.500 and 0.700 mA. How do you determine the inputs that you will test?

- Test the full range in small increments (0)
- Test the full range in large increments (0)
- Test the full range AND values slightly beyond in small increments (6)
- Test the full range AND values slightly beyond in large increments. (3)
- Check the requirements or ask the customer (0)

Q21 You are testing a system that should receive inputs between .200 and 1.400 mA. You have generated a set of input values to test. For each and every input value, you calculate the appropriate output value.

- True (0)
- False (6)

Q22 You do not test a system outside its boundary conditions of temperature range, operational voltage, current, duration, etc.

- True (0)
- False (6)

Q25 Is this course required for your major?

- Yes
- No

Q26 What was your SAT Math score

- Click to enter your score
- I did not take the SAT

Q27 What is your grade point average in your major?

Appendix B: Design Problems Selected for Scoring

Class A

Problems

1) Design a circuit that outputs the average of four 8-bit unsigned binary inputs using wider internal components or wires to avoid losing information due to overflow.

2) Design a 4-bit up/down-counter that has four control inputs: `cnt_up` enables couting up, `cnt_down` enables counting down, `clear` synchronously resets the counter to all `0`s, and `set` synchronously sets the counter to all `1`s. If two or more control inputs are `1`, the counter retains its current count value. Use a parallel-load register as a building block.

3) Design a 16-bit carry-select adder using 4-bit carry-ripple adders.

Scoring

From: [redacted for grader privacy]

Sent: Sunday, May 29, 2016 3:12 PM

To: Warren, Sheila (sw2xe)

Cc: [redacted for privacy]

Subject: Re: [redacted for privacy]class Spring 2015

Hey, sorry for a late response. I tried to look for the material but i couldn't find it. However, normally I graded the homework using the mark sheet provided to me. Mark sheet included the correct answers and one set of solution to a particular question.

1) If the answers were according to the mark sheet, full marks

2) If answers are wrong, but their methodology is correct and have used proper design components,partial marks deducted only for wrong answer

3) If answers are wrong as well as the concept of design, then partial marks were given for attempting the question.

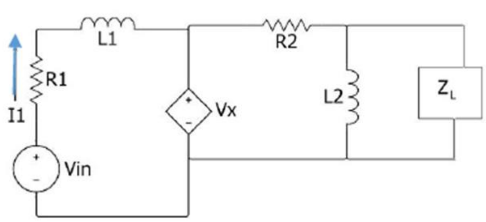
Please let me know if you need further clarification. I will be Happy to answer your queries.

Class B

Problems

1)

If Z_L must be a series combination of a capacitor and a resistor or a series combination of an inductor and a resistor, design the load (Z_L) such that it will receive maximum power in this circuit. The value of the capacitor or inductor can be left as an impedance (ie j50Ω). (20 points)



R1 = 25 Ω

R2 = 1 Ω

L1 = j10 Ω

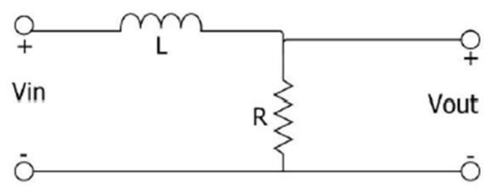
L2 = j3 Ω

Vin = 100cos(ωt) V

Vx = 5I1

2)

An engineer is trying to reduce the 60 Hz noise signal superimposed on top of a DC voltage she hopes to drive a 100 Ω load with. Her goal is to reduce the magnitude of the noise to no more than 1% of its original magnitude while driving the load. Her filter design is shown below. What is the smallest value of R she can use to accomplish her goal if she only has access to one 2.65 H inductor? (10 points)



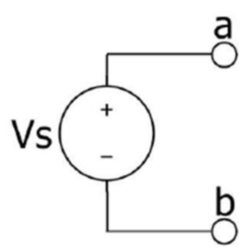
3)

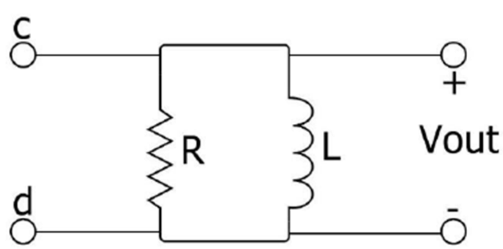
Design a circuit that connects terminals a and b to terminals c and d. This circuit can contain no more than one resistor, one capacitor, and one inductor but it does not need to contain all three. The goal of your design is to make the real power and apparent power delivered by the voltage source equal. (10 points)

Vs = 100cos(2000t) V

R = 250 Ω

L = 25 mH





Scoring

From: [redacted for privacy]

Sent: Monday, May 16, 2016 6:30 PM

To: Warren, Sheila (sw2xe)
Cc: David Feldon
Subject: Re: Data Collection for my dissertation - update and follow up question

Sheila,

Congratulations!

Unfortunately, I didn't write down the details of how the problems were graded on my key. The best I can do is tell you what I remember doing.

Exam 2 Problem 12: I gave 3 points for calculating the total equivalent impedance, 3 points for recognizing a capacitor is needed to increase the power factor, and 4 points for a final correct answer.

Exam 3 Problem 3: I gave 3 points for recognizing the thevenin equivalent impedance is needed, 7 points for correctly calculating it, and 5 points for each correct load component.

Exam 3 Problem 7: I gave 2 points for setting up the correct transfer magnitude equation, 2 points for solving for the total resistance, and 6 points for a final correct answer.

I also gave some partial credit within those categories based on my personal judgement so the grades didn't necessarily line up with straight additions of those numbers. I hope that helps some.

Best,

[redacted for privacy]

Appendix C Cognitive Task Analysis Product

Requirements

1. Identify and review product requirements.
2. IF any requirements are unclear or contradict each other THEN request clarification from client. Return to step 1.
3. IF requirements are clear and do not contain contradictions THEN assess relative importance of each requirement.
4. IF requirements are all of equal important THEN proceed to development/testing.
5. IF requirements are not of equal importance THEN develop a requirements matrix to establish fixed criteria for tradeoffs in design and testing.
    a. Submit requirements matrix to client for approval.
    b. IF client does not approve THEN repeat step 5 incorporating client feedback.
    c. IF client approves requirements matric THEN proceed to development/testing.
6. Identify individual components of the overall design that are functional and list them for testing.

Testing

1. Review components to identify input types. List all inputs and input type for each component.
    a. IF inputs are discrete and finite (e.g., Boolean) THEN list test for each condition (e.g., both true and false).
    b. IF inputs are indefinite but must conform to specified ranges (e.g., positive integer values only, upper case letters only, voltage limitation) THEN:
        i. Request from client anticipated ranges of typical values to be input by end users, as well as any known boundary conditions beyond which the system will not function appropriately.
        ii. List any known boundary conditions related to system components (e.g., memory capacity, processing speed, temperature).
        iii. For each input, retrieve from listed requirements and/or generate, then list the following: several typical acceptable and unacceptable values anticipated by the client for end users, boundary cases at the low and high end for each acceptable range, and extreme high and low values outside of known boundaries to provide test cases.
2. IF product retains inputs from prior runs (e.g., databases) THEN note the need to test components in all possible sequences of implementation, including the function of the first component after a previous operation.
3. When possible, list predicted outcomes for each test condition generated.
4. Run listed tests.
5. IF component performs as predicted in a specified test condition THEN note successful test.

6. IF multiple functions operate in parallel THEN execute component tests simultaneously after individual component tests are successful.
7. IF component does not perform as predicted in a specified test condition THEN begin troubleshooting procedure.

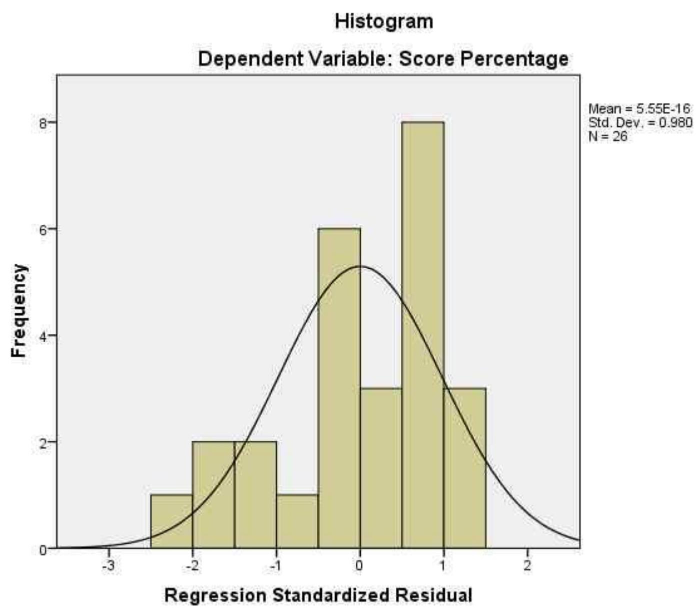
Troubleshooting

1. Identify value range in which error occurs.
2. IF value range is not known THEN generate additional test cases and predicted outcome values in small increments surrounding the value used to identify initial error.
3. Review the logic of the component's design.
4. Determine the number of steps (calculations, components) between the last correct output value and the first incorrect output value.
5. Analyze throughput of each step in sequence to determine if there is an evident design error.
6. IF evident design error is not detected THEN:
    a. IF number of steps in component's process is too large to be effectively analyzed THEN bisect the process and compare the interim value at the midpoint with the predicted value.
        i. IF interim value does not match predicted value THEN utilize first half of process for all subsequent troubleshooting steps.
        ii. IF interim value does match predicted value THEN utilize second half of process for all subsequent troubleshooting steps.
    b. Characterize nature of error in relation to target performance (e.g., value output too high, output generated too slowly, etc.)
    c. Analyze process of each step for the relevant component(s), computing interim values at all points
    d. Compare interim values to anticipated values.
    e. IF any interim values do not match anticipated values THEN:
        i. IF multiple functions operating simultaneously produces an inconsistent error THEN check requirements to ensure that operations functioning in parallel should not actually be performed in a specified order.
        ii. IF Steps 1-6 have not already been performed for relevant errors THEN return to Step 1, focusing on steps where interim values do not match predicted values.
        iii. IF Steps 1-6 have already been performed for relevant errors and the source of error is not evident THEN review specification list to determine if necessary specification was omitted from the list or ignored during design.
7. IF evident design error is detected THEN correct error and repeat listed tests.
8. IF source of error cannot be determined THEN review specification list to determine if necessary specification was omitted from the list or ignored during design.

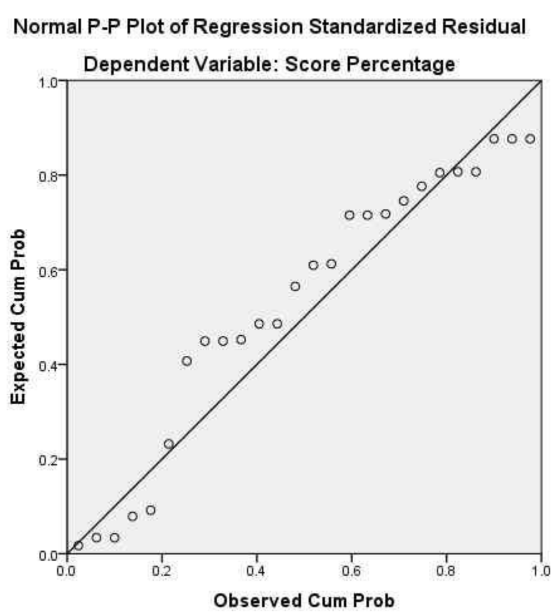
Appendix D: Linearity, Normality, and Homoscedasticity Graphs

Class A

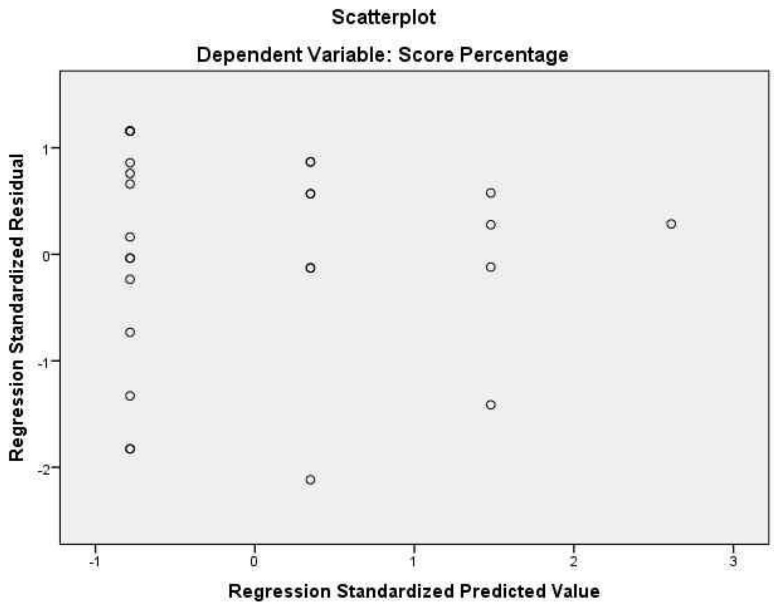
Item 1



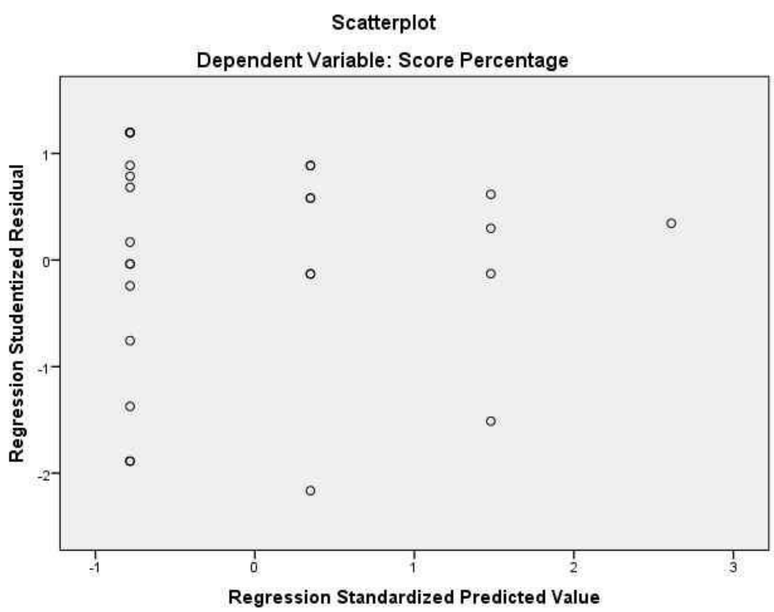
Plot 1



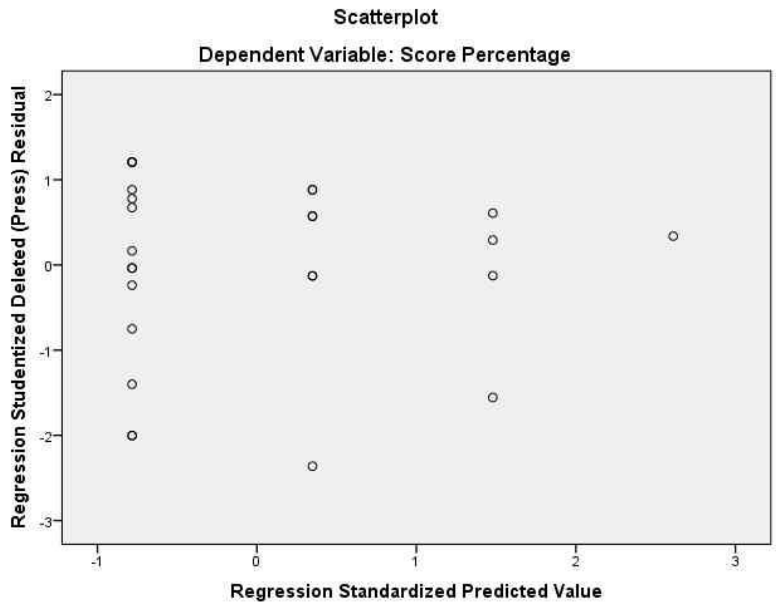
Plot 2


Scatterplot
Dependent Variable: Score Percentage
Regression Standardized Residual
Regression Standardized Predicted Value
1
0
-1
-2
-1
0
1
2
3

Plot 3

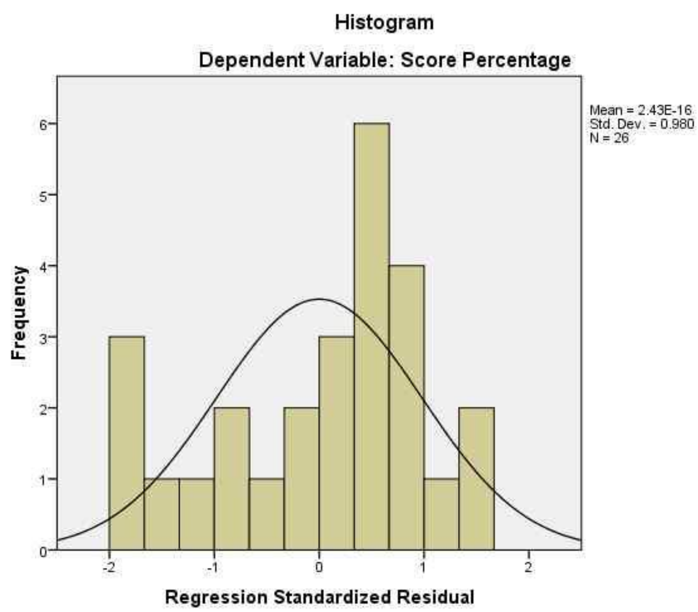

Scatterplot
Dependent Variable: Score Percentage
Regression Studentized Residual
Regression Standardized Predicted Value
1
0
-1
-2
-1
0
1
2
3

Plot 4

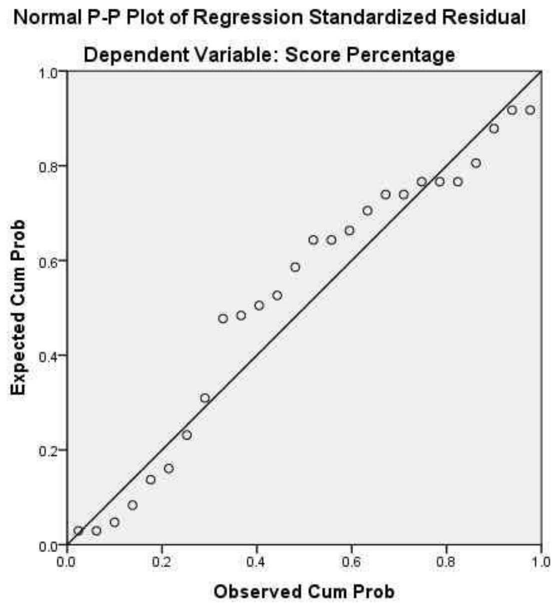


Plot 5

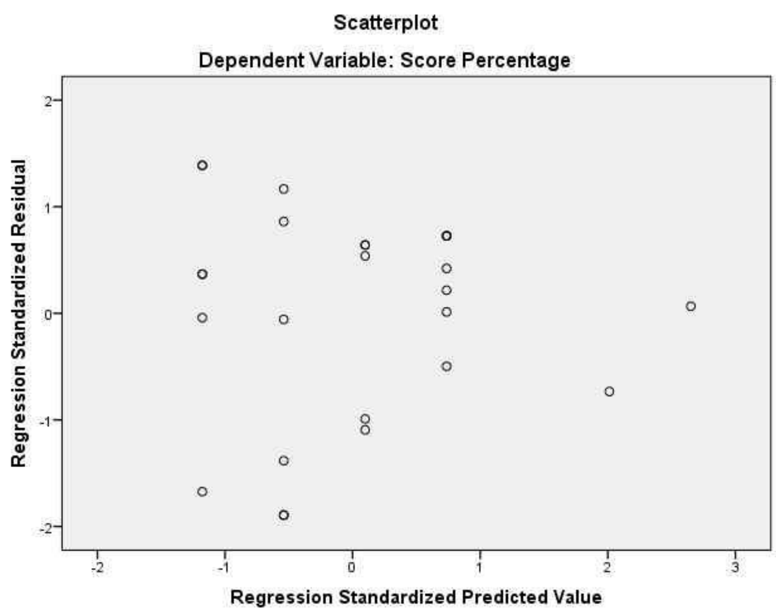
Item 2



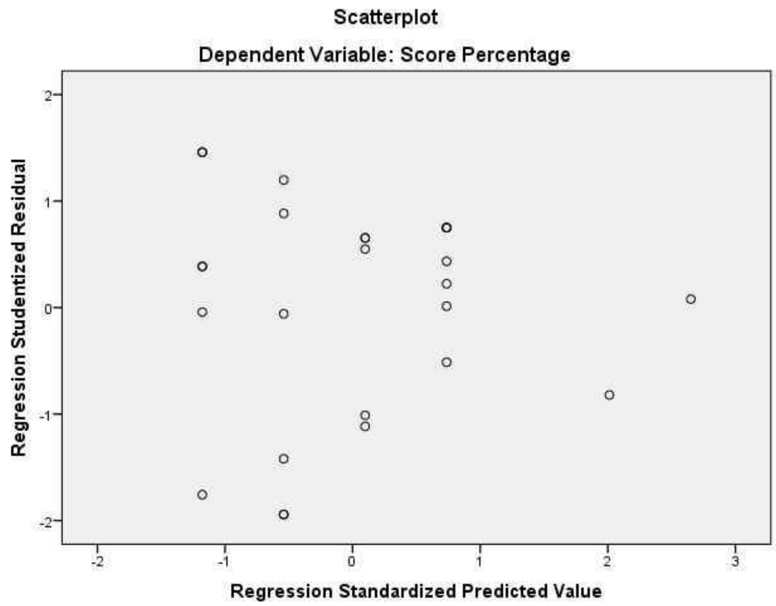
Plot 1


Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Score Percentage
Expected Cum Prob
Observed Cum Prob
0.0
0.2
0.4
0.6
0.8
1.0

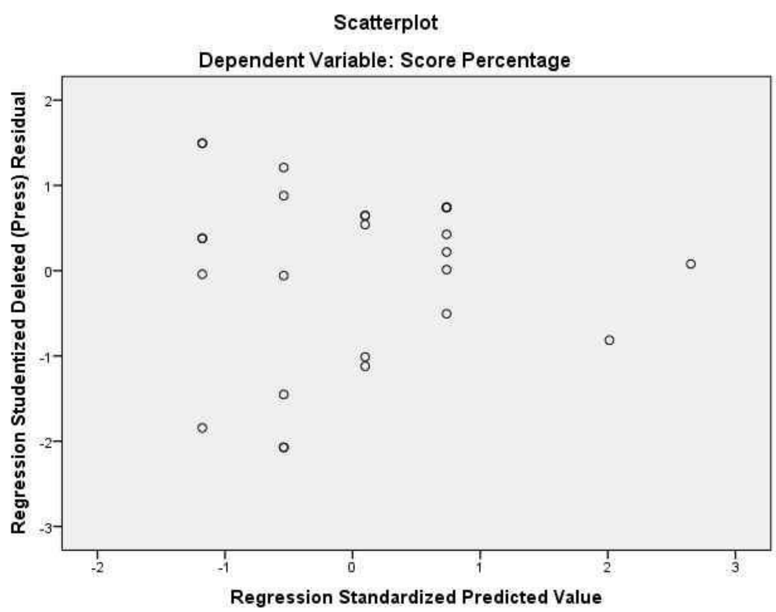
Plot 2


Scatterplot
Dependent Variable: Score Percentage
Regression Standardized Residual
Regression Standardized Predicted Value
-2
-1
0
1
2
3

Plot 3

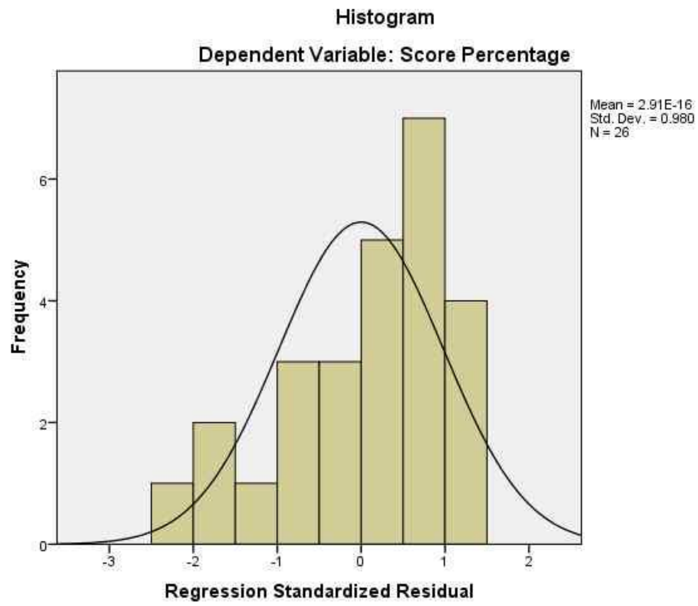


Plot 4

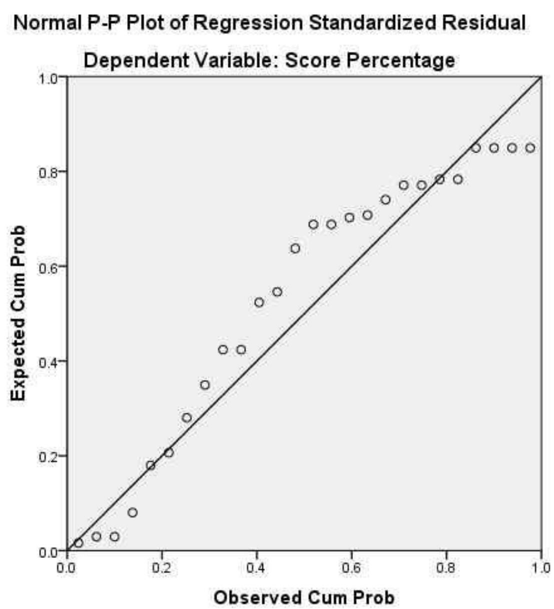


Plot 5

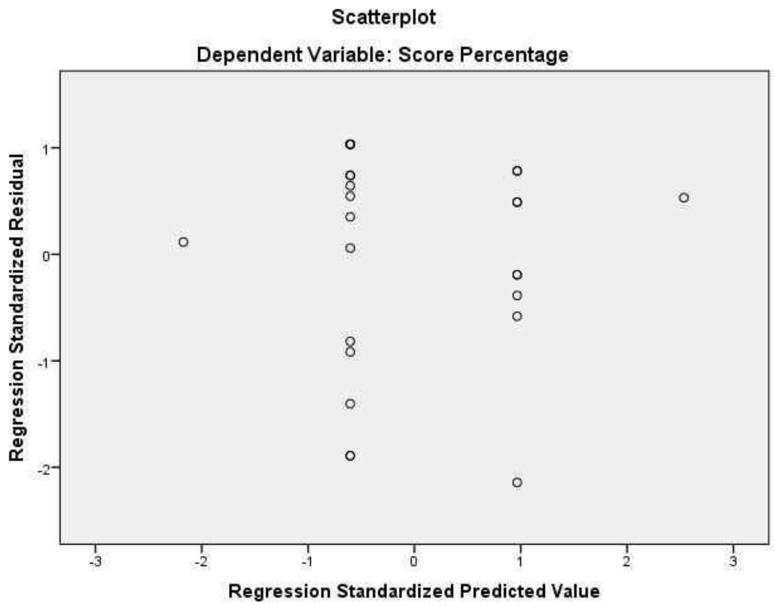
Item 3


Histogram
Dependent Variable: Score Percentage
Mean = 2.91E-16
Std. Dev. = 0.980
N = 26
Frequency
Regression Standardized Residual

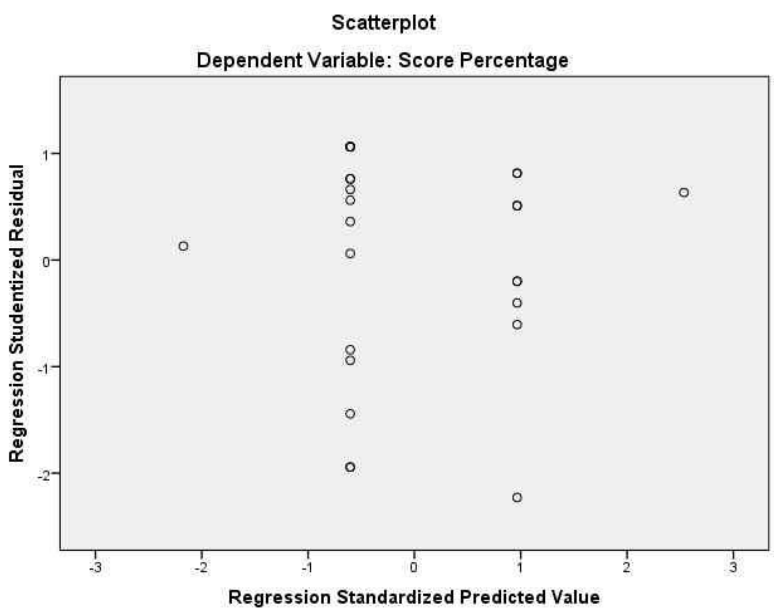
Plot 1


Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Score Percentage
Expected Cum Prob
Observed Cum Prob

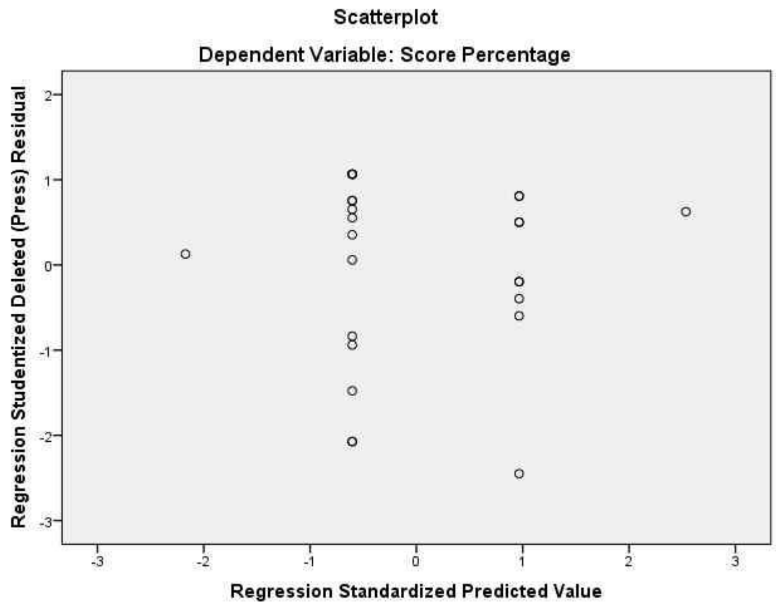
Plot 2


Scatterplot
Dependent Variable: Score Percentage
Regression Standardized Residual
Regression Standardized Predicted Value

Plot 3

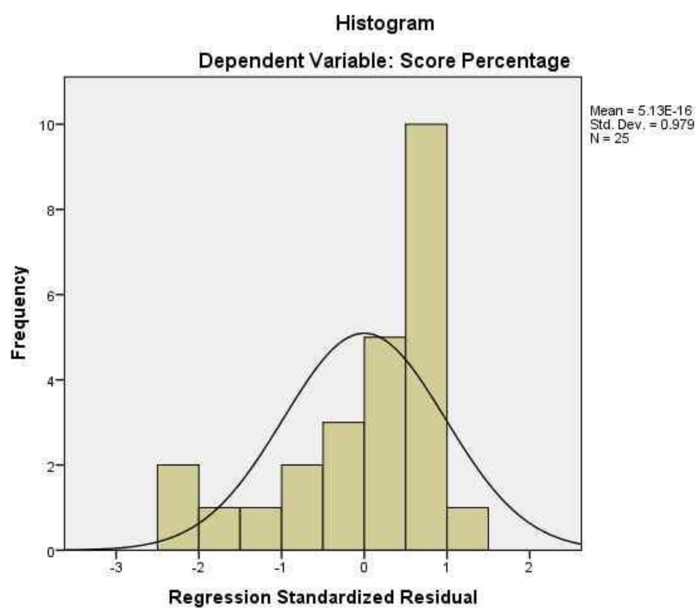

Scatterplot
Dependent Variable: Score Percentage
Regression Studentized Residual
Regression Standardized Predicted Value

Plot 4

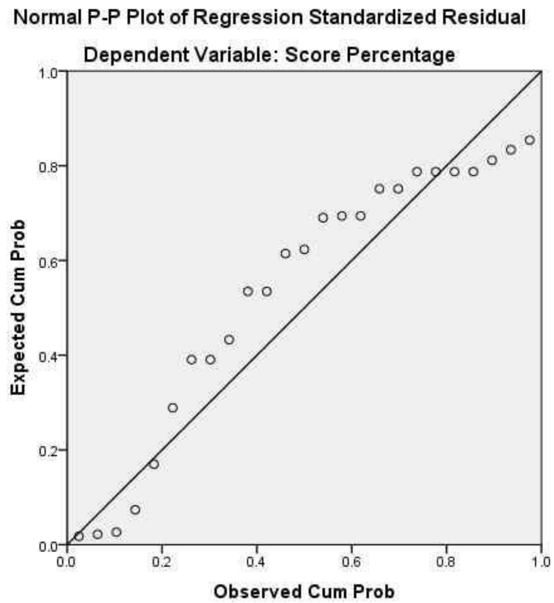


Plot 5

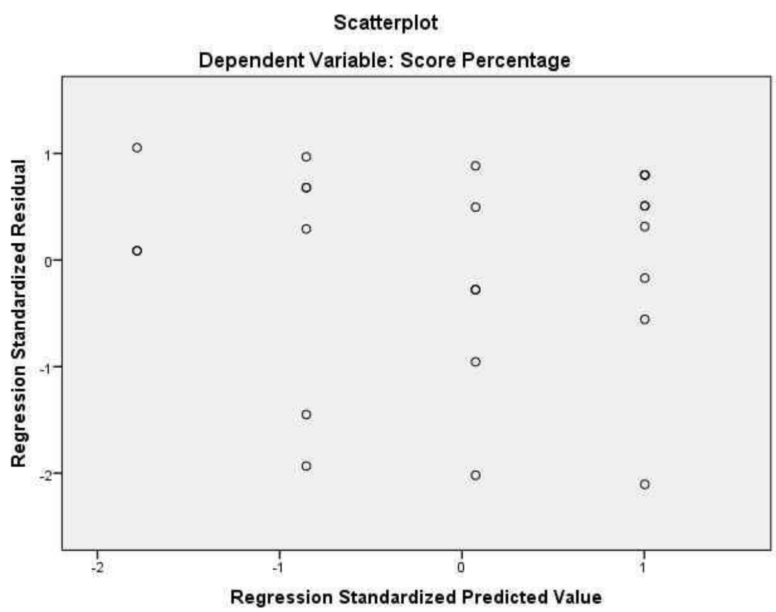
Item 4



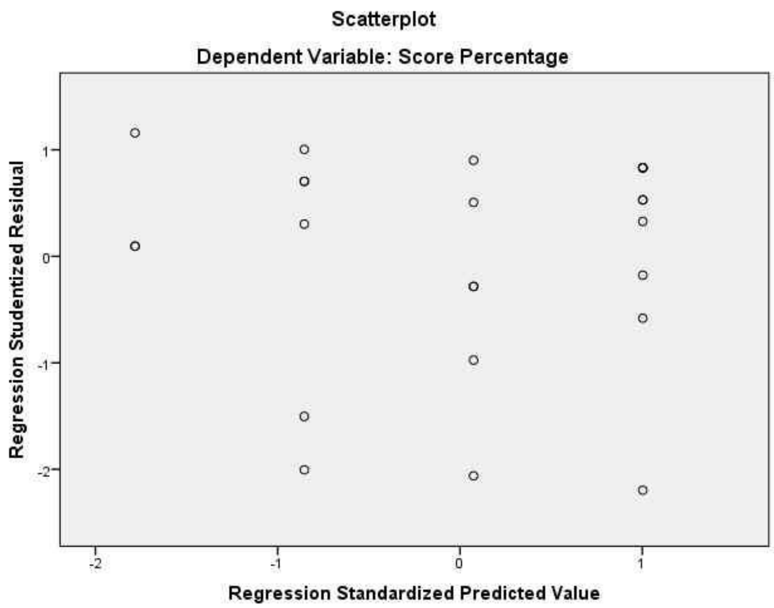
Plot 1


Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Score Percentage
Expected Cum Prob
Observed Cum Prob
0.0
0.2
0.4
0.6
0.8
1.0

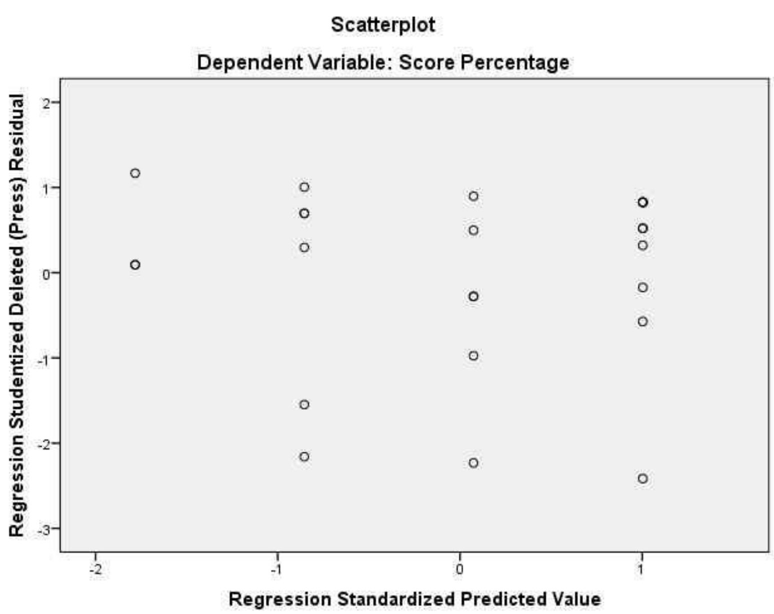
Plot 2


Scatterplot
Dependent Variable: Score Percentage
Regression Standardized Residual
Regression Standardized Predicted Value
-2
-1
0
1

Plot 3

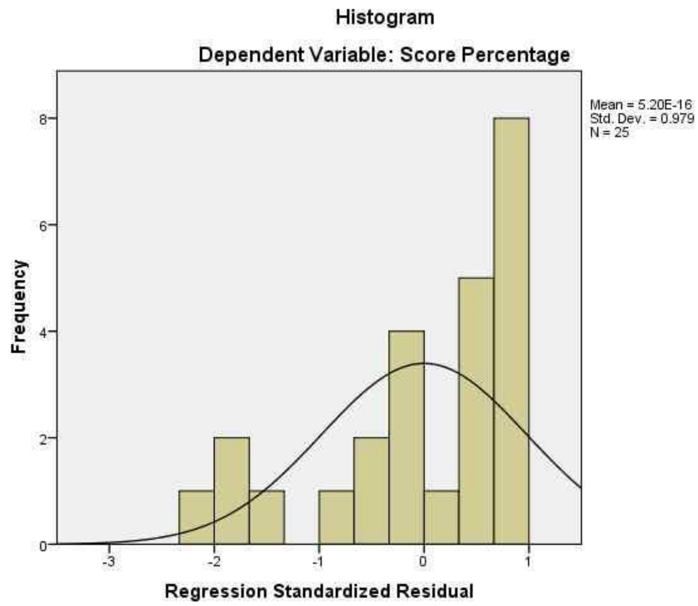


Plot 4

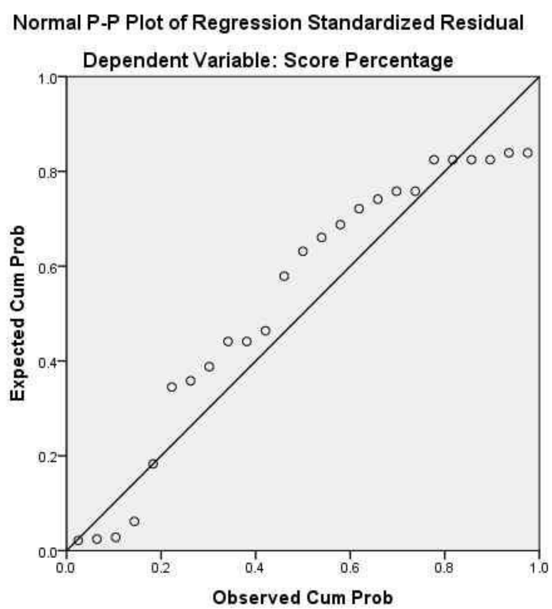


Plot 5

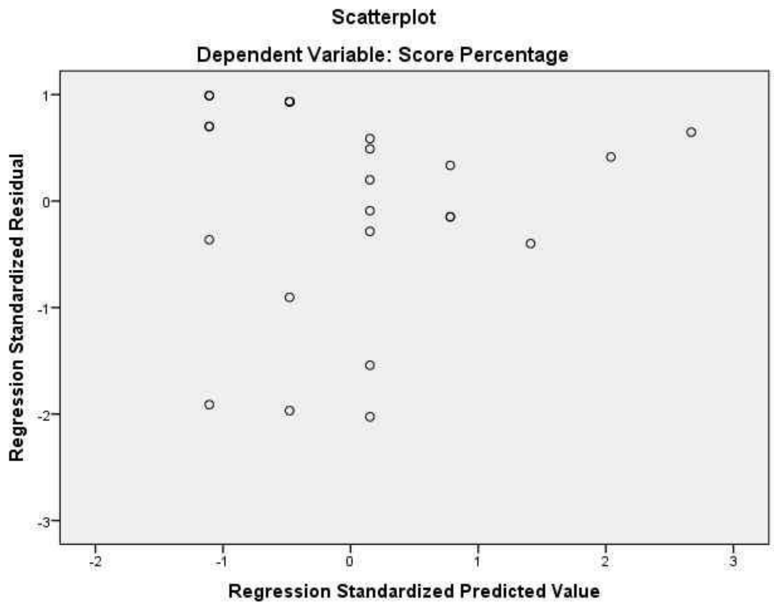
Item 5


Histogram
Dependent Variable: Score Percentage
Mean = 5.20E-16
Std. Dev. = 0.979
N = 25
Frequency
Regression Standardized Residual

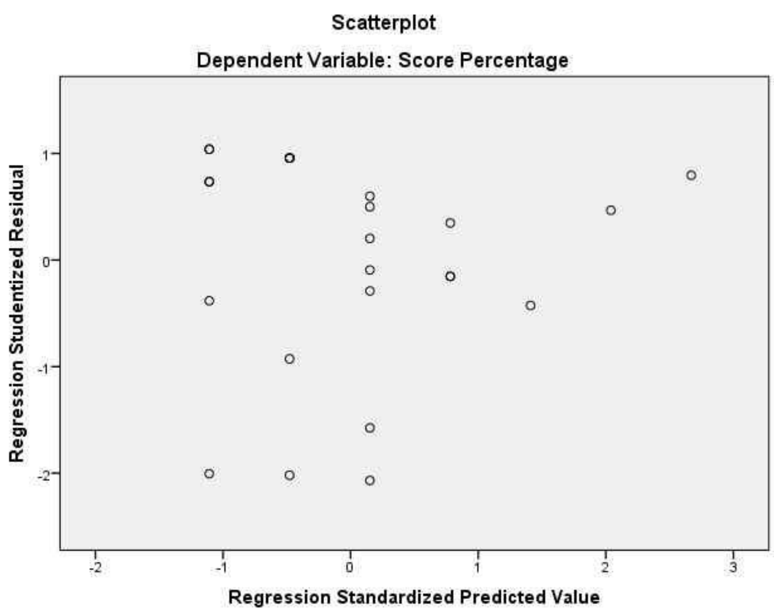
Plot 1


Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Score Percentage
Expected Cum Prob
Observed Cum Prob

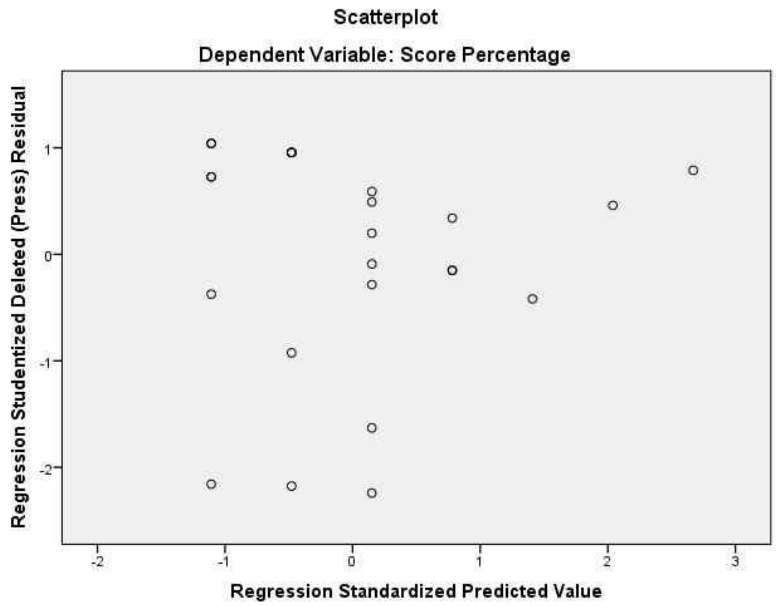
Plot 2


Scatterplot
Dependent Variable: Score Percentage
Regression Standardized Residual
Regression Standardized Predicted Value

Plot 3

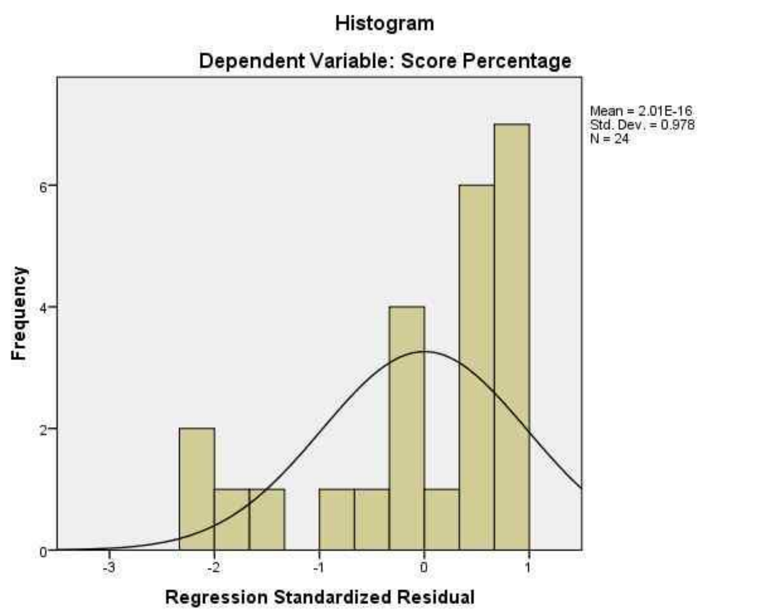

Scatterplot
Dependent Variable: Score Percentage
Regression Studentized Residual
Regression Standardized Predicted Value

Plot 4

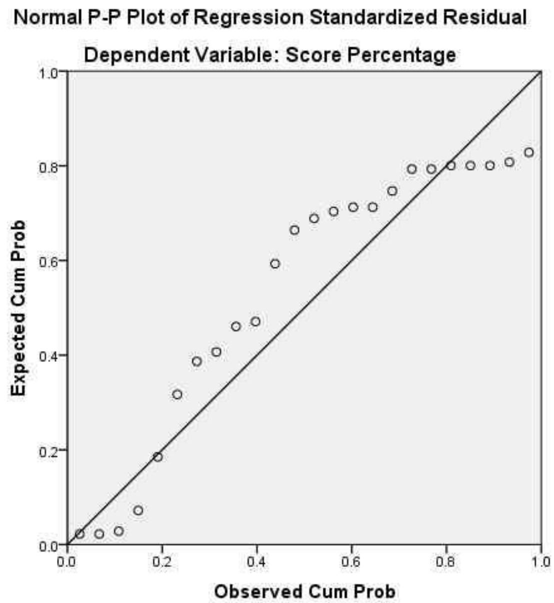


Plot 5

Item 6

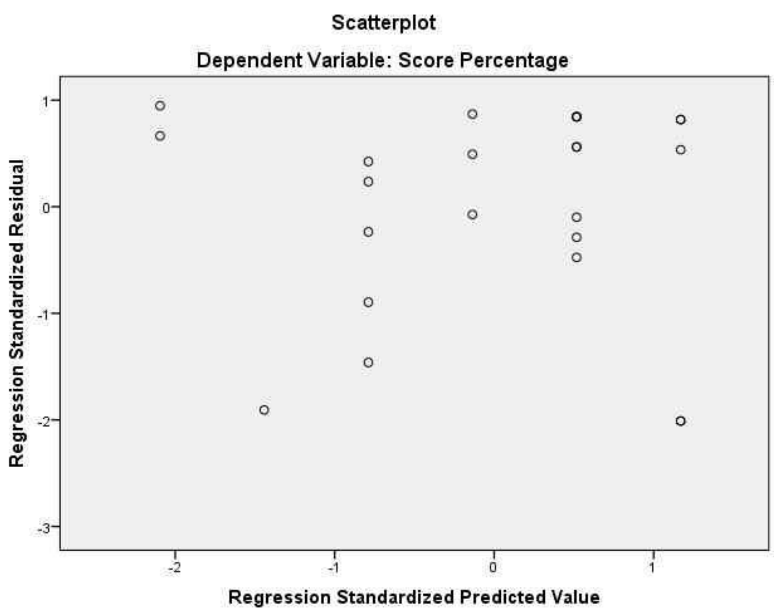


Plot 1



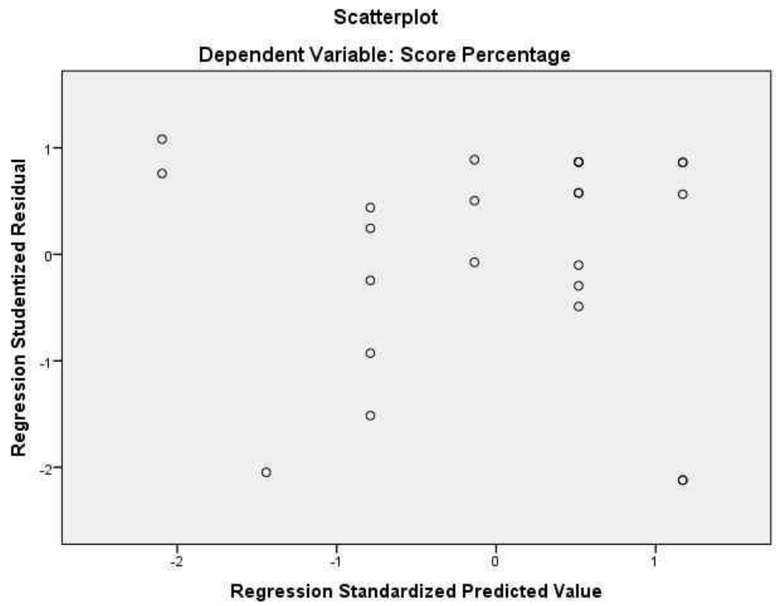
Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Score Percentage
1.0
0.8
0.6
0.4
0.2
0.0
Expected Cum Prob
0.0
0.2
0.4
0.6
0.8
1.0
Observed Cum Prob

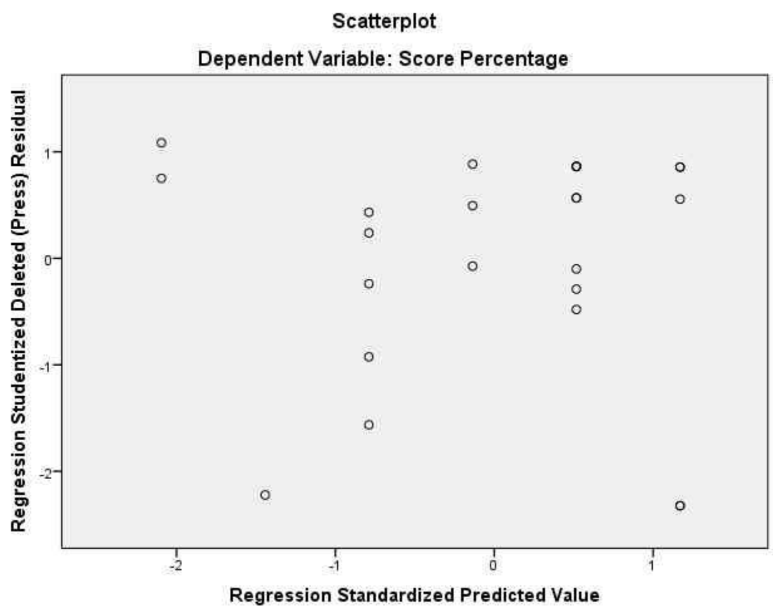
Plot 2



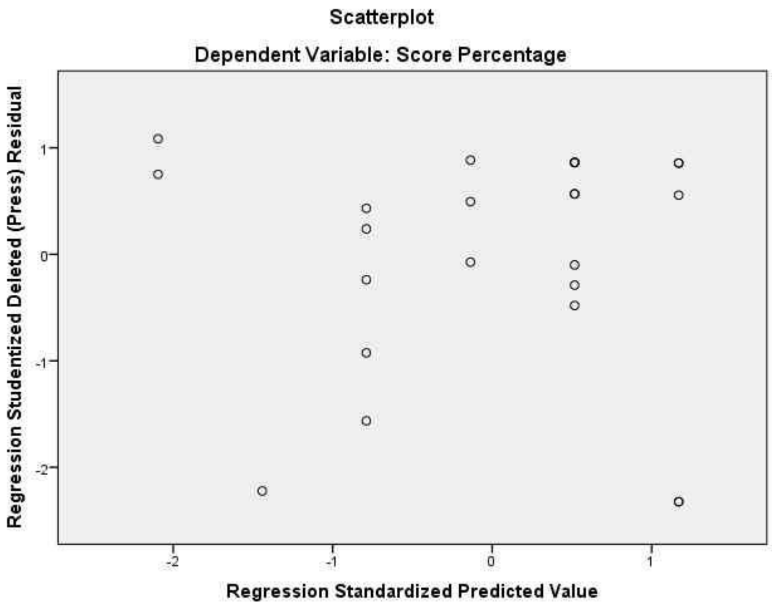
Scatterplot
Dependent Variable: Score Percentage
1
0
-1
-2
-3
Regression Standardized Residual
-2
-1
0
1
Regression Standardized Predicted Value

Plot 3


Scatterplot
Dependent Variable: Score Percentage
Regression Studentized Residual
Regression Standardized Predicted Value

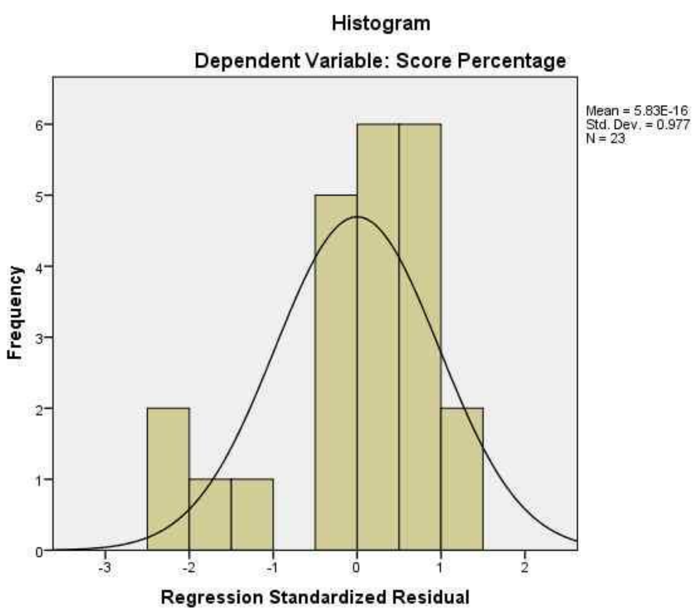

Scatterplot
Dependent Variable: Score Percentage
Regression Studentized Deleted (Press) Residual
Regression Standardized Predicted Value

Plot 4

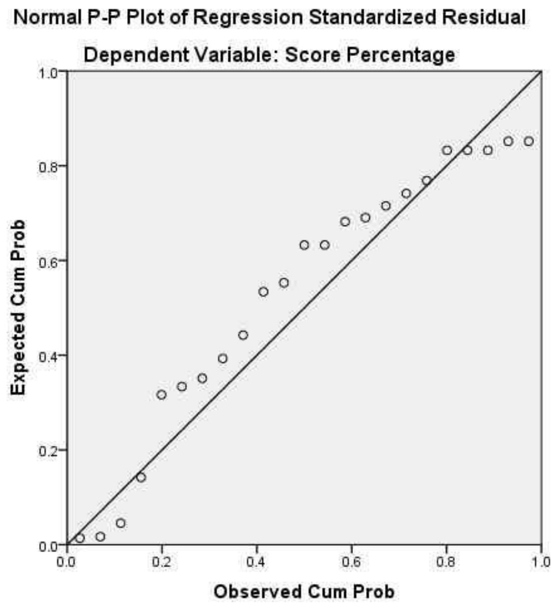


Plot 5

Item 7

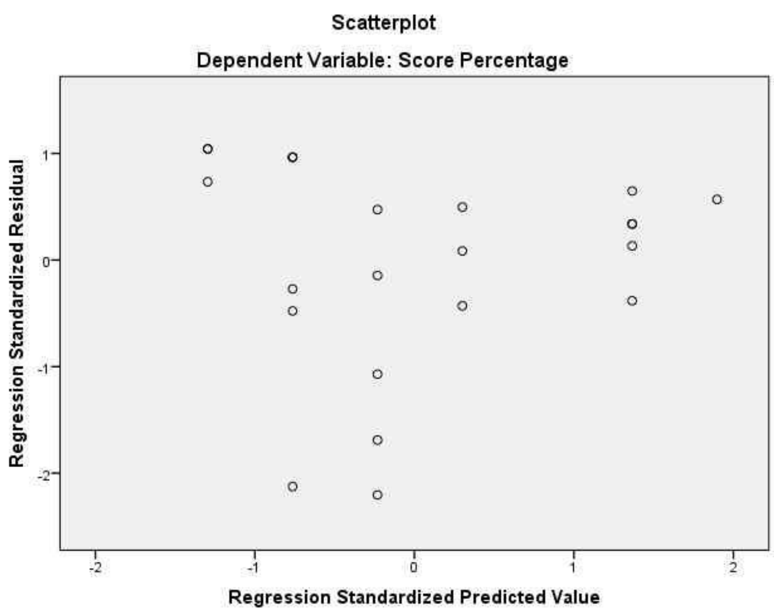


Plot 1



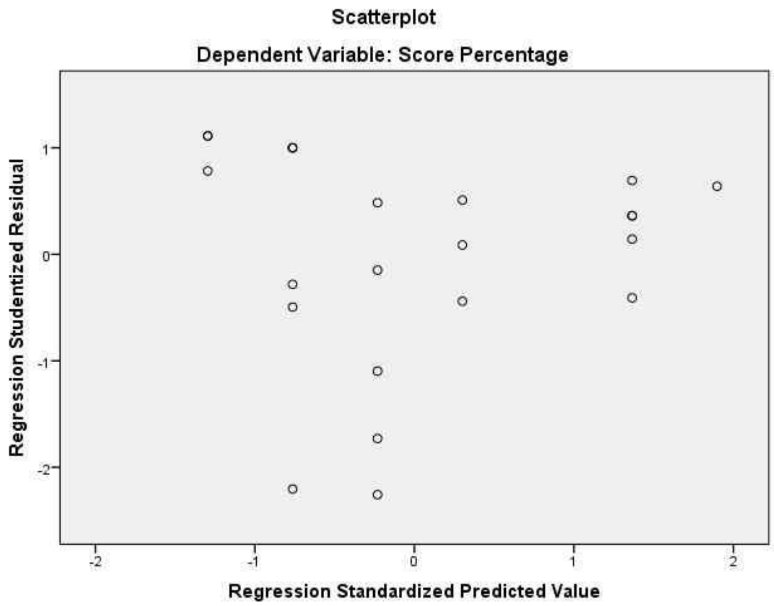
Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Score Percentage
Expected Cum Prob
Observed Cum Prob
0.0
0.2
0.4
0.6
0.8
1.0

Plot 2

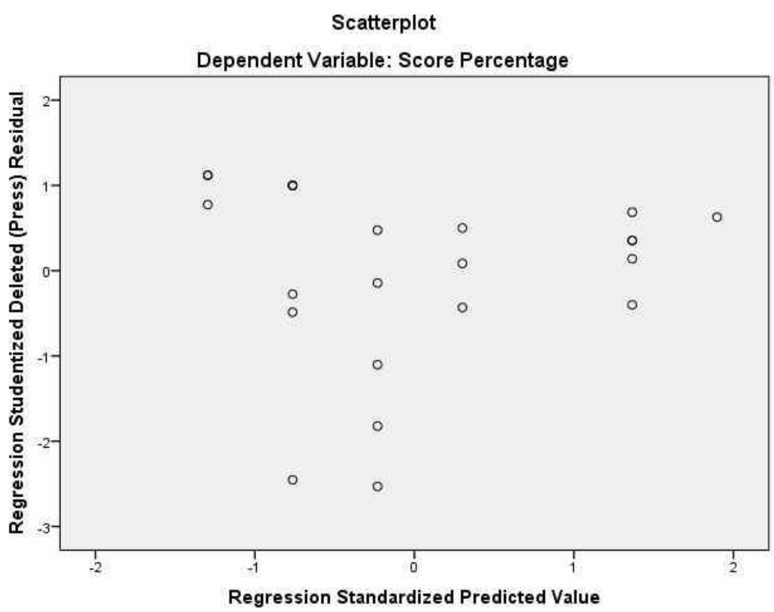


Scatterplot
Dependent Variable: Score Percentage
Regression Standardized Residual
Regression Standardized Predicted Value
-2
-1
0
1
2

Plot 3

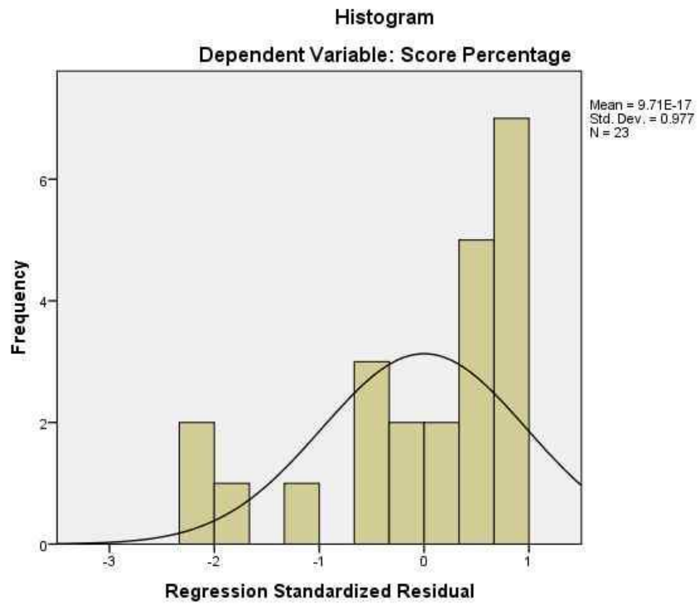


Plot 4

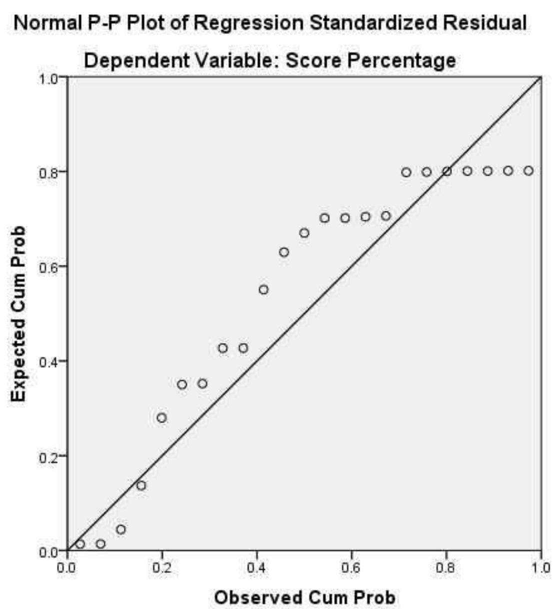


Plot 5

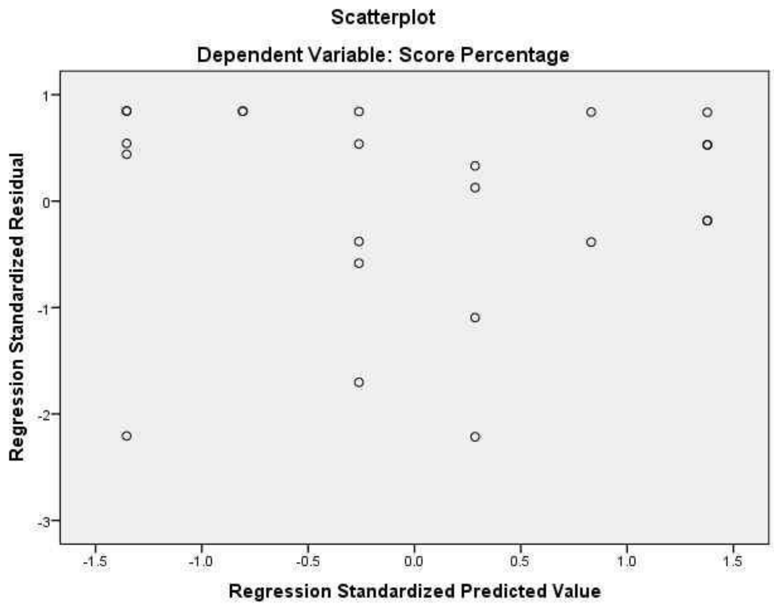
Item 8


Histogram
Dependent Variable: Score Percentage
Mean = 9.71E-17
Std. Dev. = 0.977
N = 23
Frequency
Regression Standardized Residual

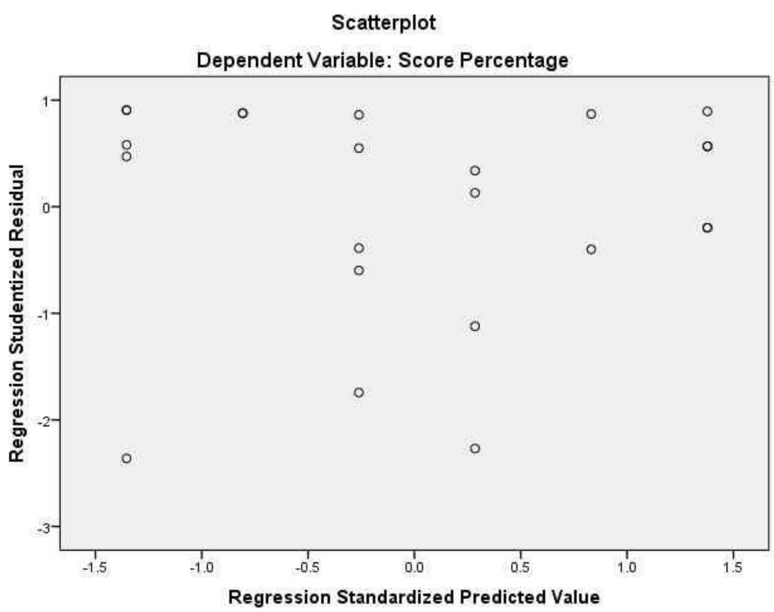
Plot 1


Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Score Percentage
Expected Cum Prob
Observed Cum Prob

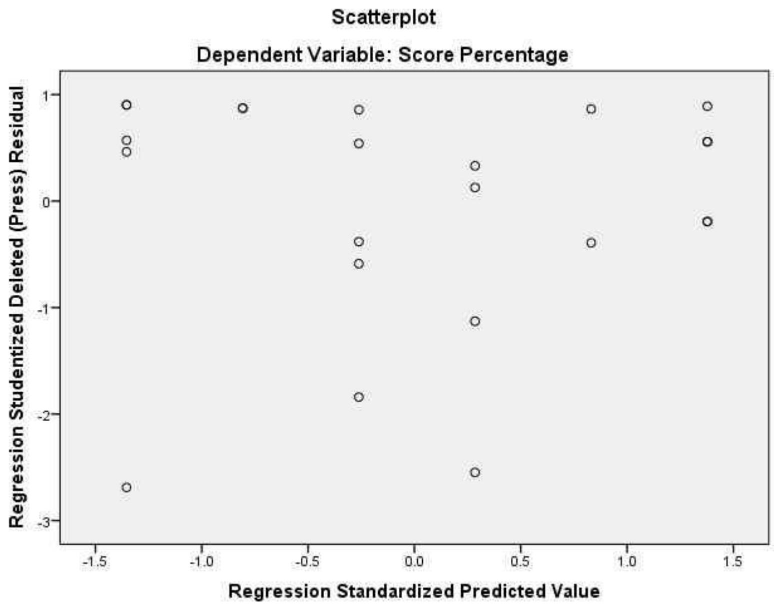
Plot 2


Scatterplot
Dependent Variable: Score Percentage
Regression Standardized Residual
1
0
-1
-2
-3
-1.5
-1.0
-0.5
0.0
0.5
1.0
1.5
Regression Standardized Predicted Value

Plot 3

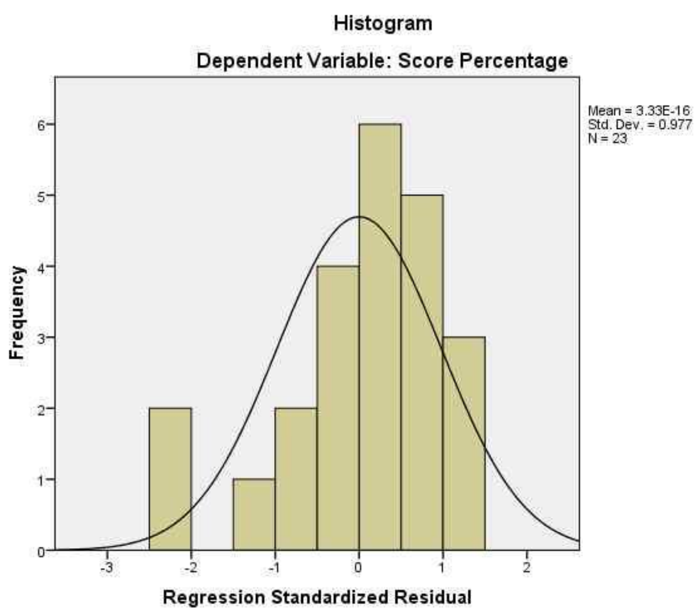

Scatterplot
Dependent Variable: Score Percentage
Regression Studentized Residual
1
0
-1
-2
-3
-1.5
-1.0
-0.5
0.0
0.5
1.0
1.5
Regression Standardized Predicted Value

Plot 4

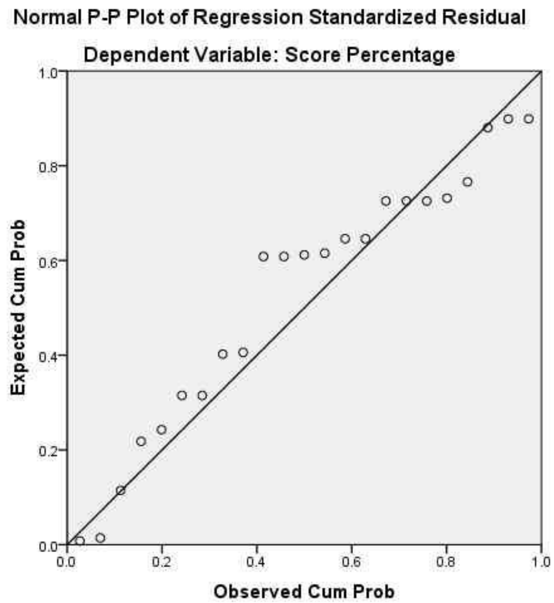


Plot 5

Item 9

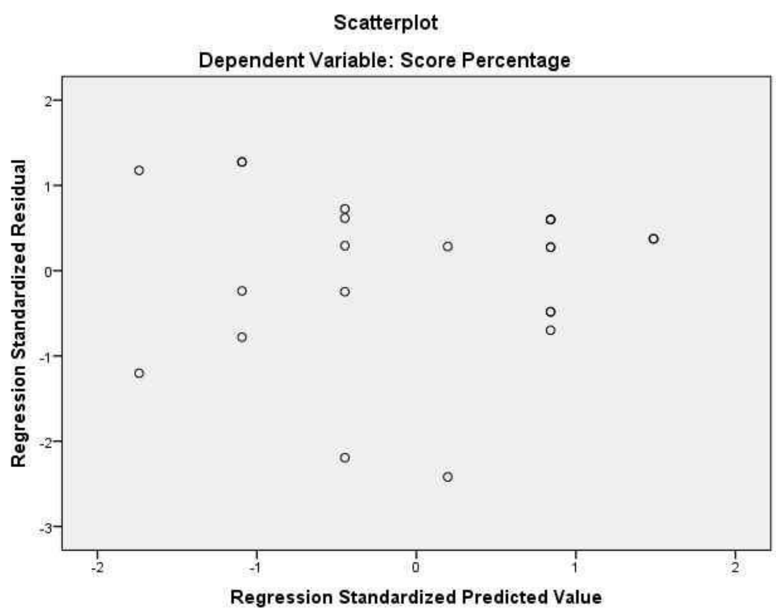


Plot 1



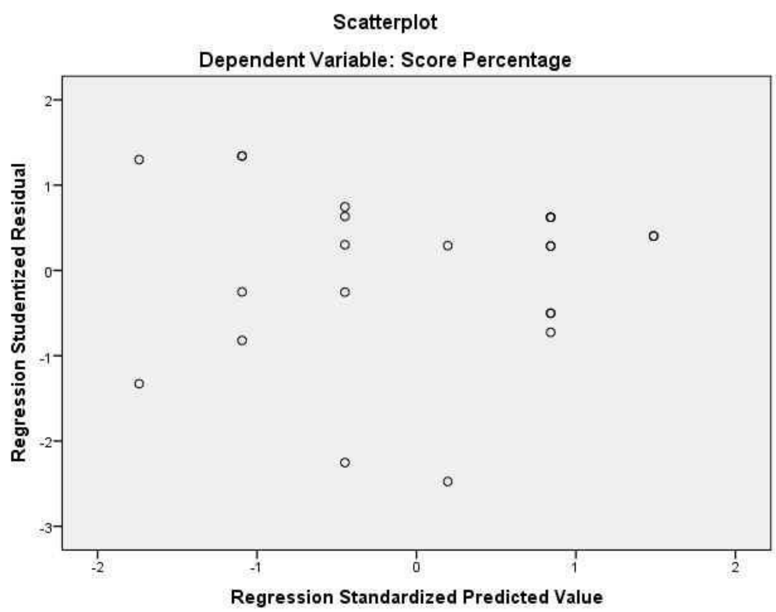
Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Score Percentage
Expected Cum Prob
1.0
0.8
0.6
0.4
0.2
0.0
0.0
0.2
0.4
0.6
0.8
1.0
Observed Cum Prob

Plot 2

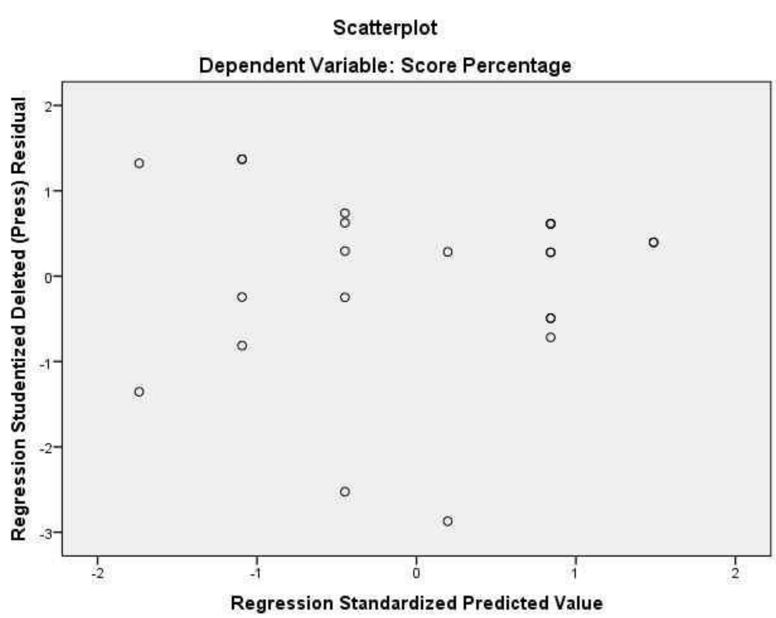


Scatterplot
Dependent Variable: Score Percentage
Regression Standardized Residual
2
1
0
-1
-2
-3
-2
-1
0
1
2
Regression Standardized Predicted Value

Plot 3

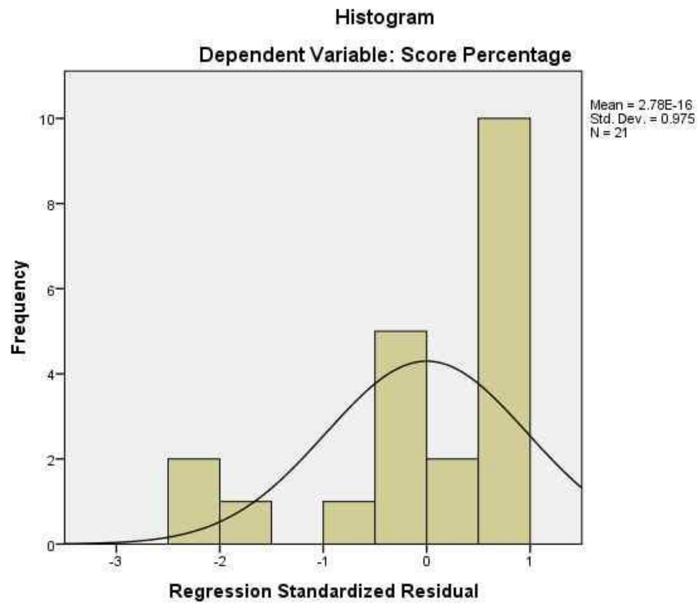


Plot 4

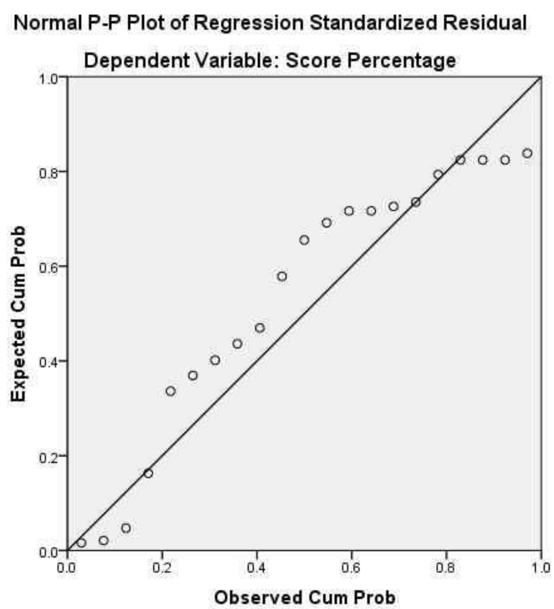


Plot 5

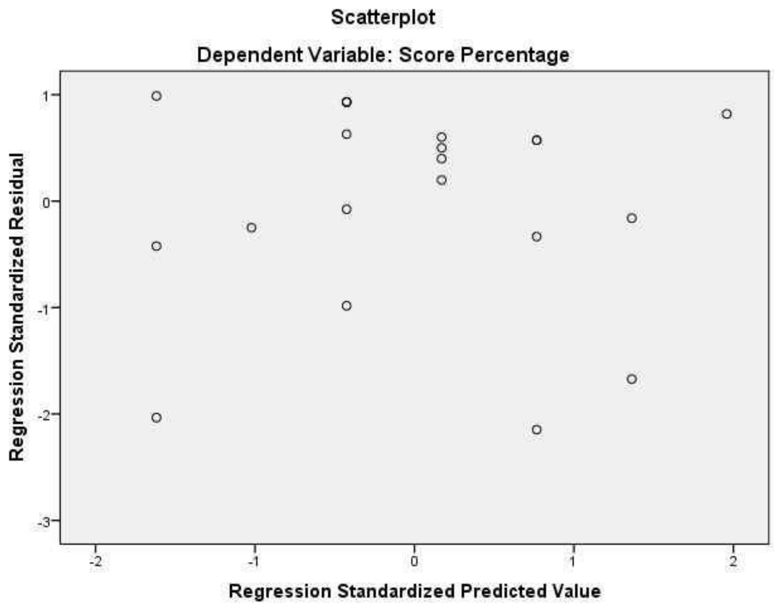
Item 10


Histogram
Dependent Variable: Score Percentage
Mean = 2.78E-16
Std. Dev. = 0.975
N = 21
Frequency
Regression Standardized Residual

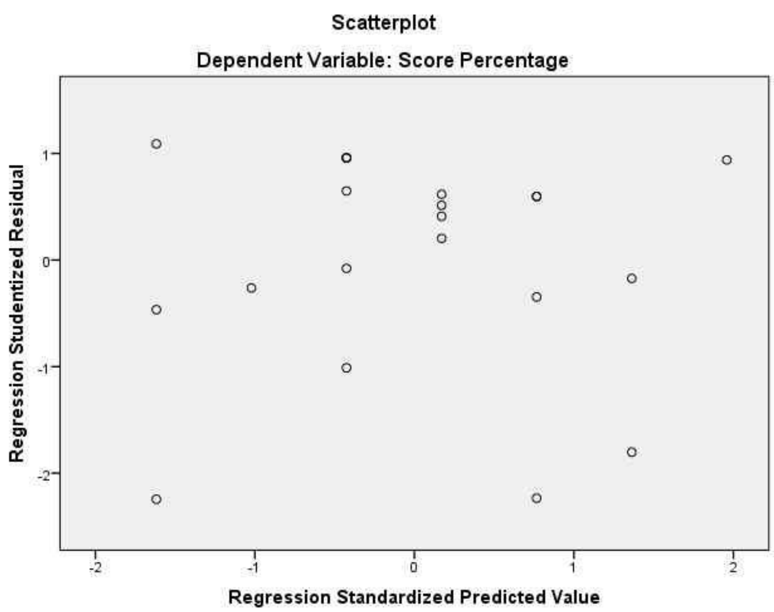
Plot 1


Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Score Percentage
Expected Cum Prob
Observed Cum Prob

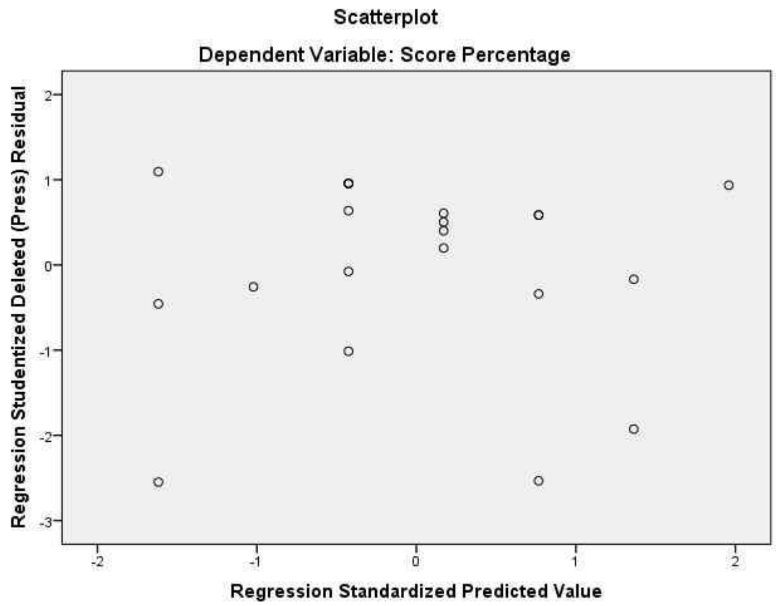
Plot 2


Scatterplot
Dependent Variable: Score Percentage
Regression Standardized Residual
Regression Standardized Predicted Value
1
0
-1
-2
-3
-2
-1
0
1
2

Plot 3

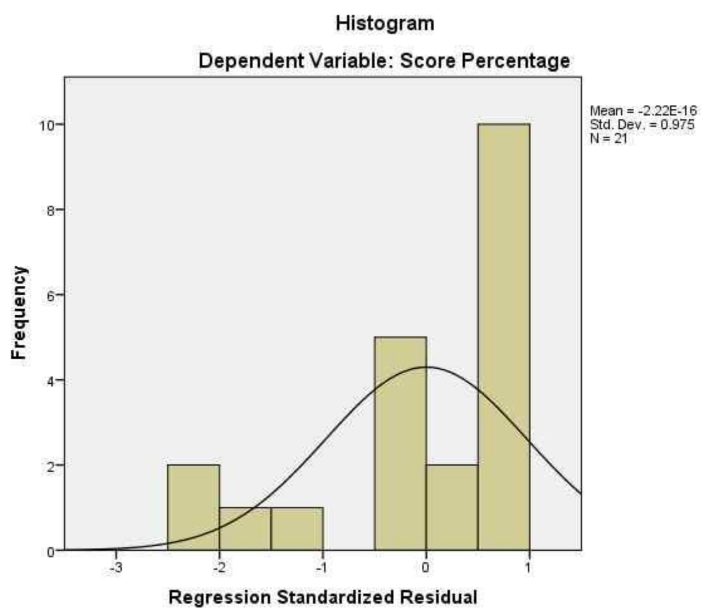

Scatterplot
Dependent Variable: Score Percentage
Regression Studentized Residual
Regression Standardized Predicted Value
1
0
-1
-2
-2
-1
0
1
2

Plot 4

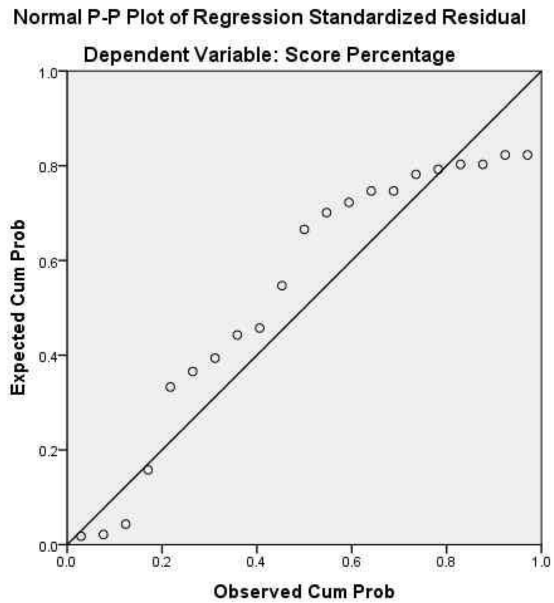


Plot 5

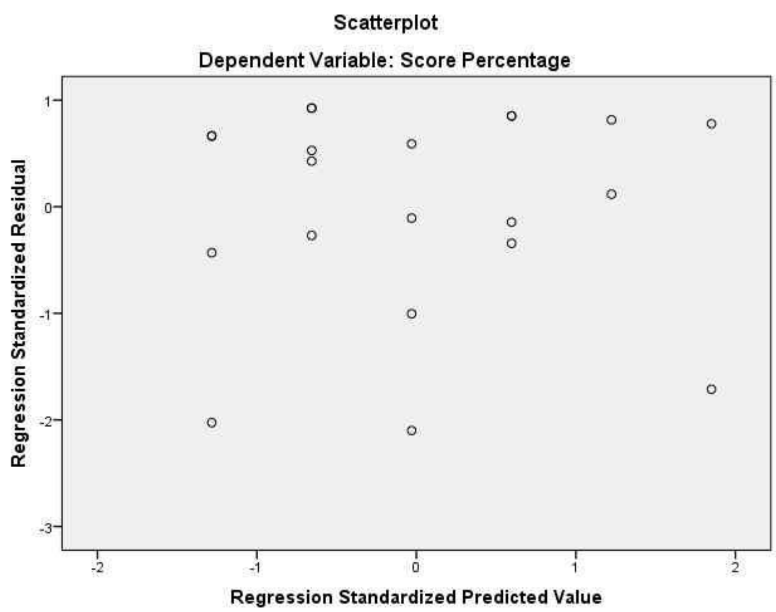
Item 11



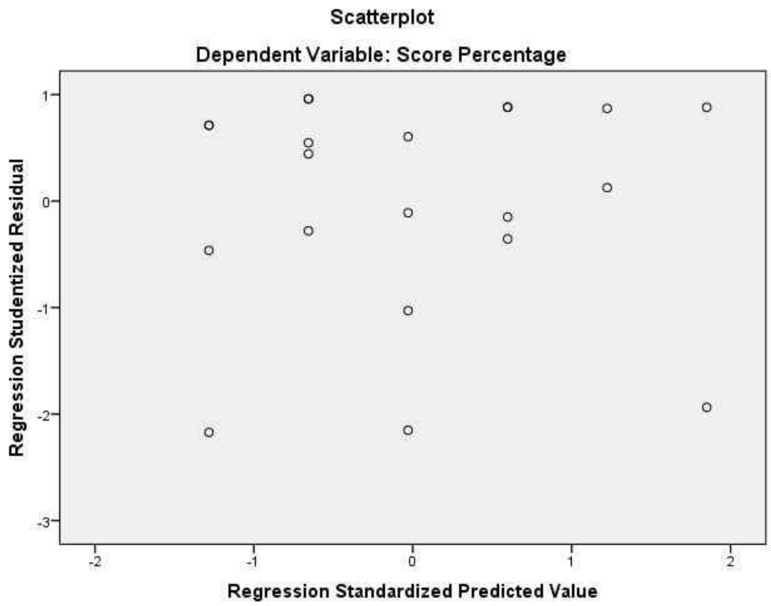
Plot 1


Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Score Percentage
Expected Cum Prob
Observed Cum Prob
0.0
0.2
0.4
0.6
0.8
1.0

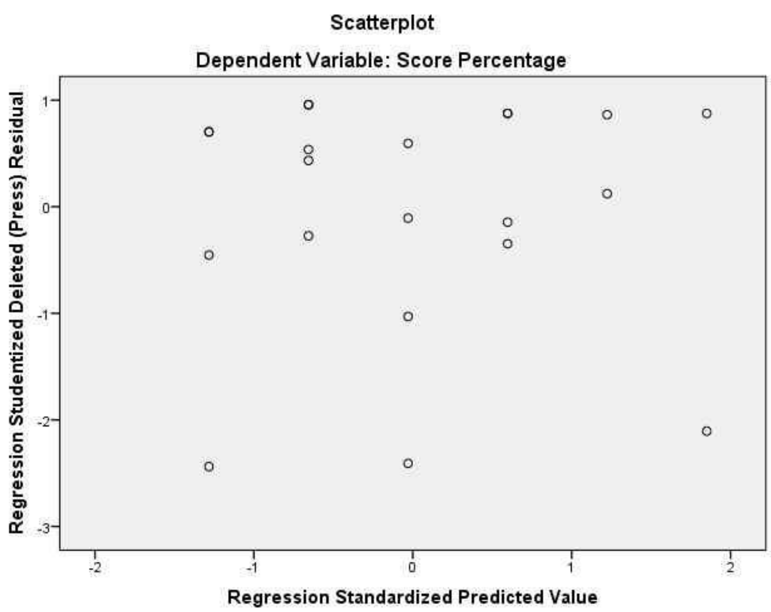
Plot 2


Scatterplot
Dependent Variable: Score Percentage
Regression Standardized Residual
Regression Standardized Predicted Value
1
0
-1
-2
-3
2

Plot 3

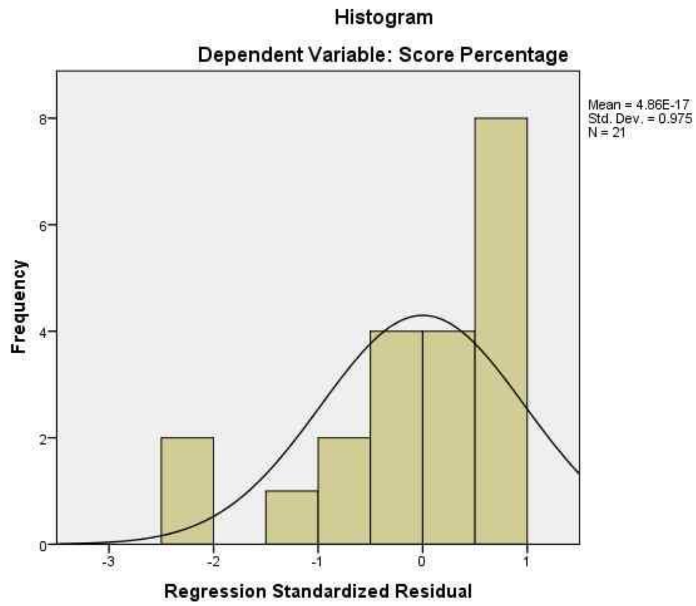


Plot 4

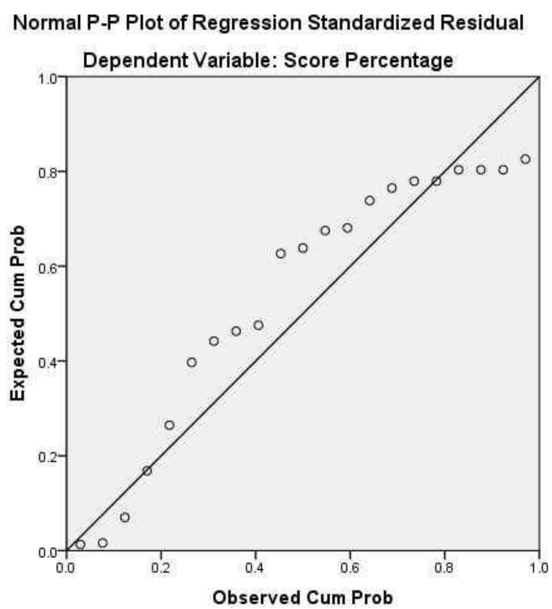


Plot 5

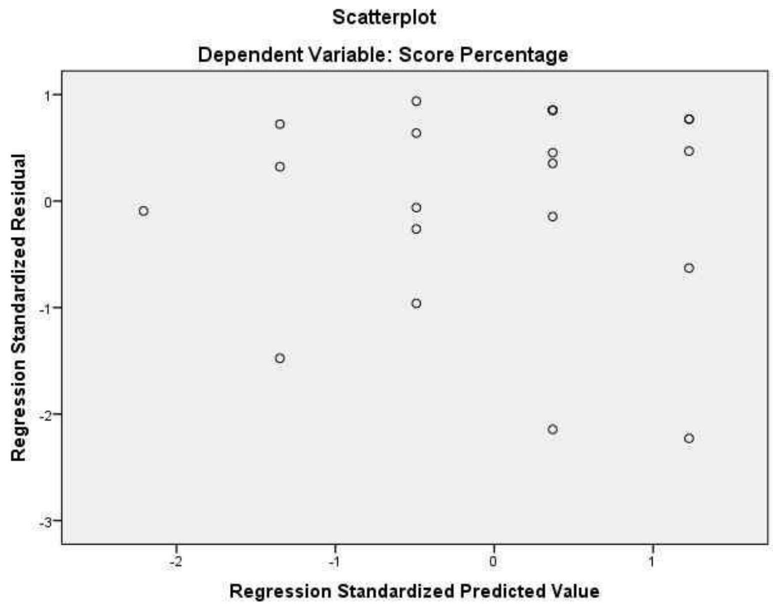
Item 12


Histogram
Dependent Variable: Score Percentage
Mean = 4.86E-17
Std. Dev. = 0.975
N = 21
Frequency
Regression Standardized Residual

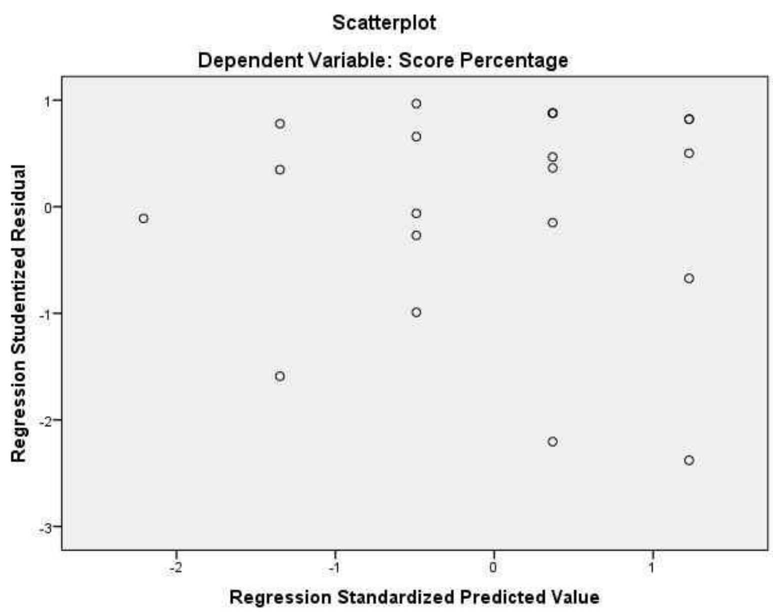
Plot 1


Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Score Percentage
Expected Cum Prob
Observed Cum Prob

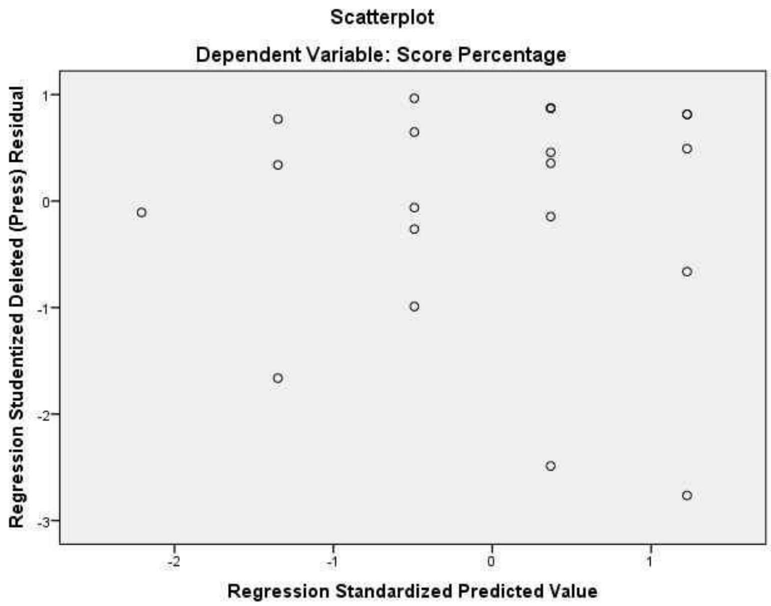
Plot 2


Scatterplot
Dependent Variable: Score Percentage
Regression Standardized Residual
Regression Standardized Predicted Value

Plot 3

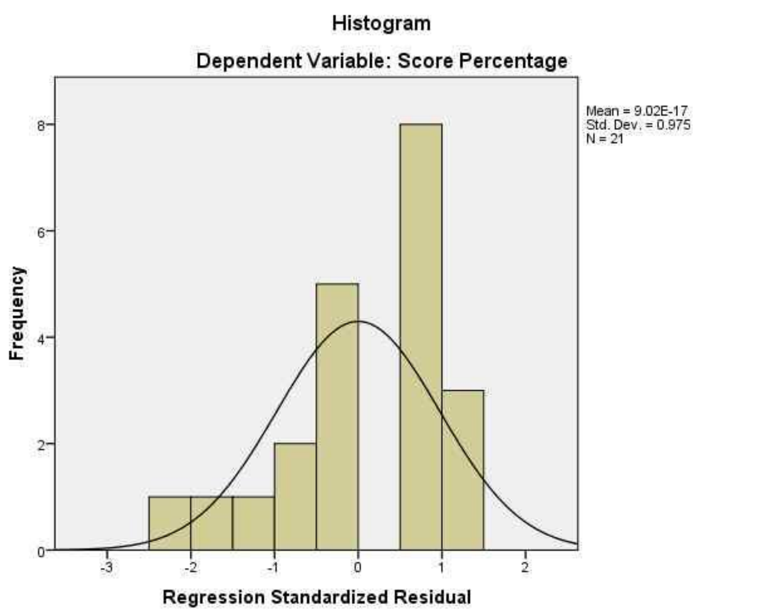

Scatterplot
Dependent Variable: Score Percentage
Regression Studentized Residual
Regression Standardized Predicted Value

Plot 4

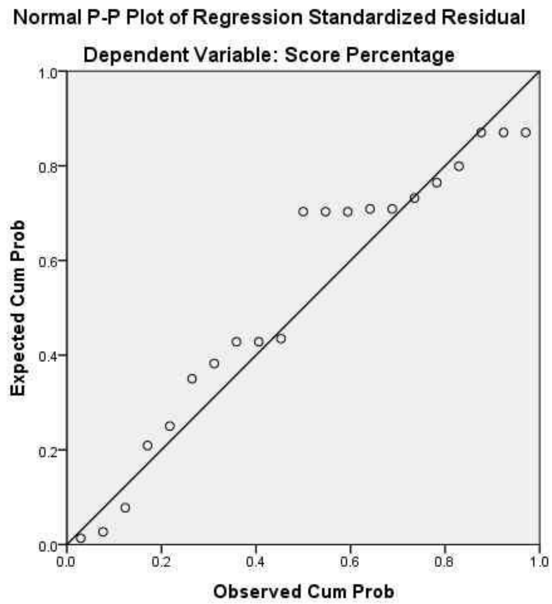


Plot 5

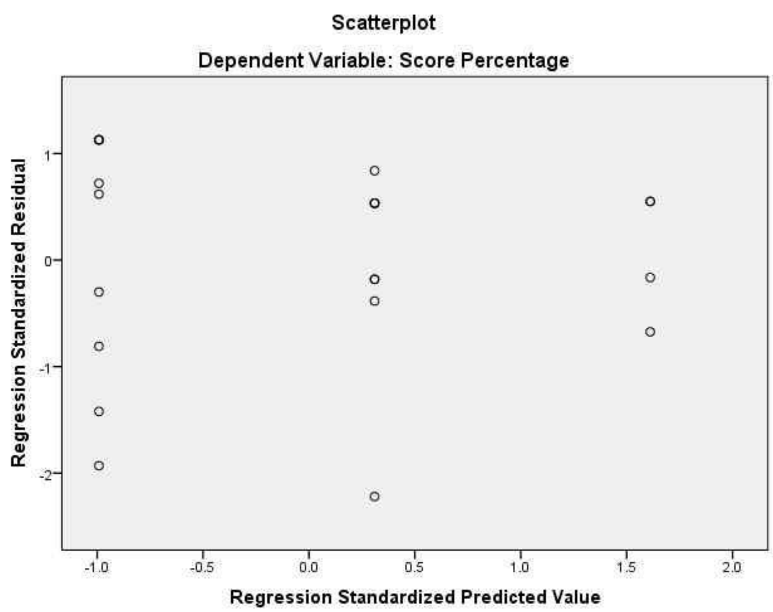
Item 13



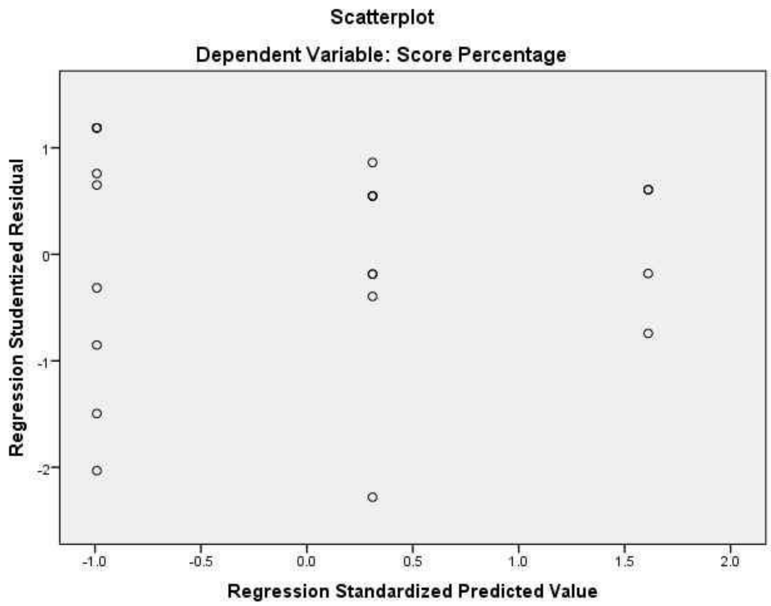
Plot 1


Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Score Percentage
Expected Cum Prob
Observed Cum Prob
0.0
0.2
0.4
0.6
0.8
1.0

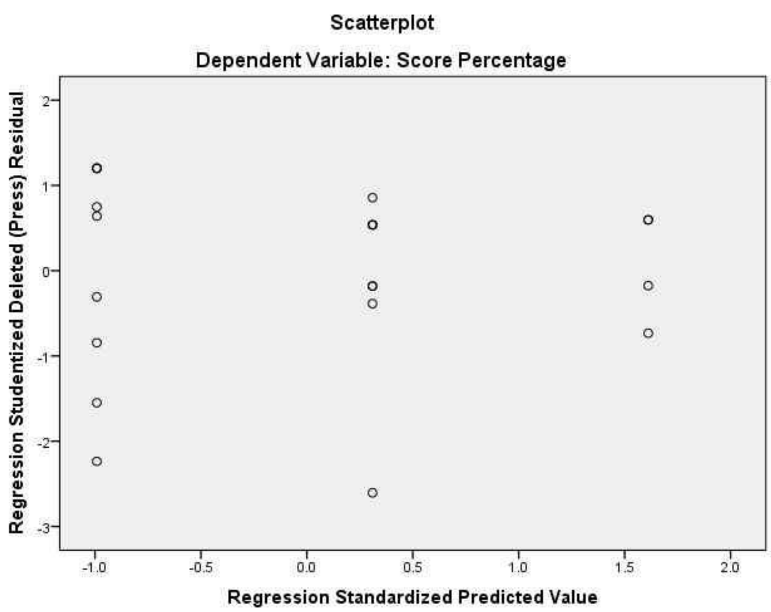
Plot 2


Scatterplot
Dependent Variable: Score Percentage
Regression Standardized Residual
Regression Standardized Predicted Value
1
0
-1
-2
-1.0
-0.5
0.0
0.5
1.0
1.5
2.0

Plot 3

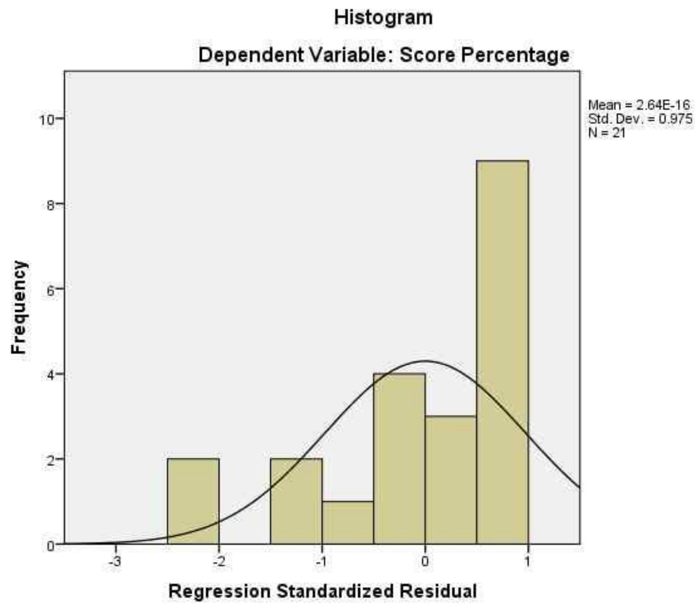


Plot 4

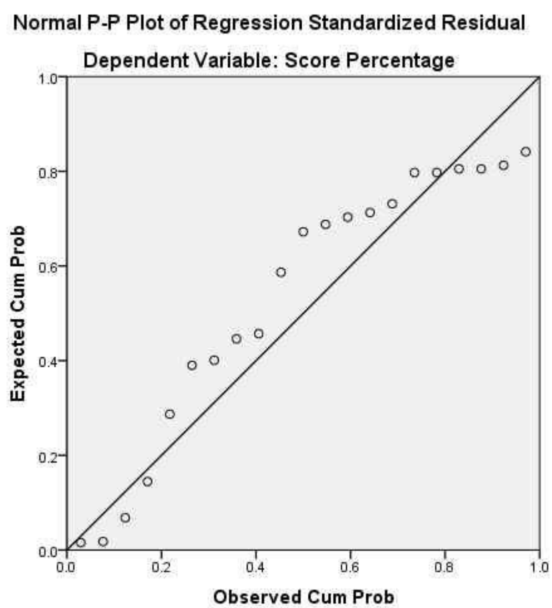


Plot 5

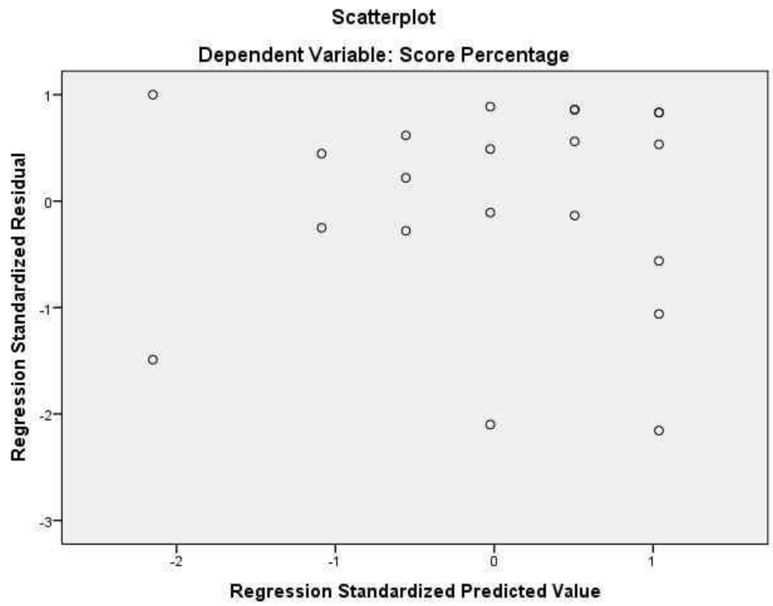
Item 14


Histogram
Dependent Variable: Score Percentage
Mean = 2.64E-16
Std. Dev. = 0.975
N = 21
Frequency
Regression Standardized Residual

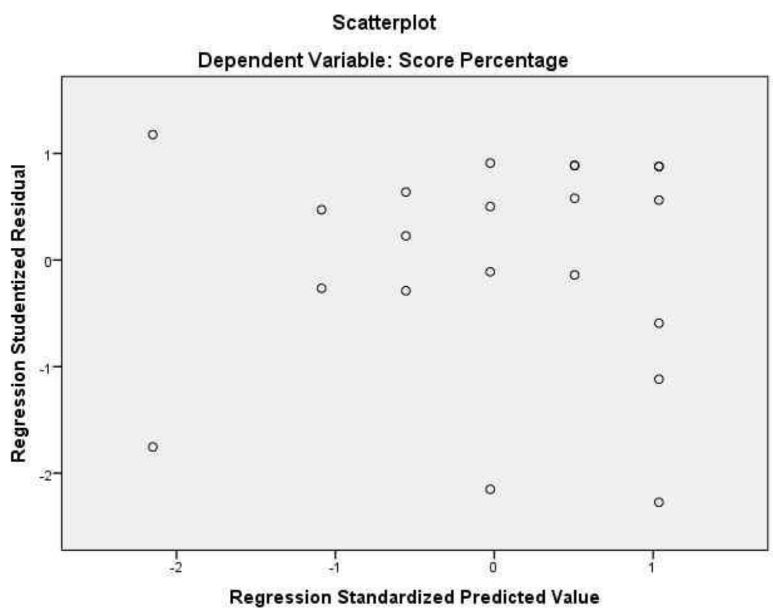
Plot 1


Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Score Percentage
Expected Cum Prob
Observed Cum Prob

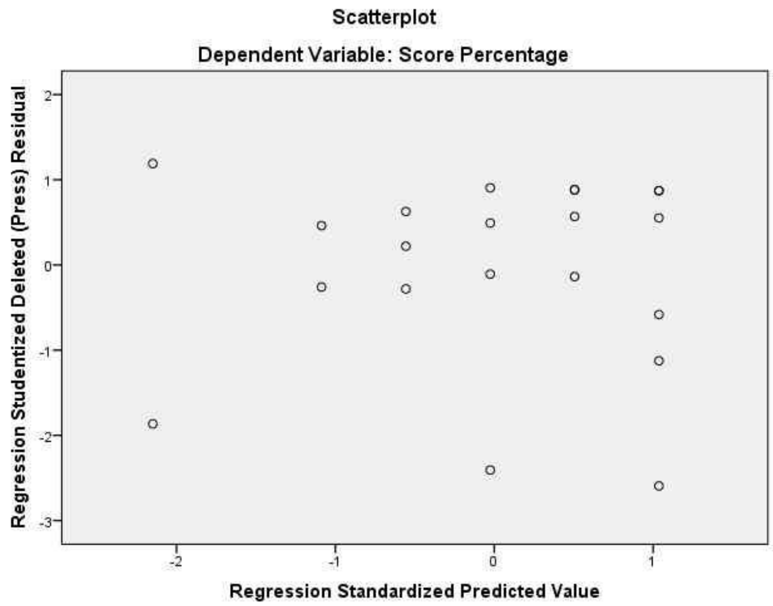
Plot 2


Scatterplot
Dependent Variable: Score Percentage
Regression Standardized Residual
Regression Standardized Predicted Value

Plot 3

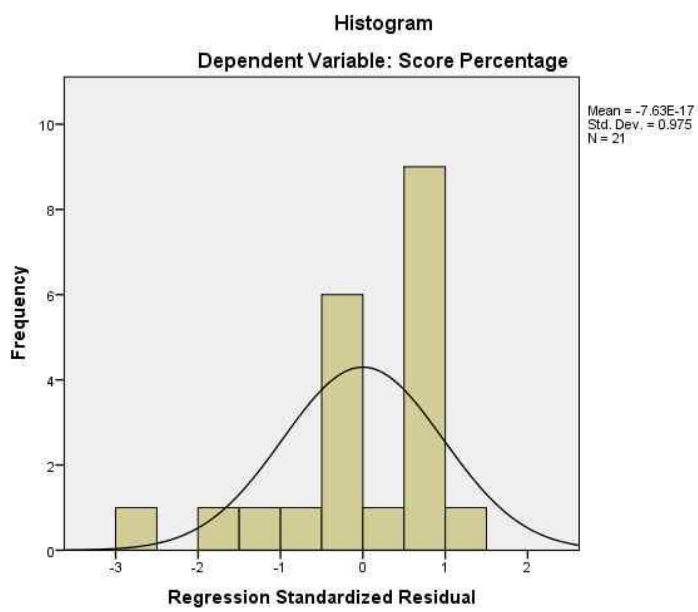

Scatterplot
Dependent Variable: Score Percentage
Regression Studentized Residual
Regression Standardized Predicted Value

Plot 4

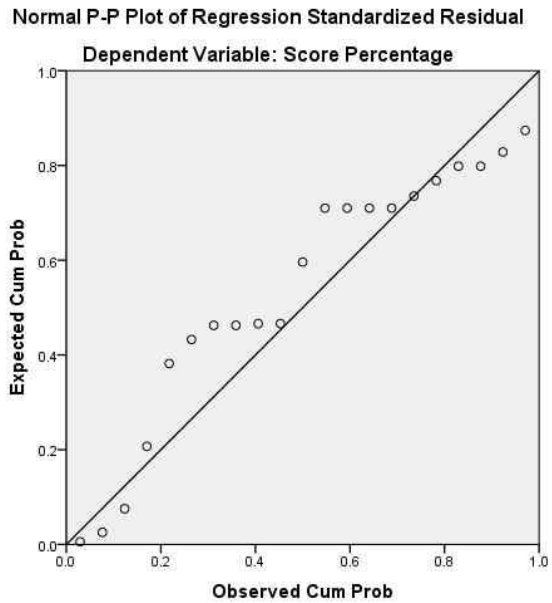


Plot 5

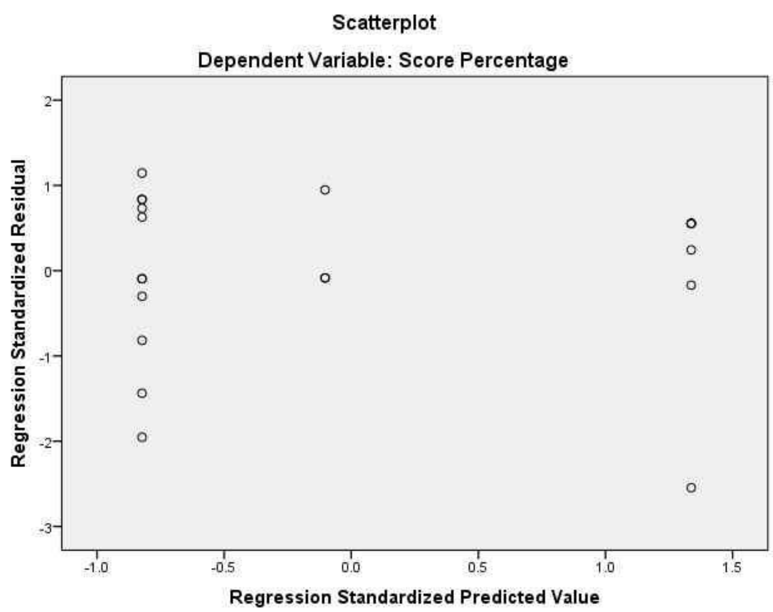
Item 15



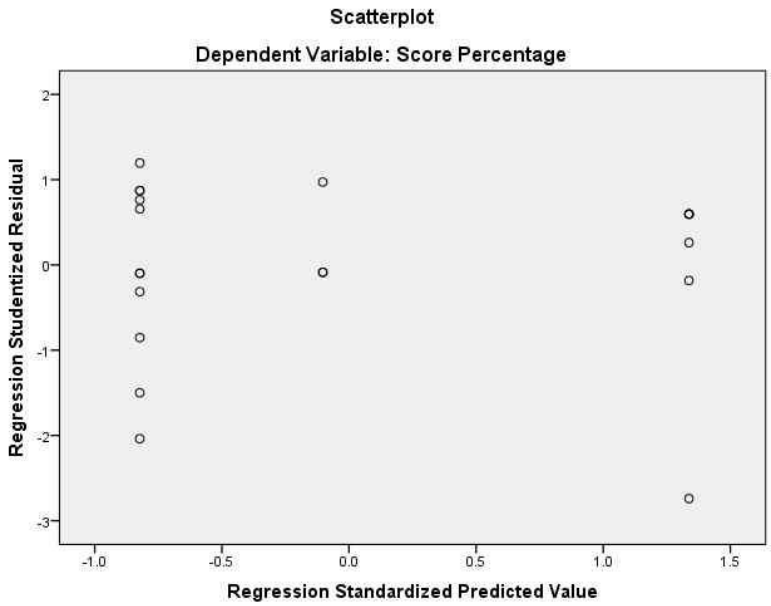
Plot 1


Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Score Percentage
Expected Cum Prob
Observed Cum Prob
0.0
0.2
0.4
0.6
0.8
1.0

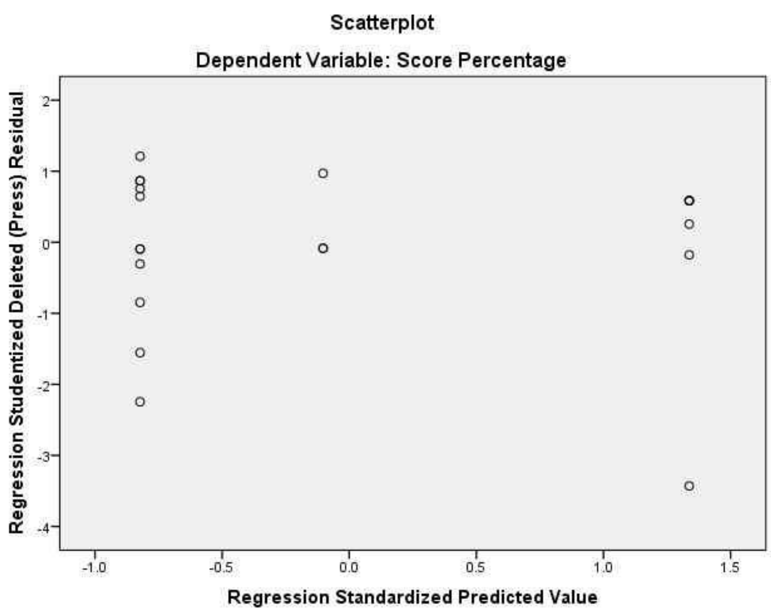
Plot 2


Scatterplot
Dependent Variable: Score Percentage
Regression Standardized Residual
Regression Standardized Predicted Value
2
1
0
-1
-2
-3
-1.0
-0.5
0.0
0.5
1.0
1.5

Plot 3

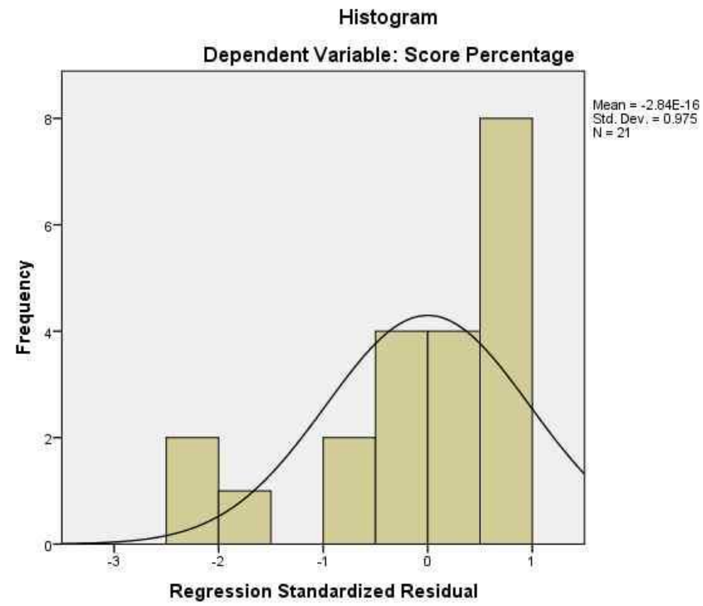


Plot 4

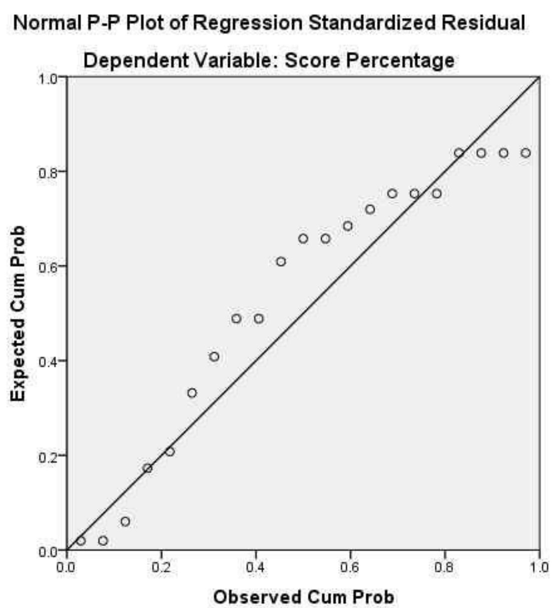


Plot 5

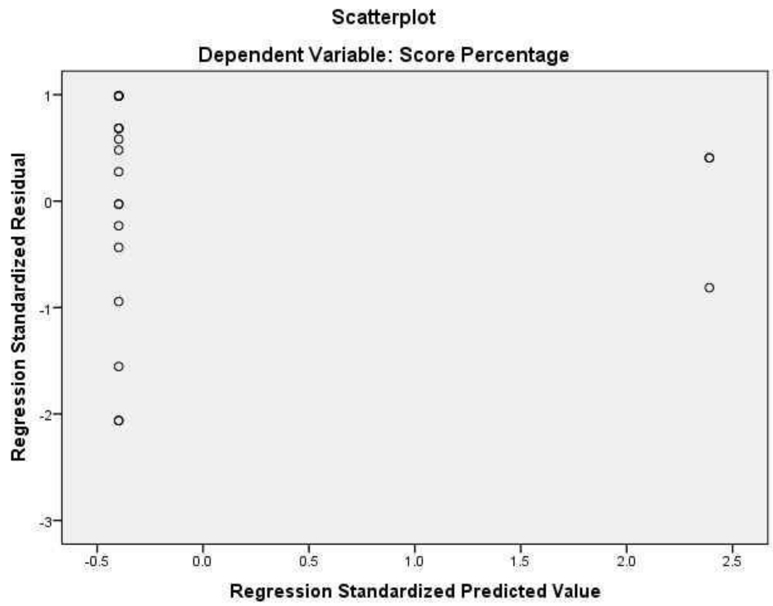
Item 16


Histogram
Dependent Variable: Score Percentage
Mean = -2.84E-16
Std. Dev. = 0.975
N = 21
Frequency
Regression Standardized Residual

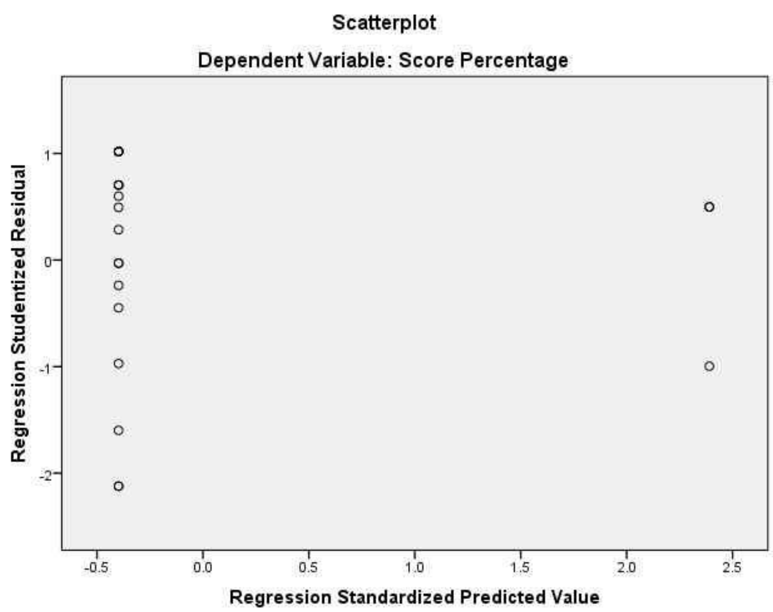
Plot 1


Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Score Percentage
Expected Cum Prob
Observed Cum Prob

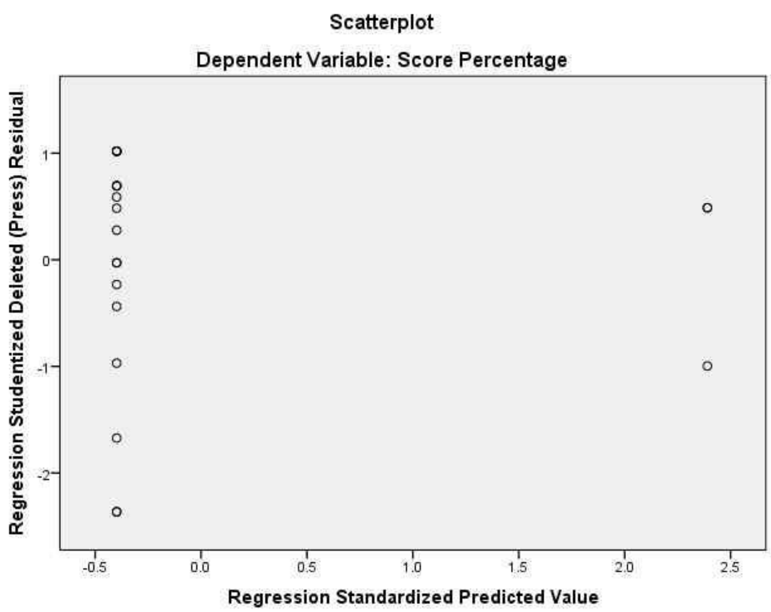
Plot 2


Scatterplot
Dependent Variable: Score Percentage
Regression Standardized Residual
Regression Standardized Predicted Value
1
0
-1
-2
-3
-0.5
0.0
0.5
1.0
1.5
2.0
2.5

Plot 3

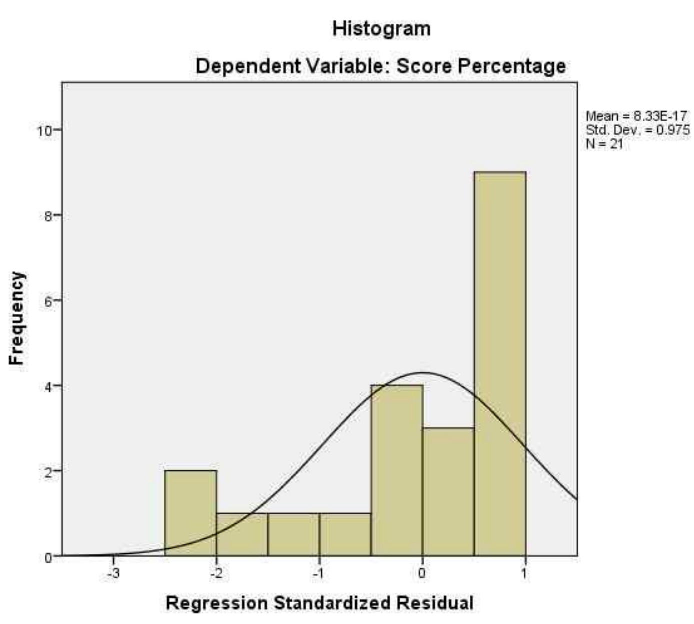

Scatterplot
Dependent Variable: Score Percentage
Regression Studentized Residual
Regression Standardized Predicted Value
1
0
-1
-2
-0.5
0.0
0.5
1.0
1.5
2.0
2.5

Plot 4

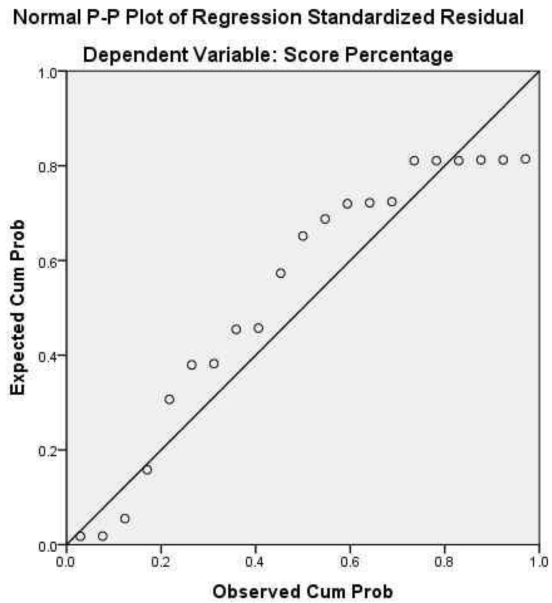


Plot 5

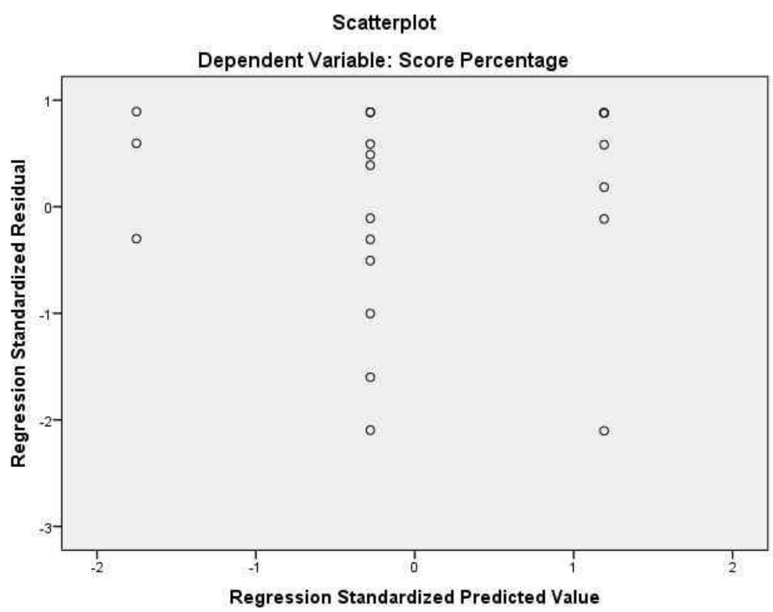
Item 17



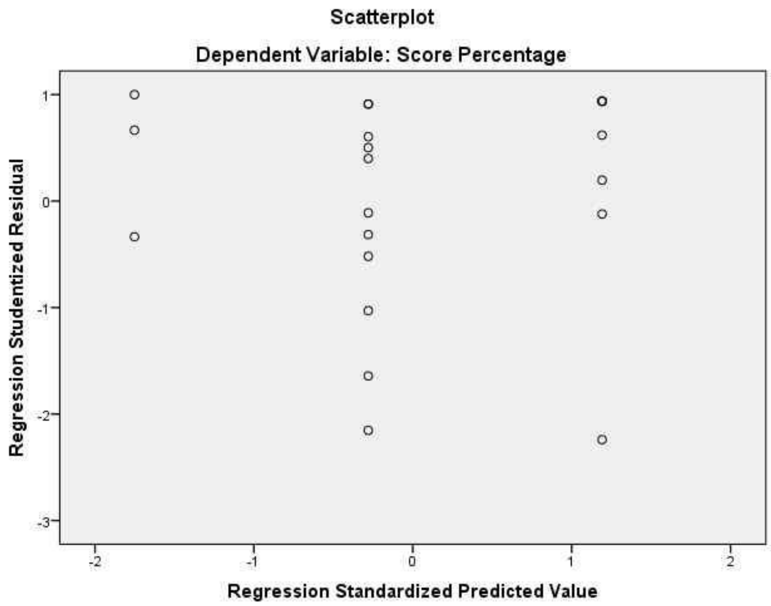
Plot 1


Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Score Percentage
Expected Cum Prob
Observed Cum Prob
0.0
0.2
0.4
0.6
0.8
1.0

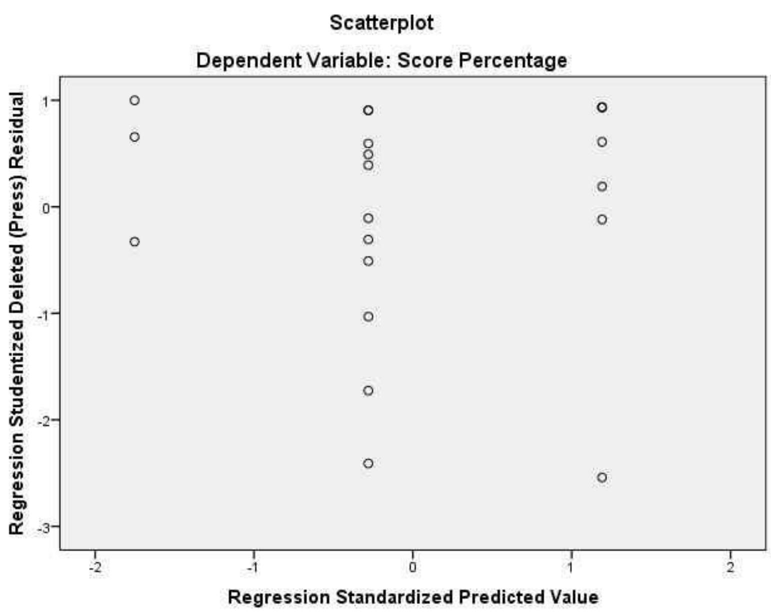
Plot 2


Scatterplot
Dependent Variable: Score Percentage
Regression Standardized Residual
Regression Standardized Predicted Value
1
0
-1
-2
-3
2

Plot 3

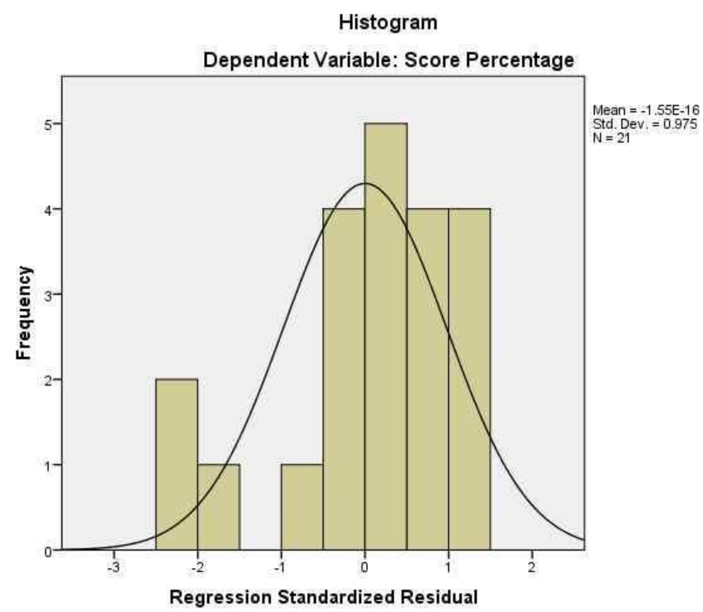


Plot 4

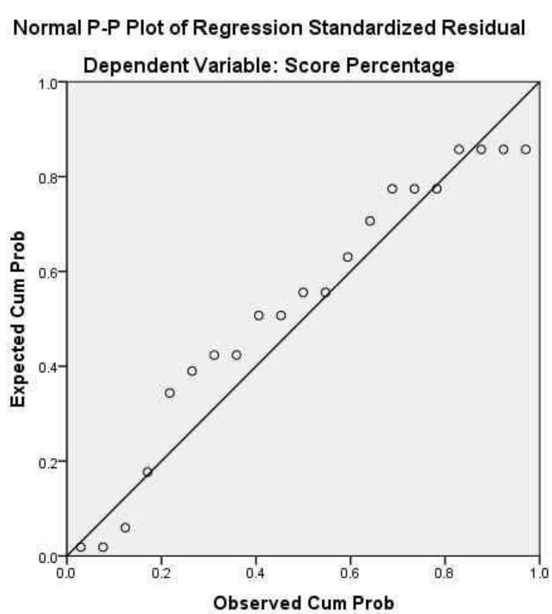


Plot 5

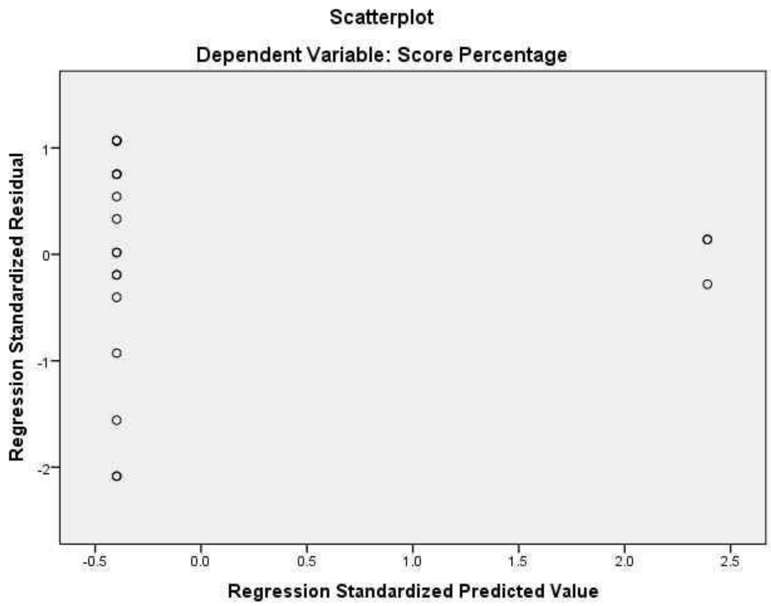
Item 18


Histogram
Dependent Variable: Score Percentage
Mean = -1.55E-16
Std. Dev. = 0.975
N = 21
Frequency
Regression Standardized Residual

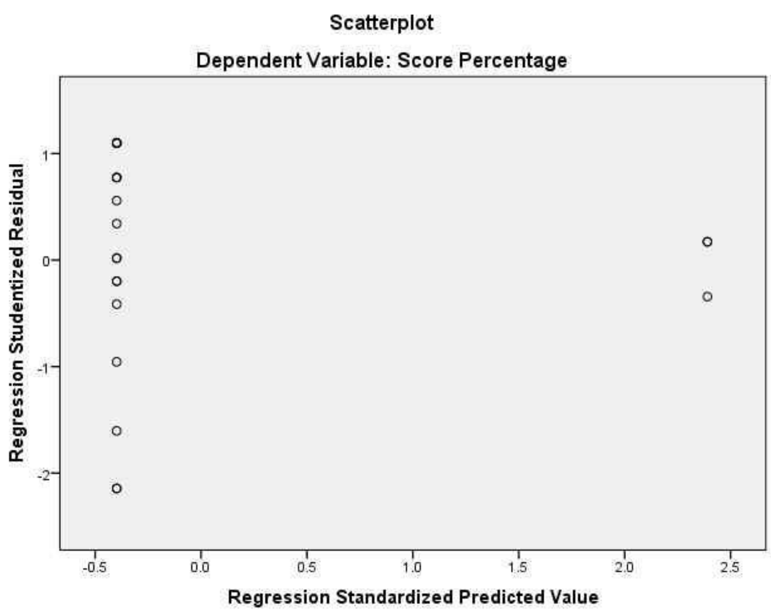
Plot 1


Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Score Percentage
Expected Cum Prob
Observed Cum Prob

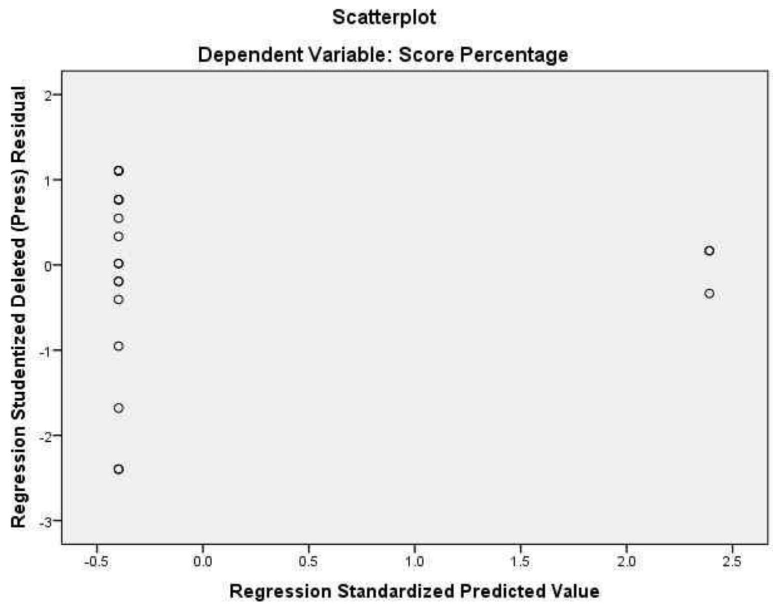
Plot 2


Scatterplot
Dependent Variable: Score Percentage
Regression Standardized Residual
Regression Standardized Predicted Value
1
0
-1
-2
-0.5
0.0
0.5
1.0
1.5
2.0
2.5

Plot 3

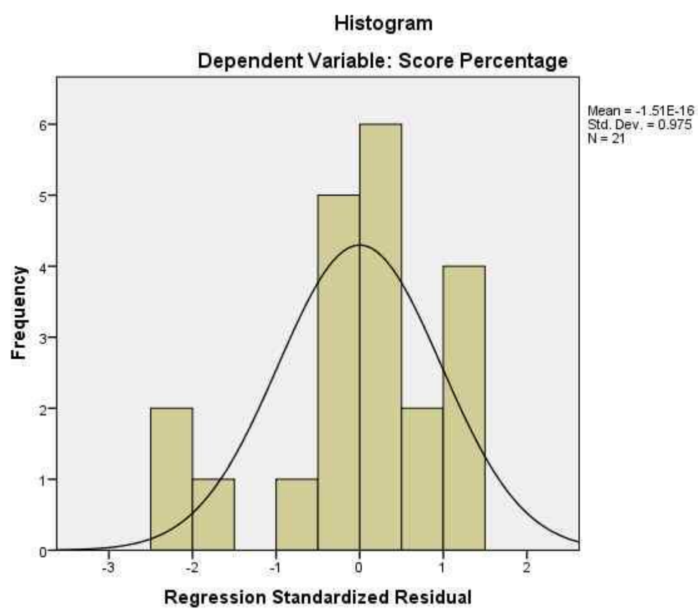

Scatterplot
Dependent Variable: Score Percentage
Regression Studentized Residual
Regression Standardized Predicted Value
1
0
-1
-2
-0.5
0.0
0.5
1.0
1.5
2.0
2.5

Plot 4

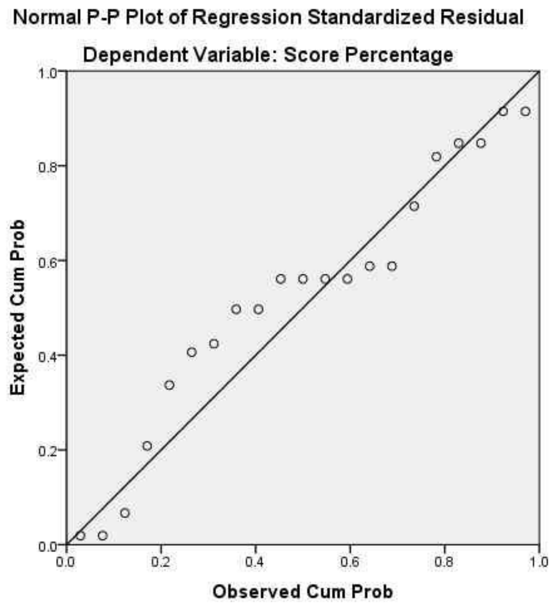


Plot 5

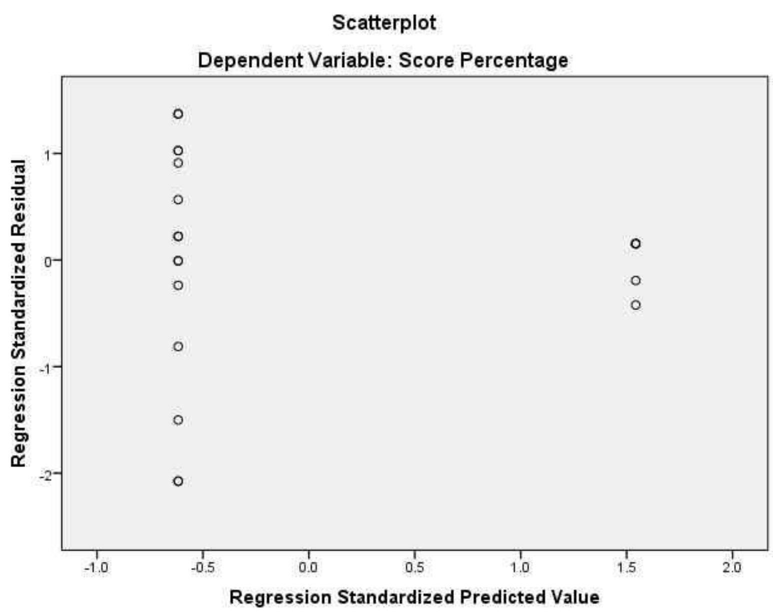
Item 19



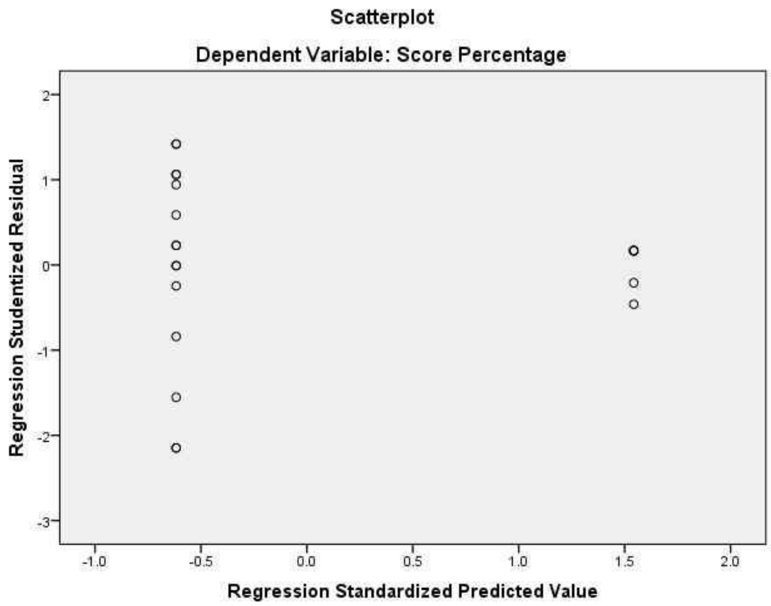
Plot 1


Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Score Percentage
Expected Cum Prob
Observed Cum Prob
0.0
0.2
0.4
0.6
0.8
1.0

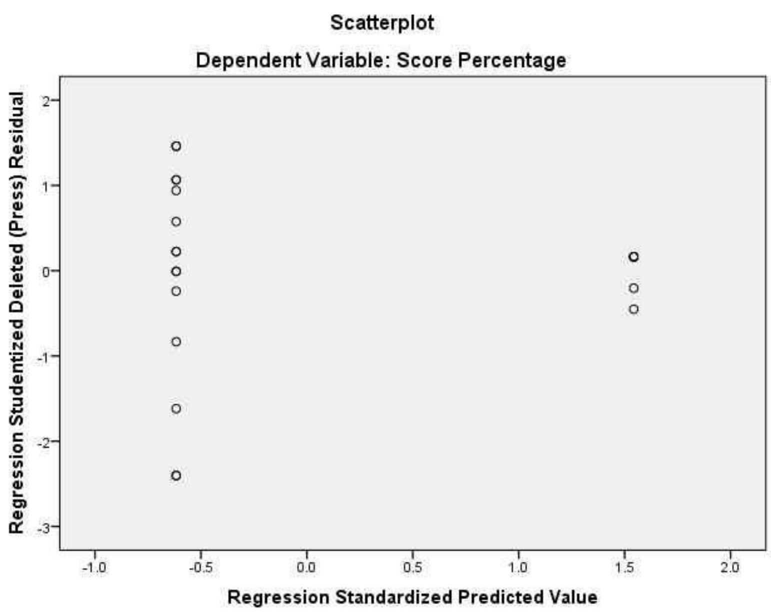
Plot 2


Scatterplot
Dependent Variable: Score Percentage
Regression Standardized Residual
Regression Standardized Predicted Value
1
0
-1
-2
-1.0
-0.5
0.0
0.5
1.0
1.5
2.0

Plot 3

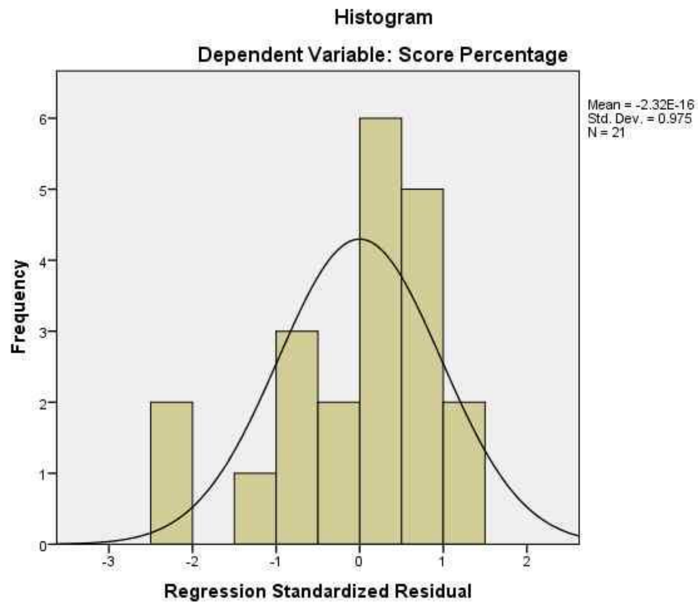


Plot 4

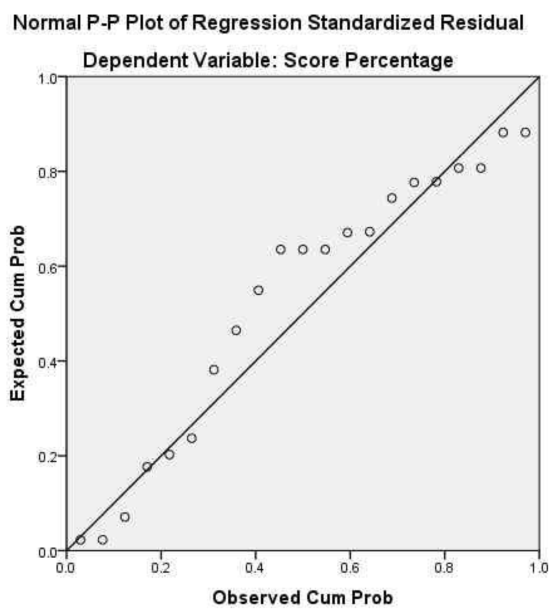


Plot 5

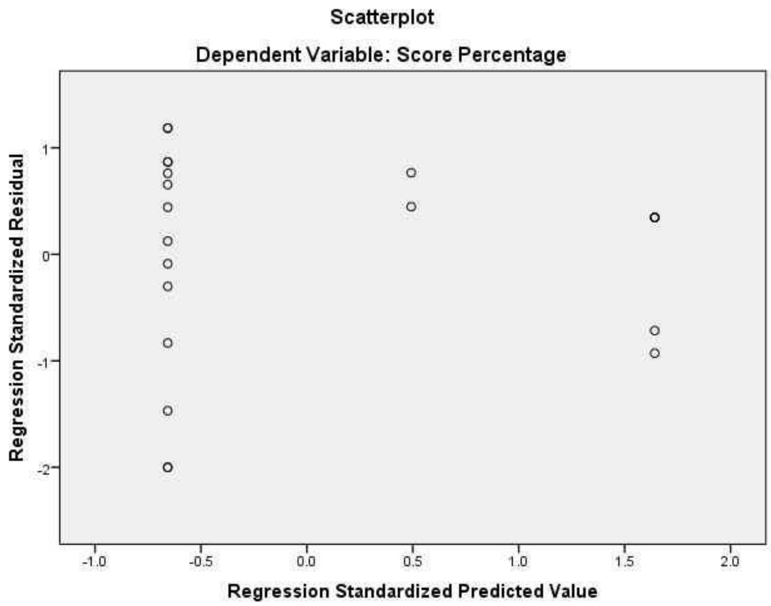
Item 20


Histogram
Dependent Variable: Score Percentage
Mean = -2.32E-16
Std. Dev. = 0.975
N = 21
Frequency
Regression Standardized Residual

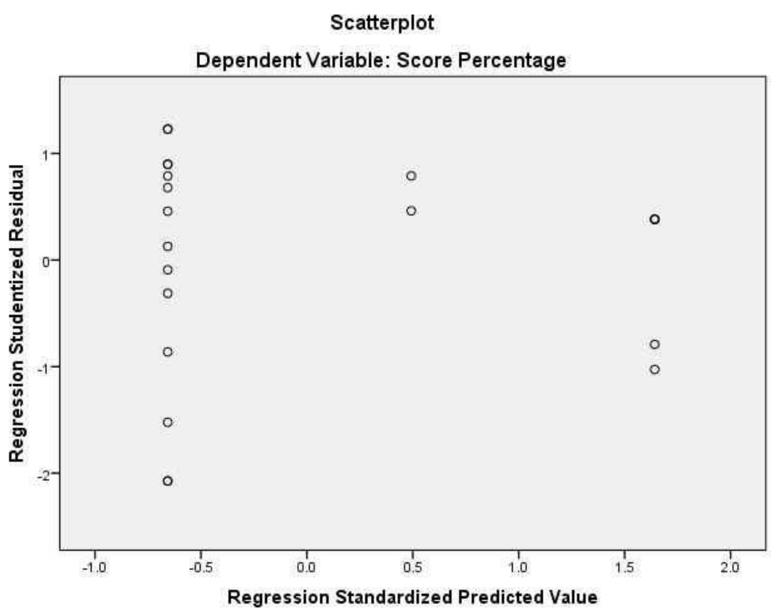
Plot 1


Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Score Percentage
Expected Cum Prob
Observed Cum Prob

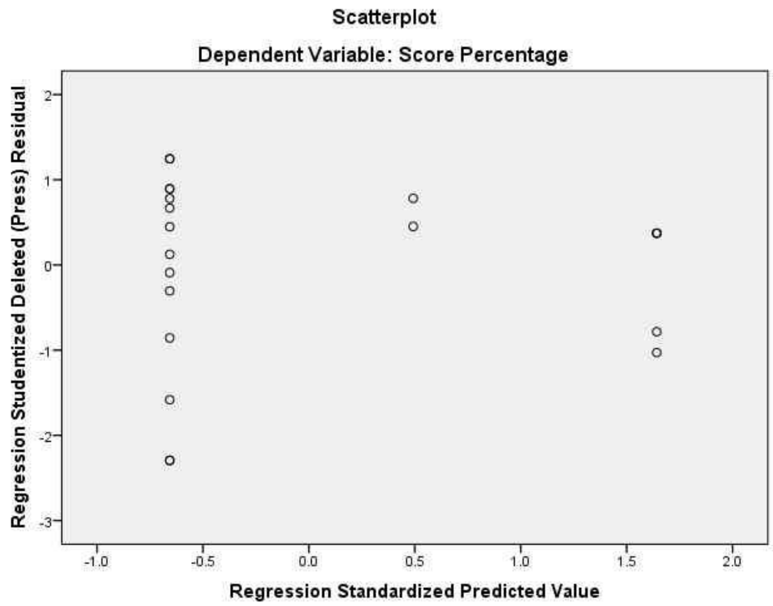
Plot 2


Scatterplot
Dependent Variable: Score Percentage
Regression Standardized Residual
Regression Standardized Predicted Value
1
0
-1
-2
-1.0
-0.5
0.0
0.5
1.0
1.5
2.0

Plot 3

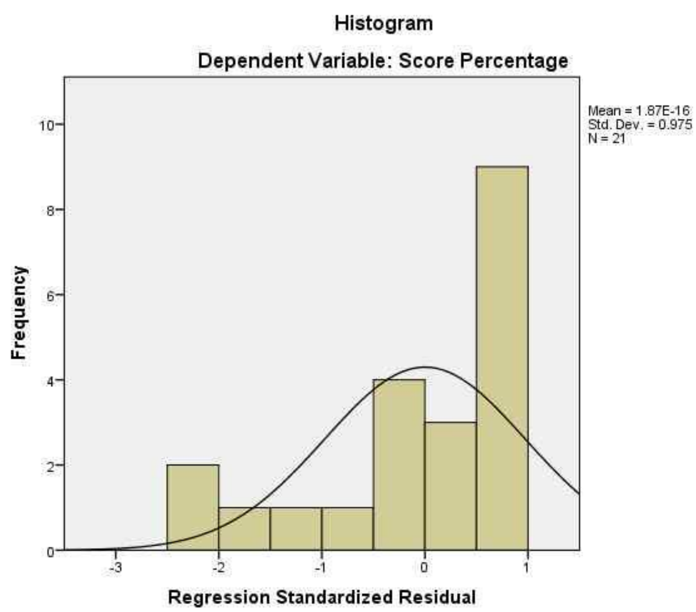

Scatterplot
Dependent Variable: Score Percentage
Regression Studentized Residual
Regression Standardized Predicted Value
1
0
-1
-2
-1.0
-0.5
0.0
0.5
1.0
1.5
2.0

Plot 4

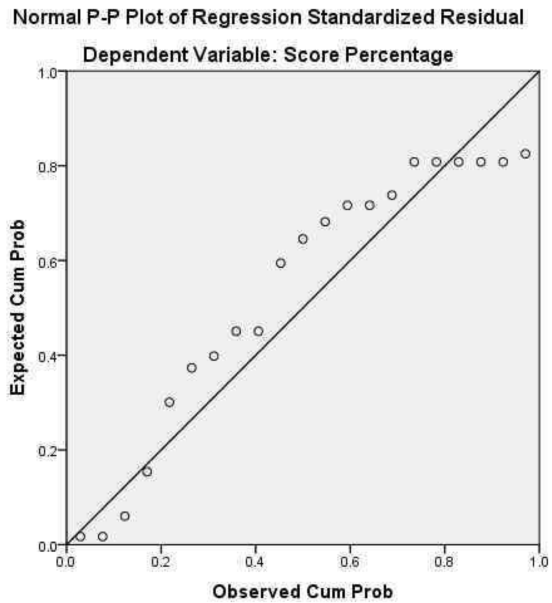


Plot 5

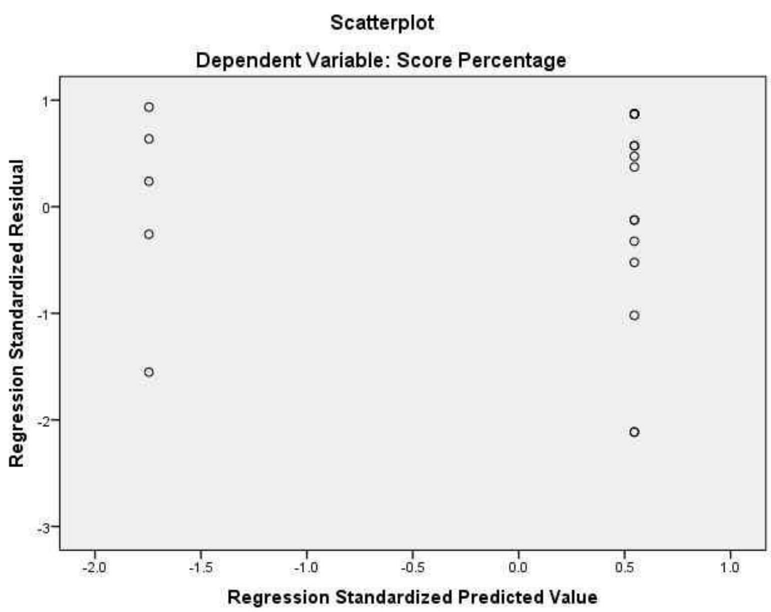
Item 21



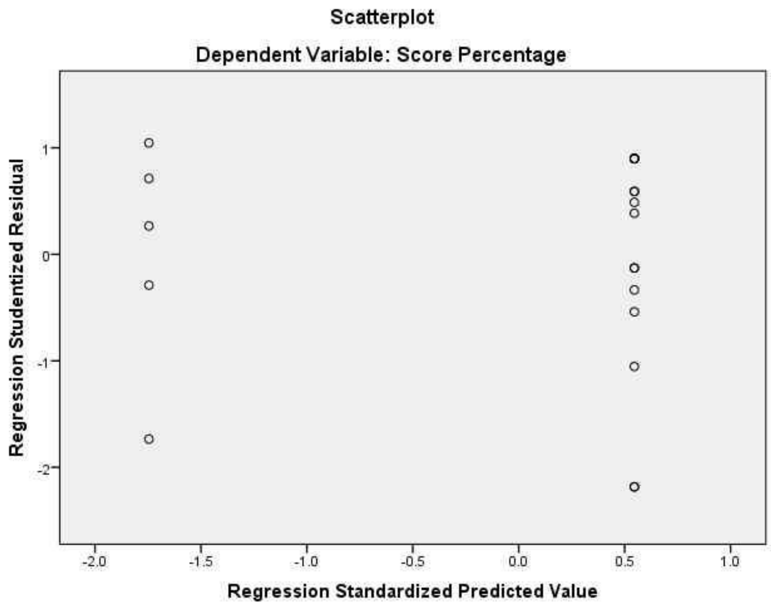
Plot 1


Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Score Percentage
Expected Cum Prob
Observed Cum Prob
0.0
0.2
0.4
0.6
0.8
1.0

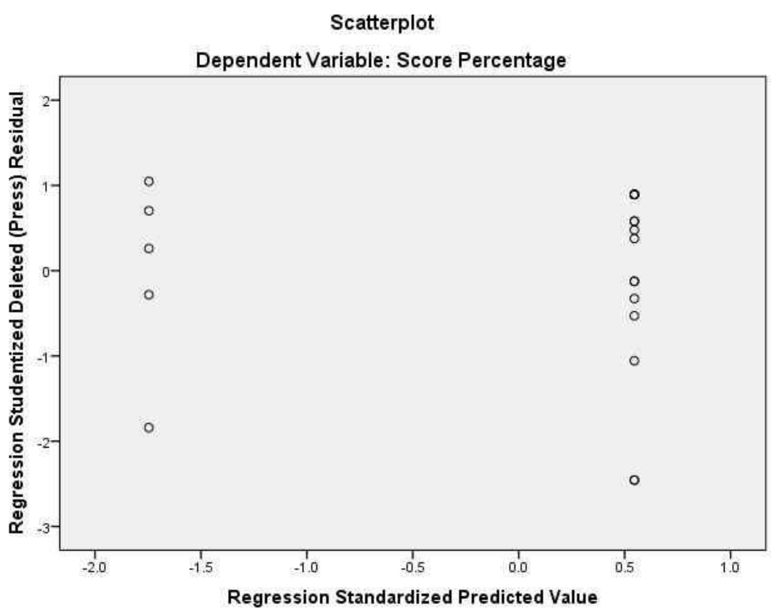
Plot 2


Scatterplot
Dependent Variable: Score Percentage
Regression Standardized Residual
Regression Standardized Predicted Value
1
0
-1
-2
-3
-2.0
-1.5
-1.0
-0.5
0.0
0.5
1.0

Plot 3

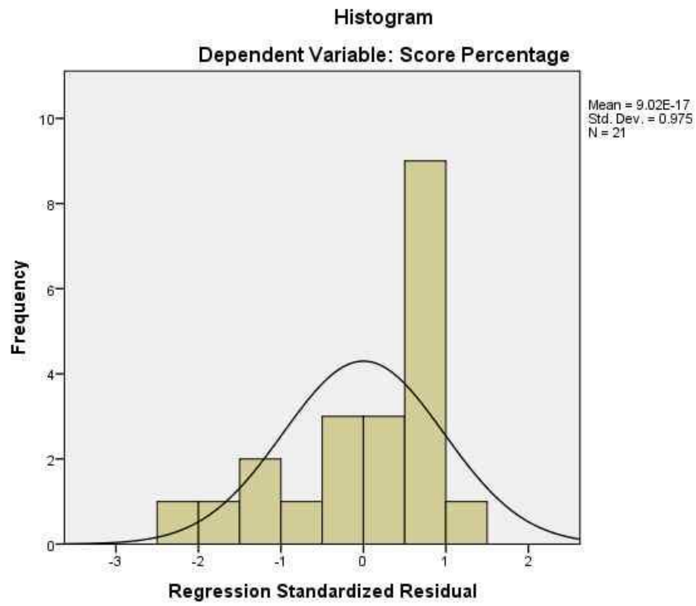


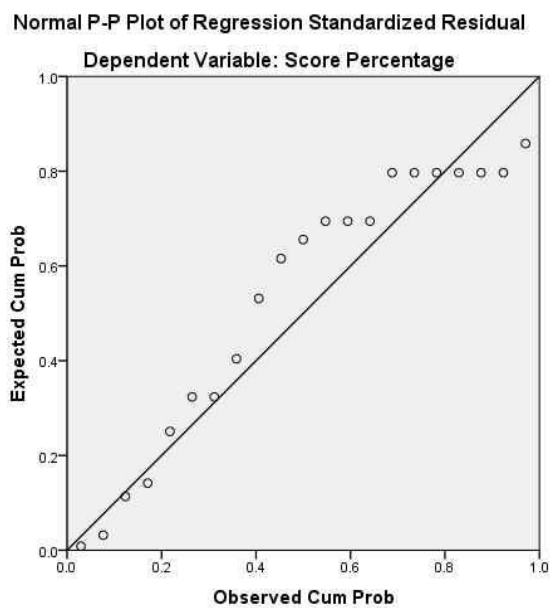
Plot 4

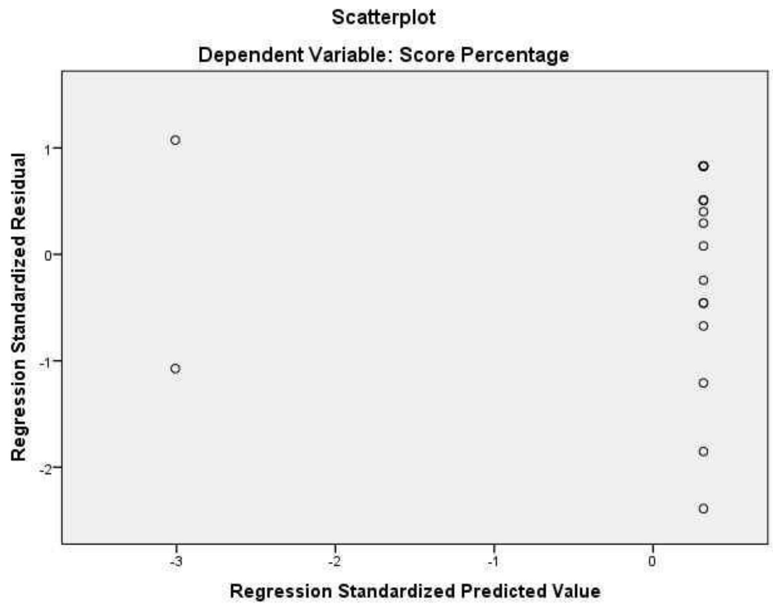


Plot 5

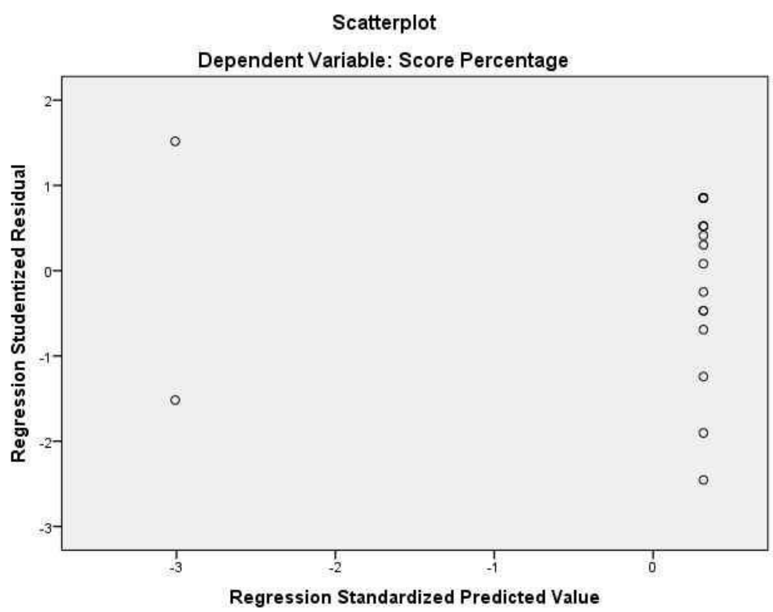
Item 22


Histogram
Dependent Variable: Score Percentage
Mean = 9.02E-17
Std. Dev. = 0.975
N = 21
Frequency
Regression Standardized Residual
Plot 1

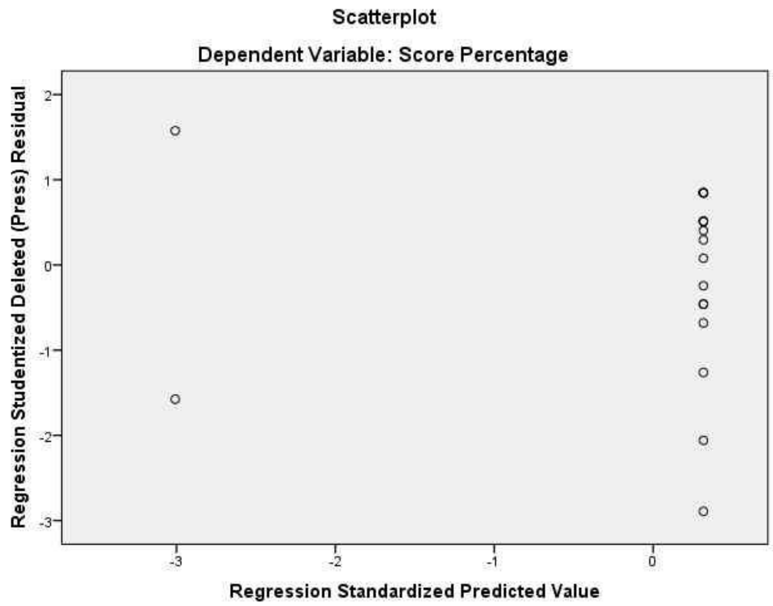

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Score Percentage
Expected Cum Prob
Observed Cum Prob
Plot 2


Scatterplot
Dependent Variable: Score Percentage
Regression Standardized Residual
Regression Standardized Predicted Value

Plot 3

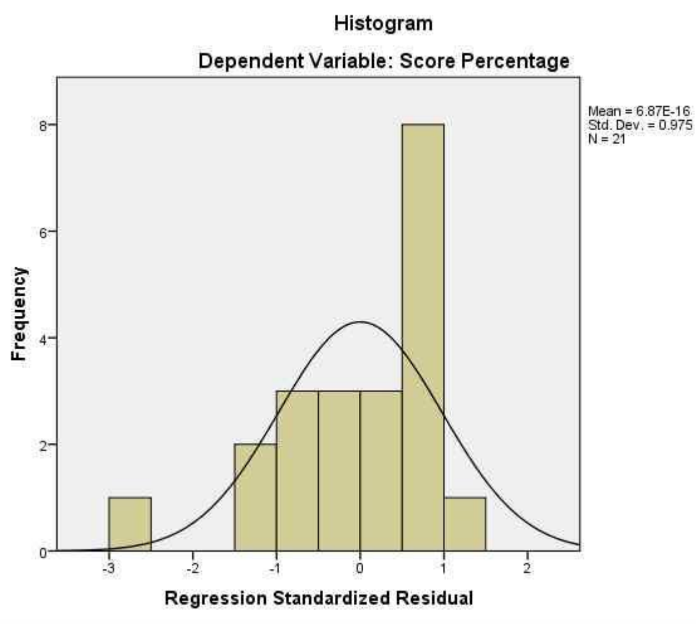

Scatterplot
Dependent Variable: Score Percentage
Regression Studentized Residual
Regression Standardized Predicted Value

Plot 4

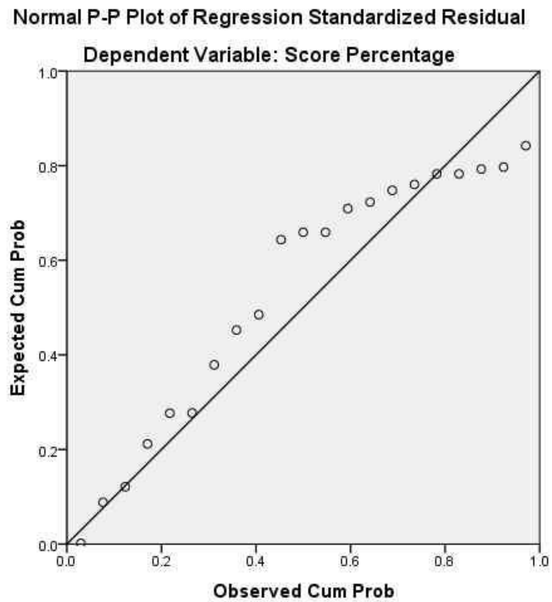


Plot 5

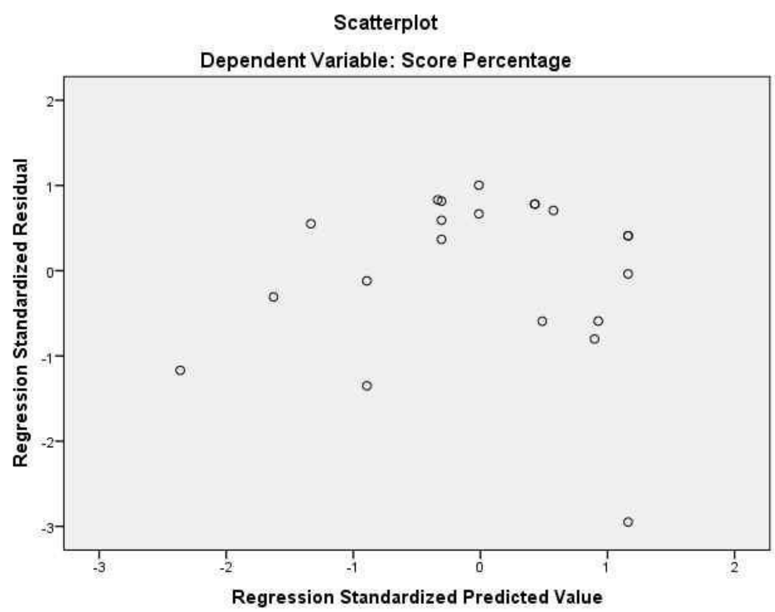
Item MajorGPA



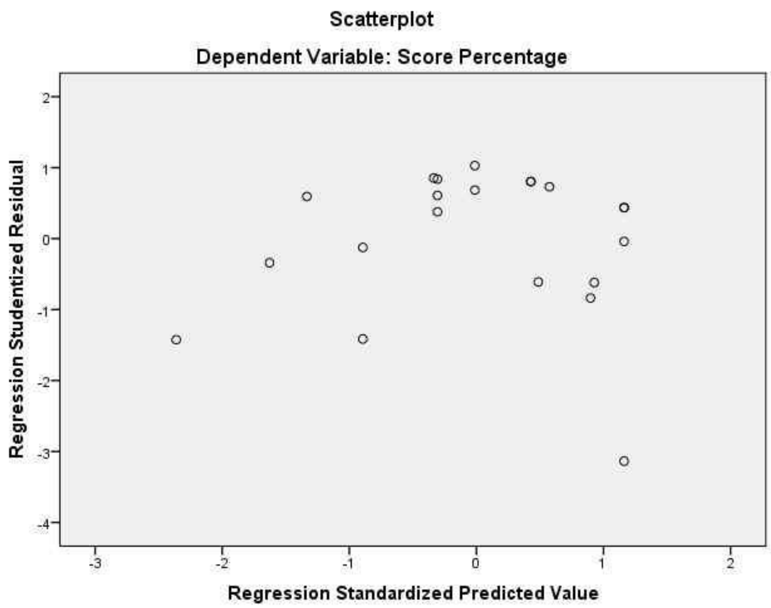
Plot 1


Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Score Percentage
Expected Cum Prob
Observed Cum Prob
0.0
0.2
0.4
0.6
0.8
1.0

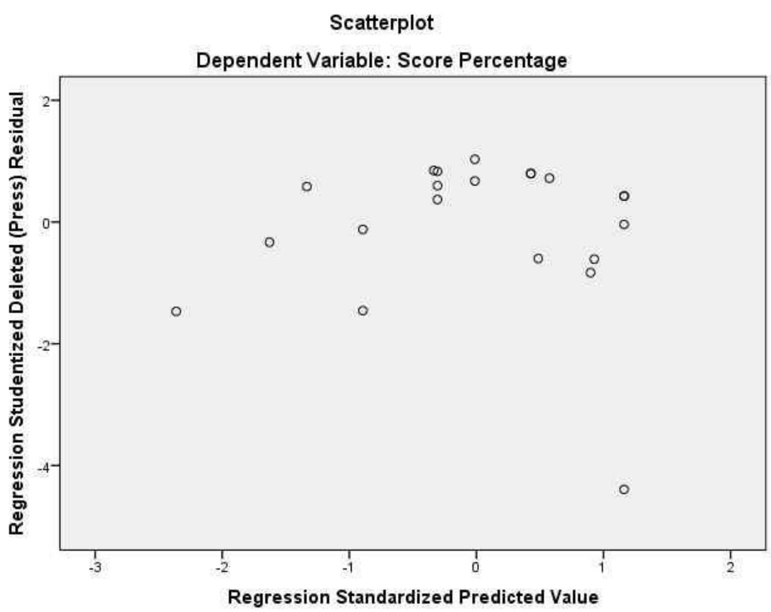
Plot 2


Scatterplot
Dependent Variable: Score Percentage
Regression Standardized Residual
Regression Standardized Predicted Value
-3
-2
-1
0
1
2

Plot 3


Scatterplot
Dependent Variable: Score Percentage
Regression Studentized Residual
Regression Standardized Predicted Value

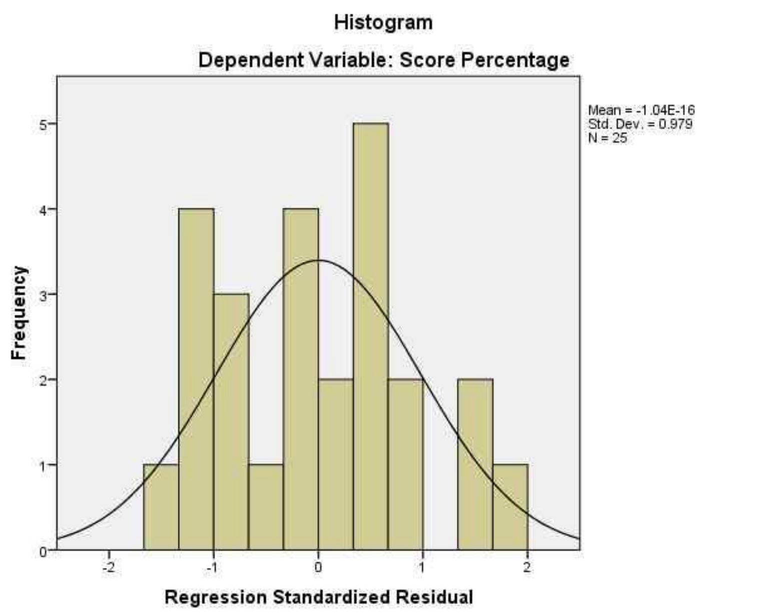
Plot 4


Scatterplot
Dependent Variable: Score Percentage
Regression Studentized Deleted (Press) Residual
Regression Standardized Predicted Value

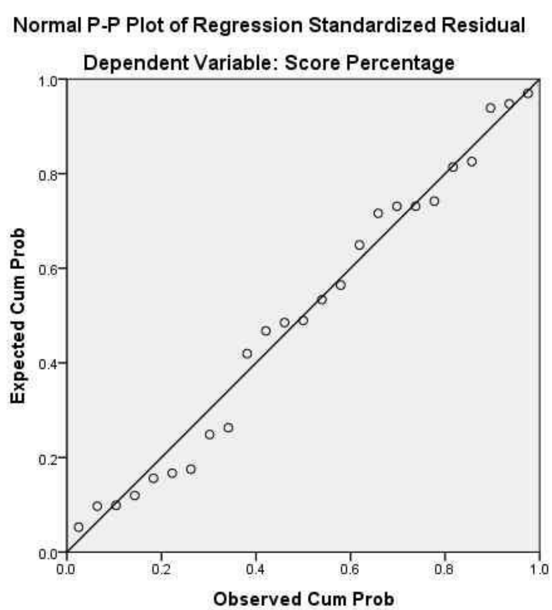
Plot 5

Class B

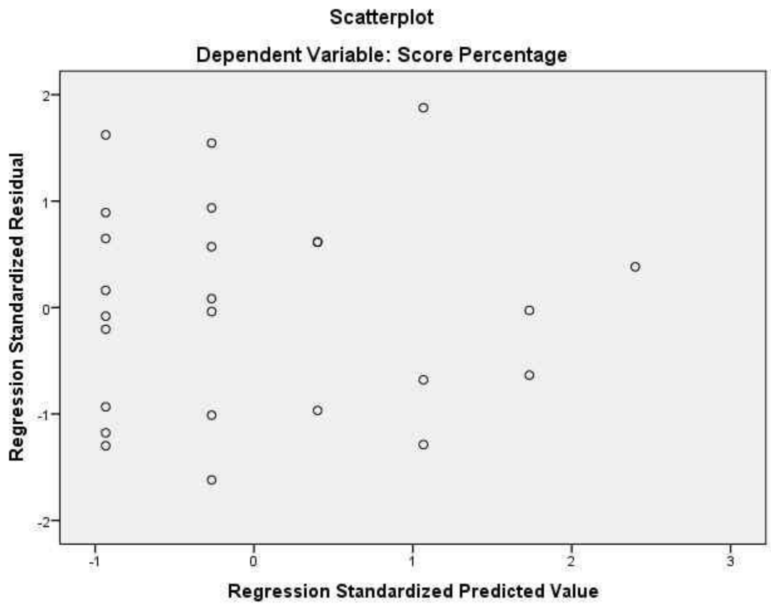
Item 1



Plot 1

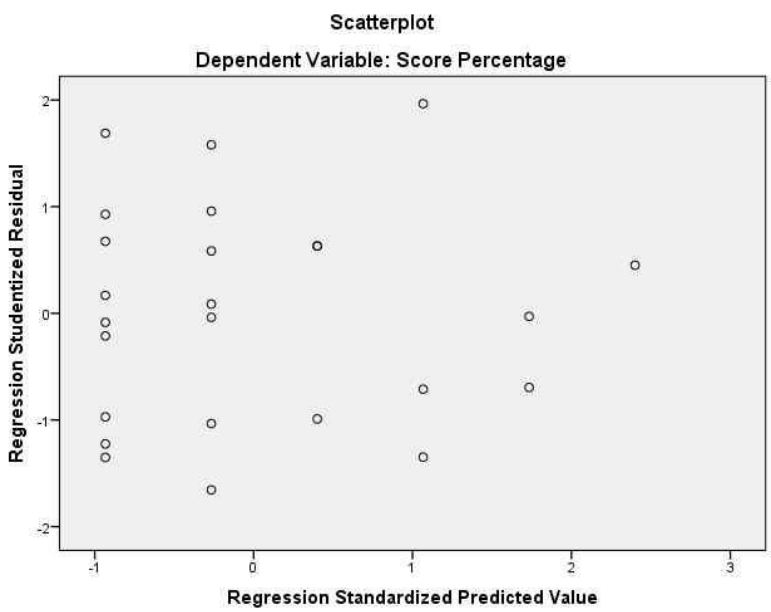


Plot 2



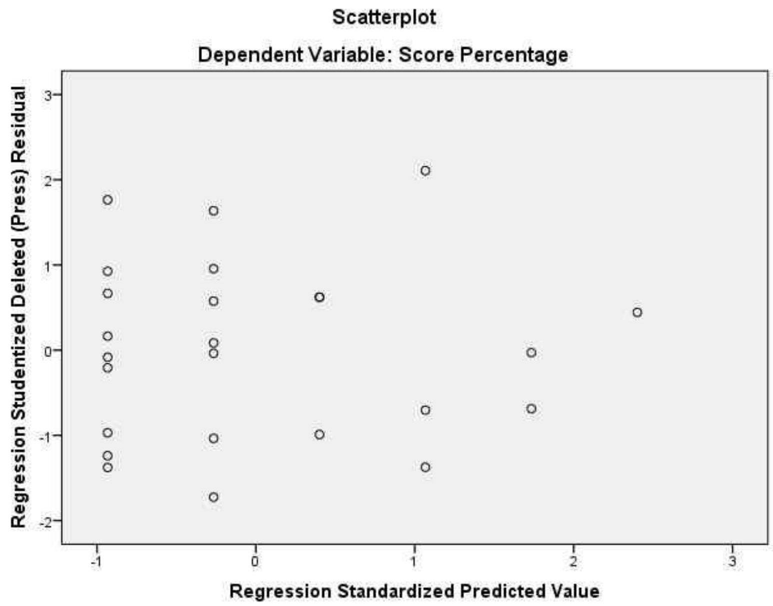
Scatterplot
Dependent Variable: Score Percentage
Regression Standardized Residual
Regression Standardized Predicted Value

Plot 3



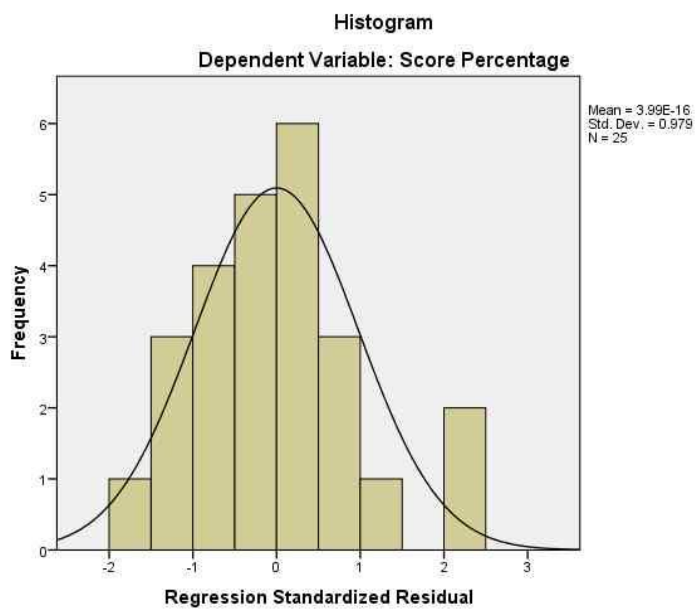
Scatterplot
Dependent Variable: Score Percentage
Regression Studentized Residual
Regression Standardized Predicted Value

Plot 4

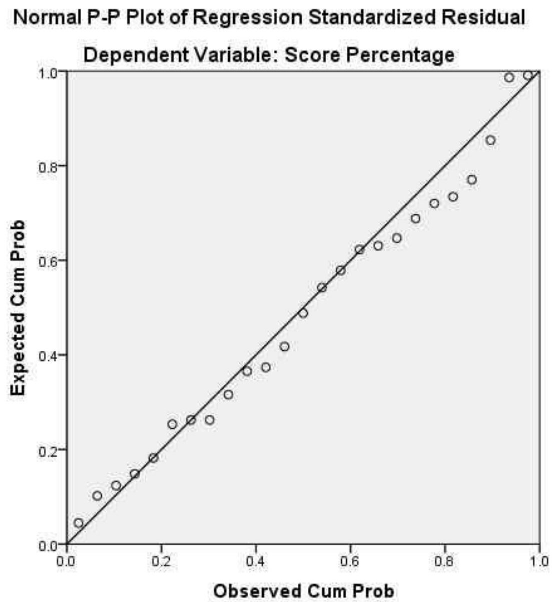


Plot 5

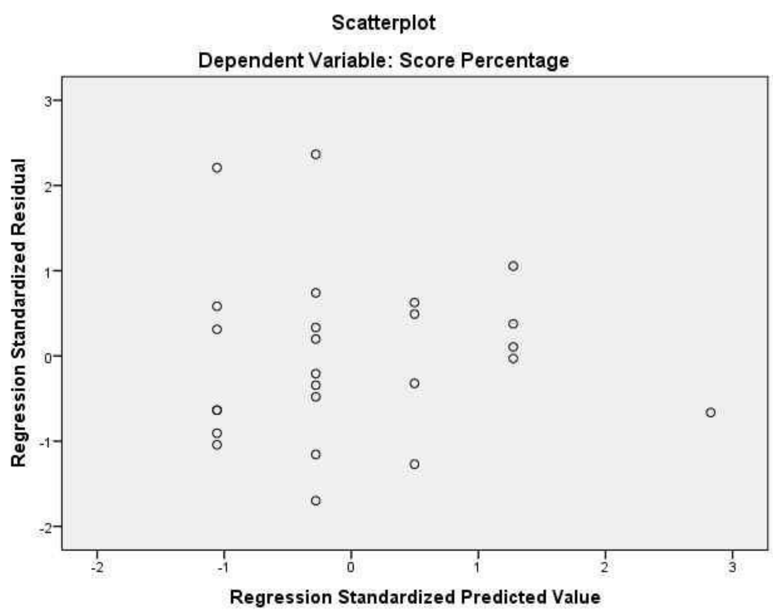
Item 2



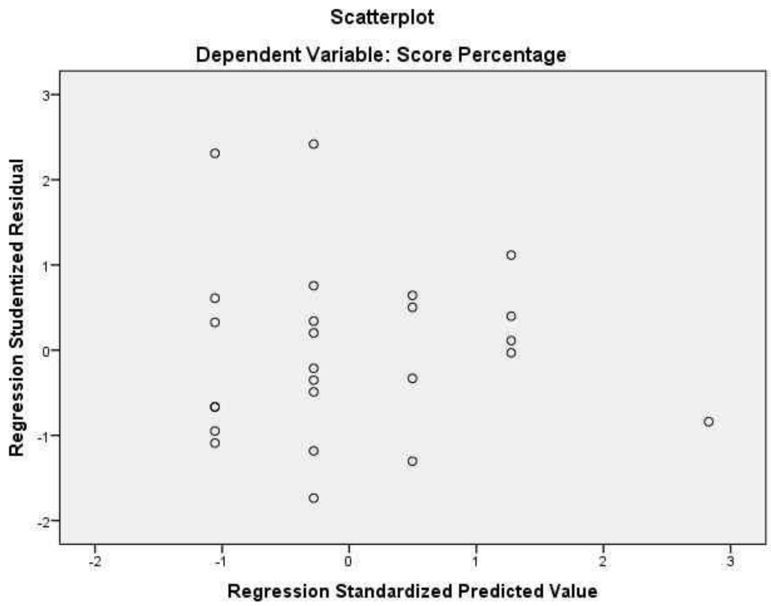
Plot 1


Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Score Percentage
Expected Cum Prob
Observed Cum Prob
0.0
0.2
0.4
0.6
0.8
1.0

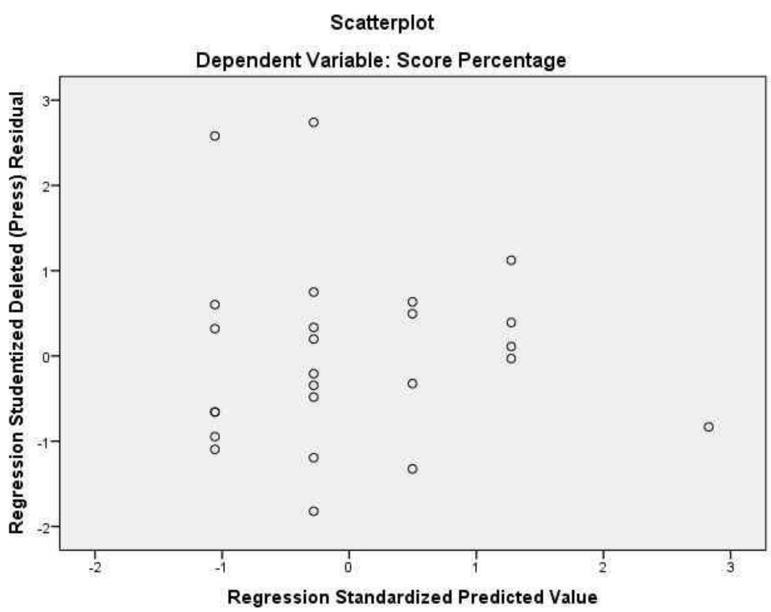
Plot 2


Scatterplot
Dependent Variable: Score Percentage
Regression Standardized Residual
Regression Standardized Predicted Value
-2
-1
0
1
2
3

Plot 3

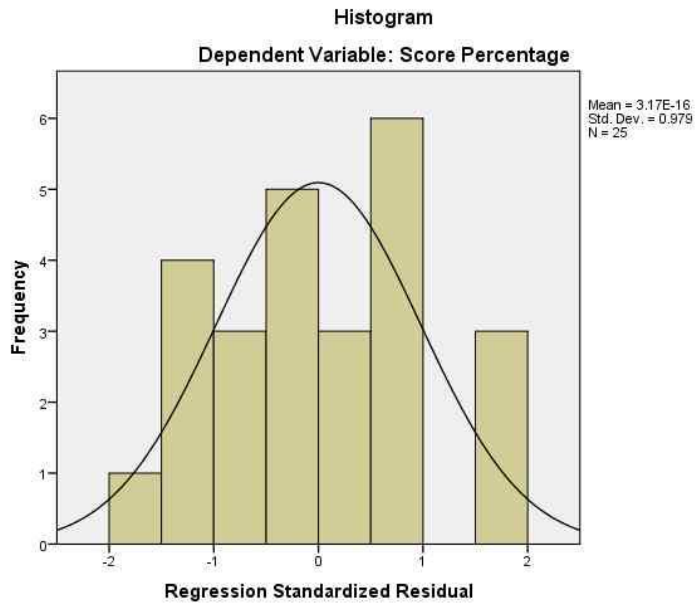


Plot 4

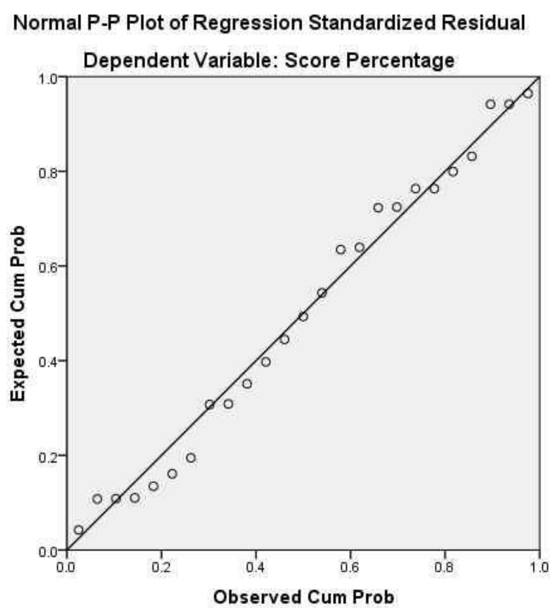


Plot 5

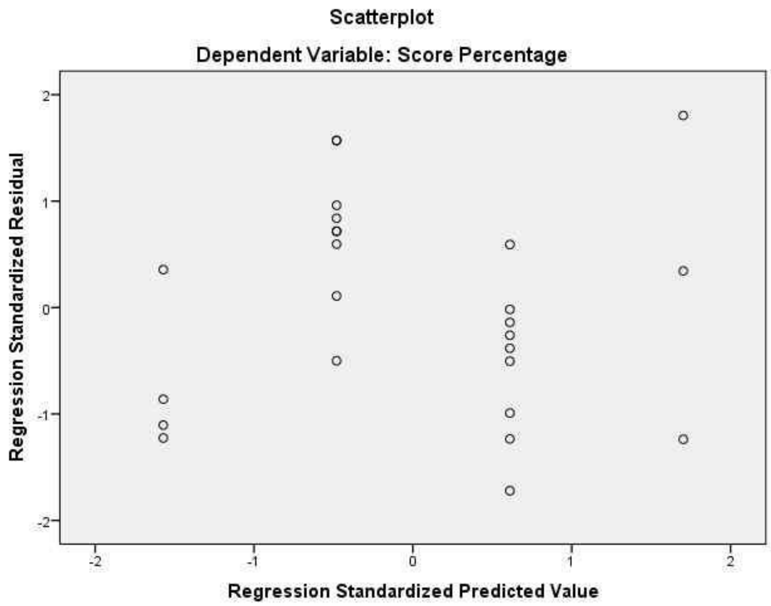
Item 3


Histogram
Dependent Variable: Score Percentage
Mean = 3.17E-16
Std. Dev. = 0.979
N = 25
Frequency
Regression Standardized Residual

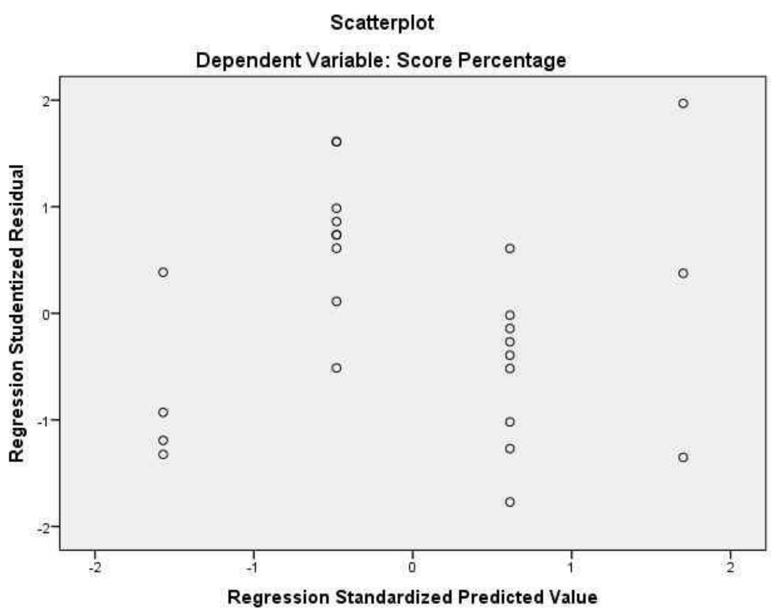
Plot 1


Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Score Percentage
Expected Cum Prob
Observed Cum Prob

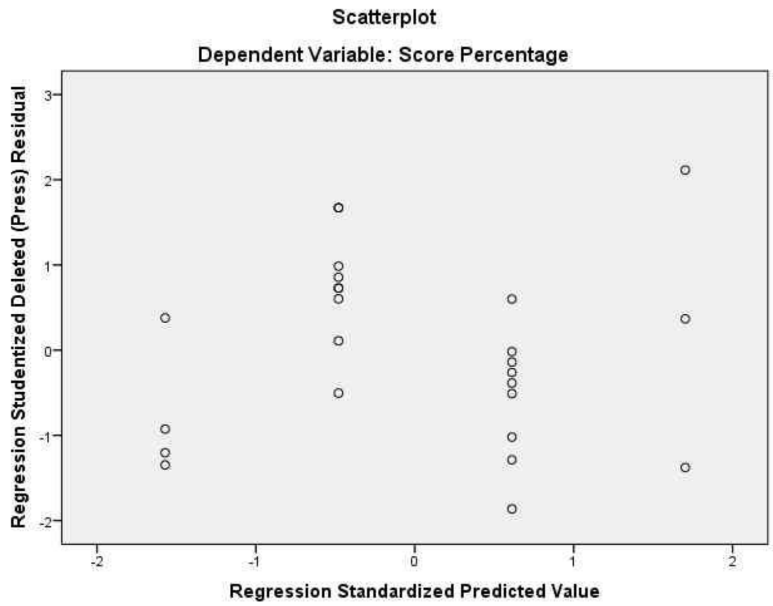
Plot 2


Scatterplot
Dependent Variable: Score Percentage
Regression Standardized Residual
Regression Standardized Predicted Value
2
1
0
-1
-2
-2
-1
0
1
2

Plot 3

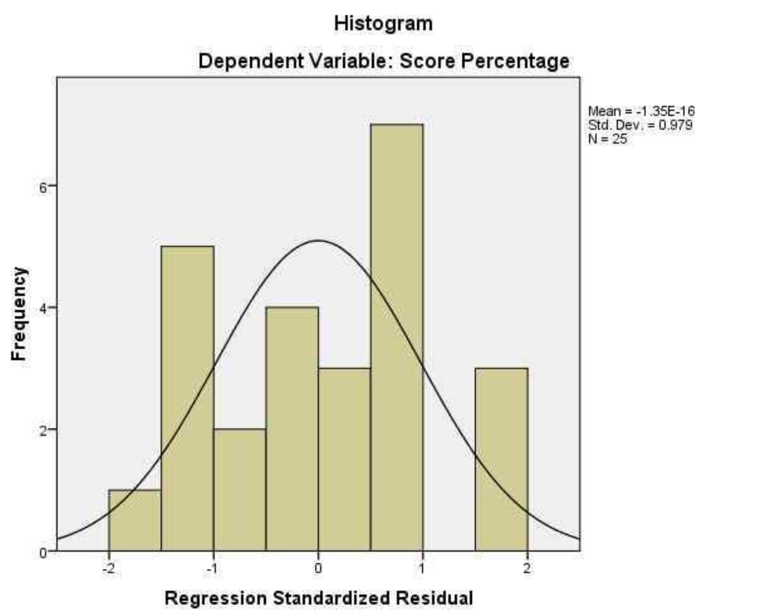

Scatterplot
Dependent Variable: Score Percentage
Regression Studentized Residual
Regression Standardized Predicted Value
2
1
0
-1
-2
-2
-1
0
1
2

Plot 4

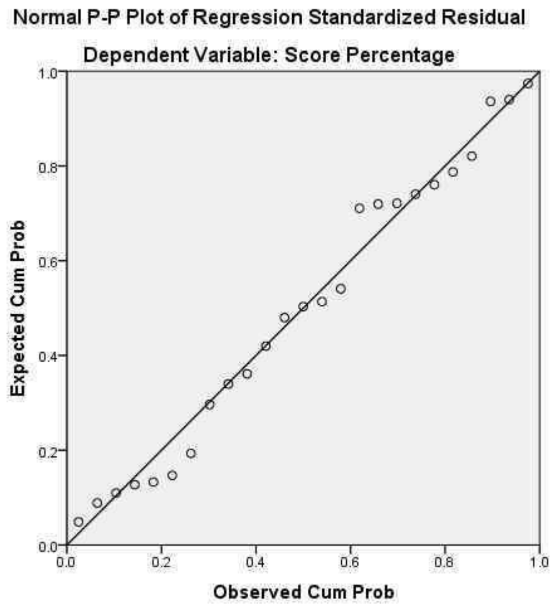


Plot 5

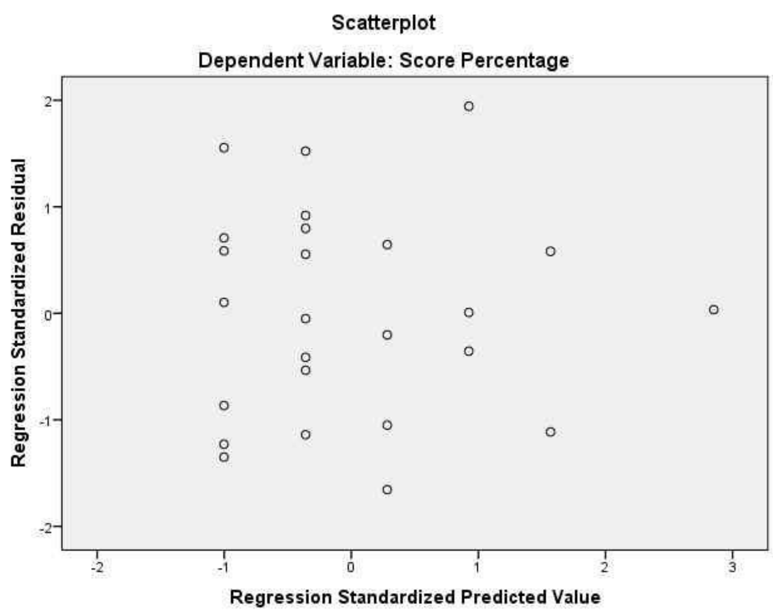
Item 4



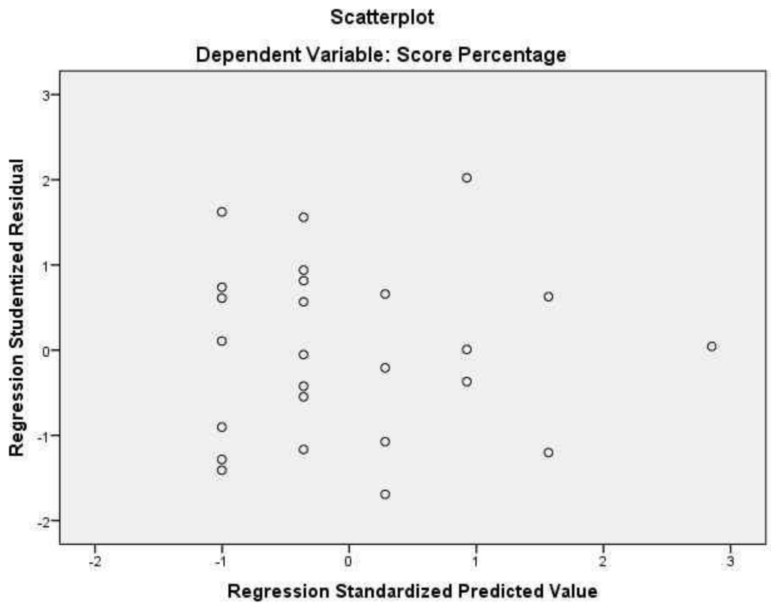
Plot 1


Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Score Percentage
Expected Cum Prob
Observed Cum Prob
0.0
0.2
0.4
0.6
0.8
1.0

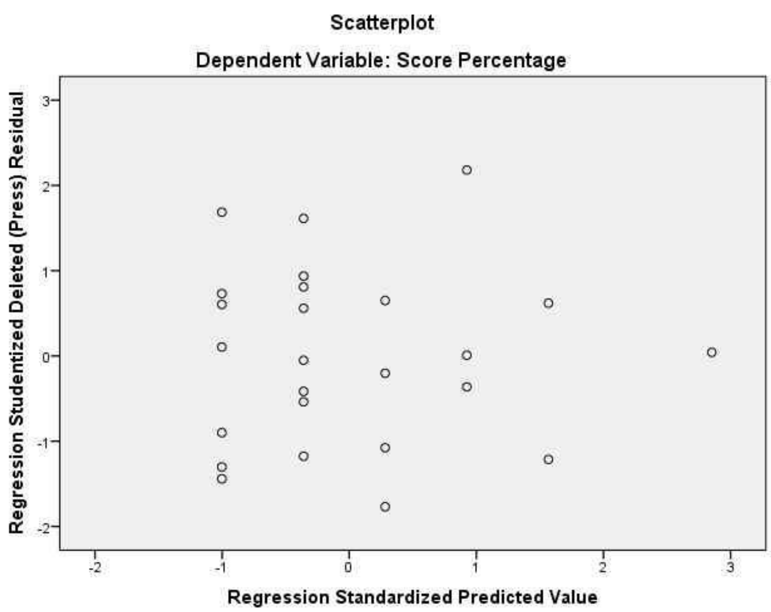
Plot 2


Scatterplot
Dependent Variable: Score Percentage
Regression Standardized Residual
Regression Standardized Predicted Value
-2
-1
0
1
2
3

Plot 3

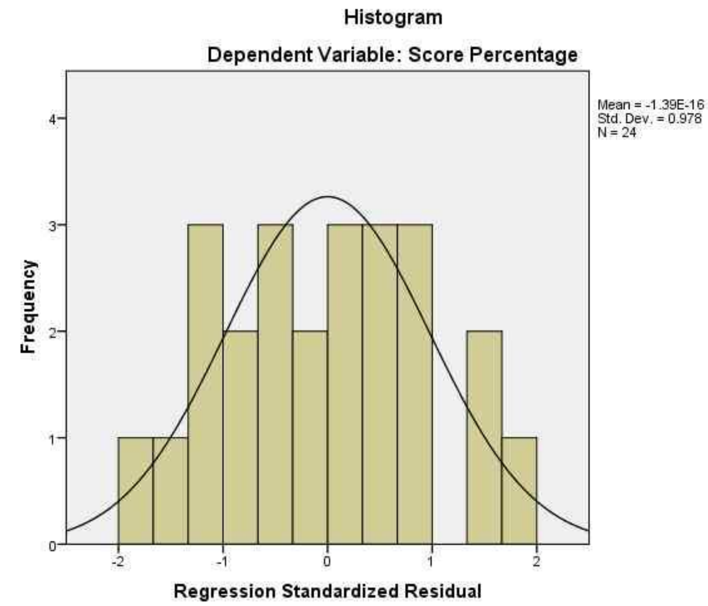


Plot 4

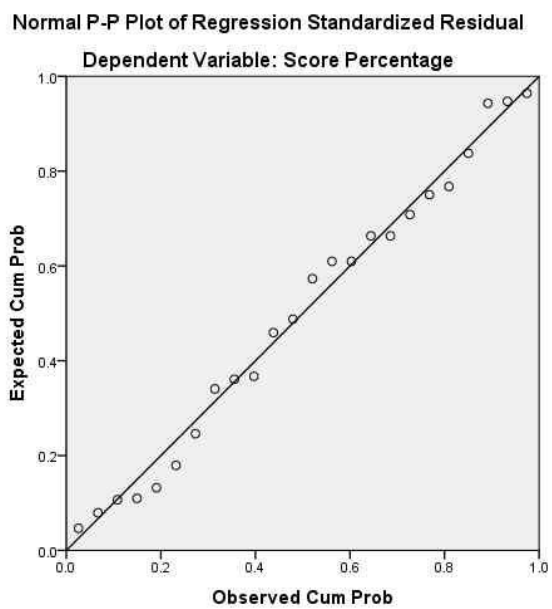


Plot 5

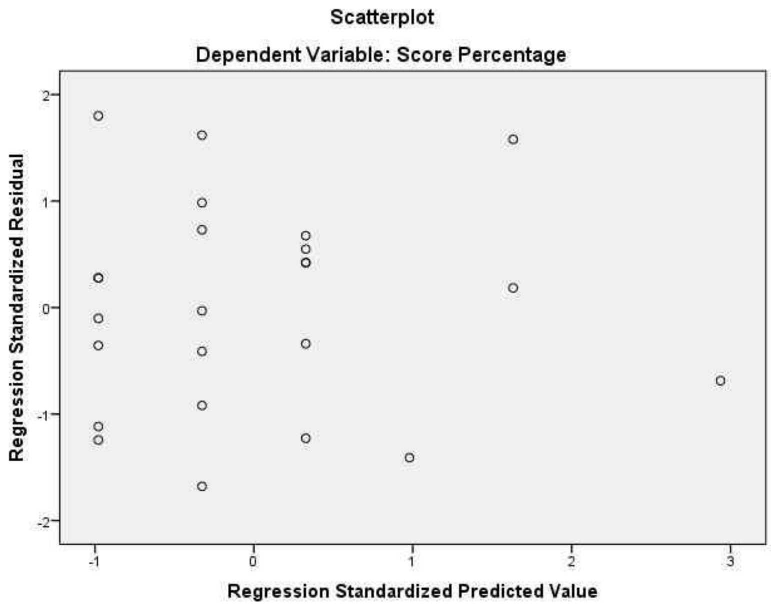
Item 5


Histogram
Dependent Variable: Score Percentage
Mean = -1.39E-16
Std. Dev. = 0.978
N = 24
Frequency
Regression Standardized Residual

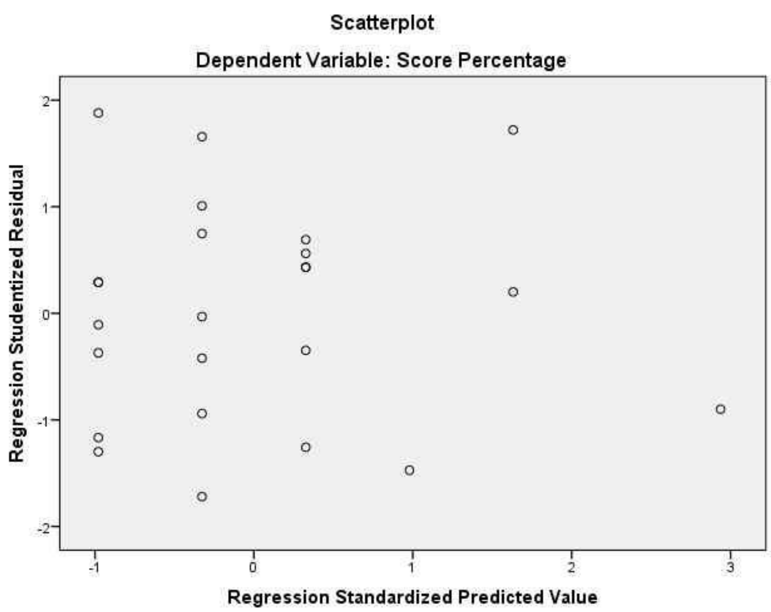
Plot 1


Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Score Percentage
Expected Cum Prob
Observed Cum Prob

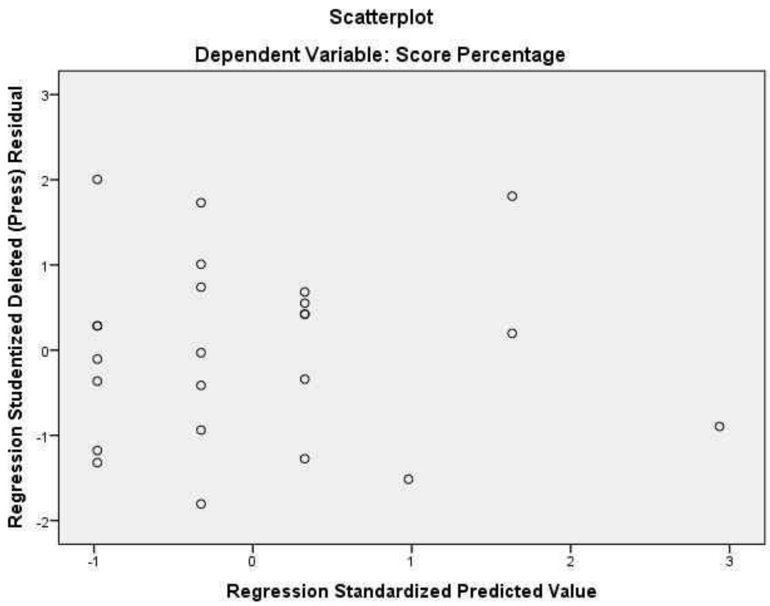
Plot 2


Scatterplot
Dependent Variable: Score Percentage
Regression Standardized Residual
Regression Standardized Predicted Value

Plot 3

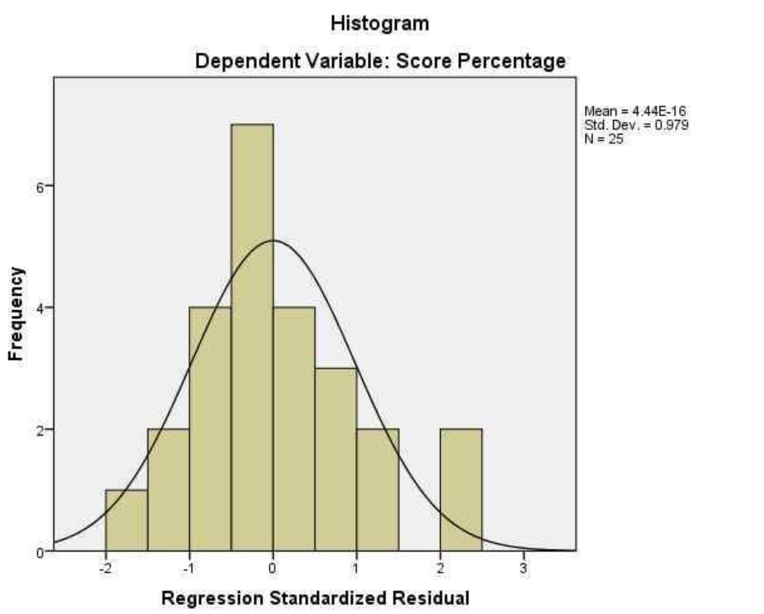

Scatterplot
Dependent Variable: Score Percentage
Regression Studentized Residual
Regression Standardized Predicted Value

Plot 4

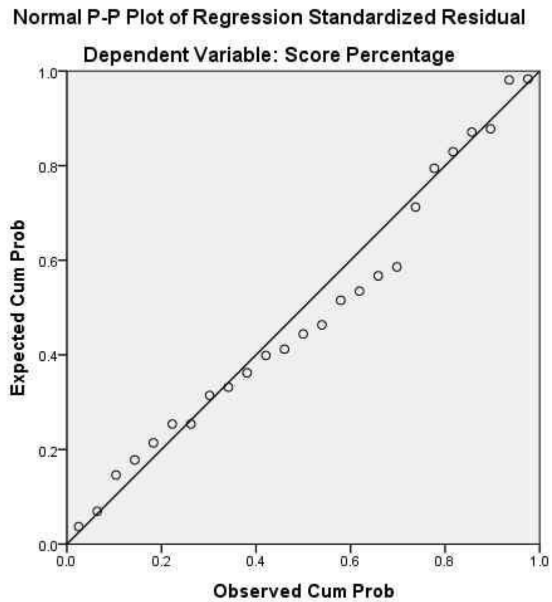


Plot 5

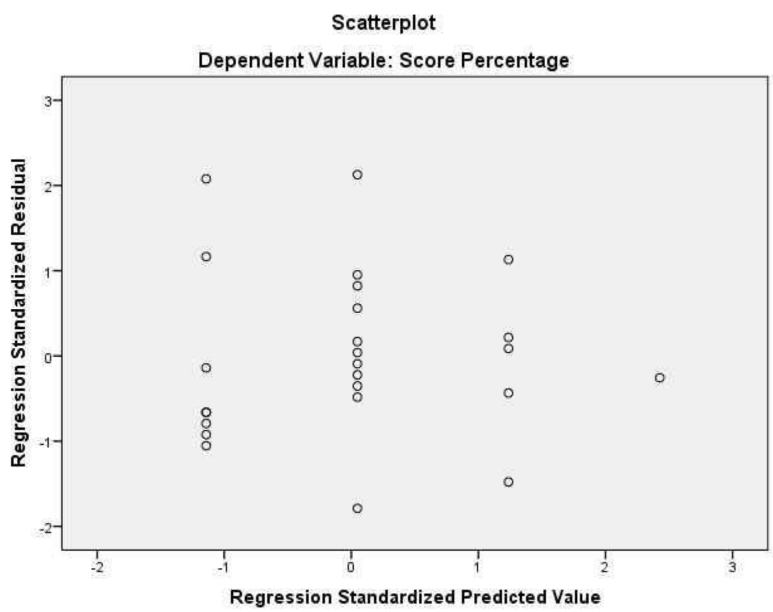
Item 6



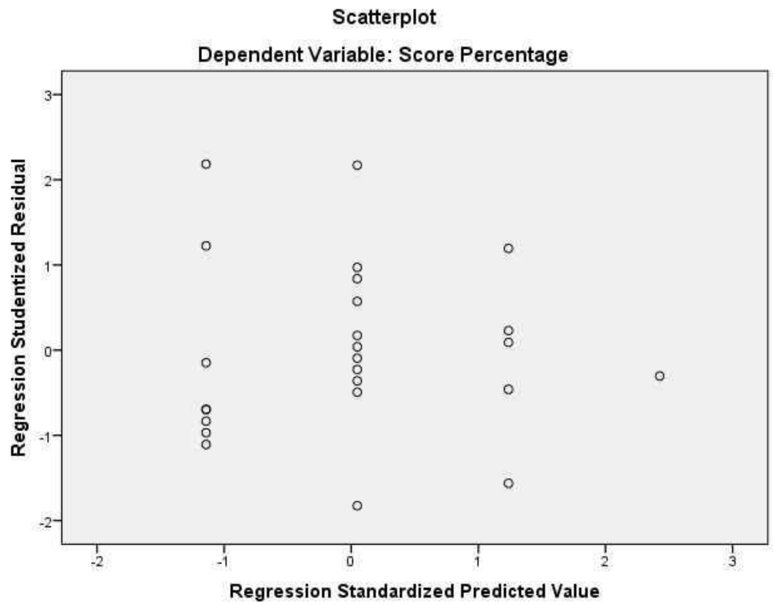
Plot 1


Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Score Percentage
Expected Cum Prob
Observed Cum Prob
0.0
0.2
0.4
0.6
0.8
1.0

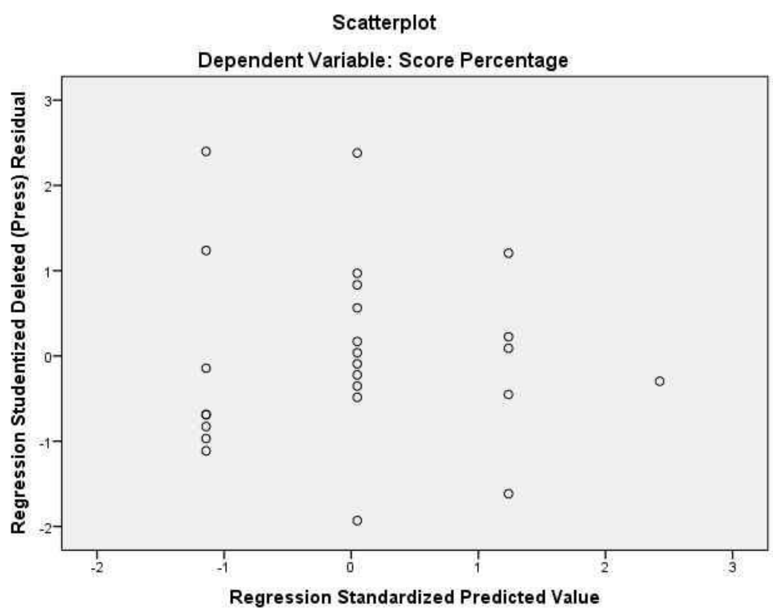
Plot 2


Scatterplot
Dependent Variable: Score Percentage
Regression Standardized Residual
Regression Standardized Predicted Value
-2
-1
0
1
2
3

Plot 3

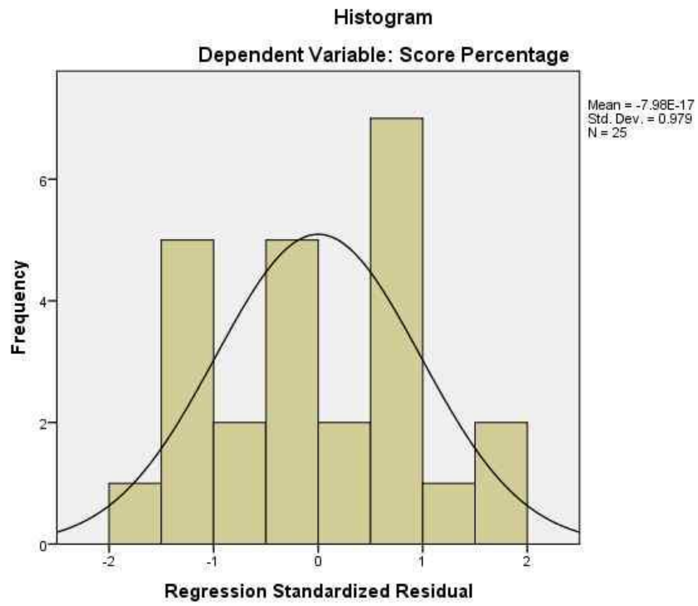


Plot 4

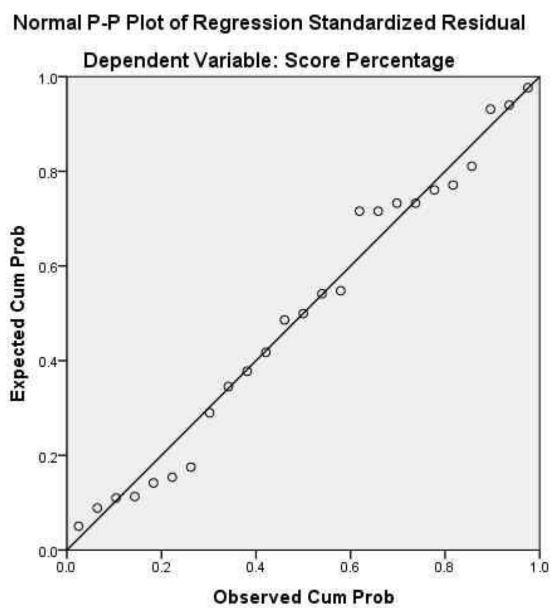


Plot 5

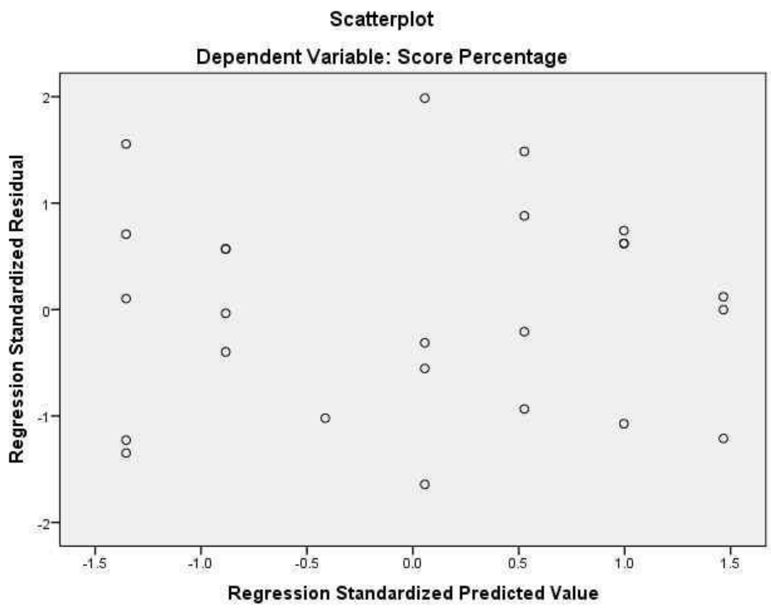
Item 7


Histogram
Dependent Variable: Score Percentage
Mean = -7.98E-17
Std. Dev. = 0.979
N = 25
Frequency
Regression Standardized Residual

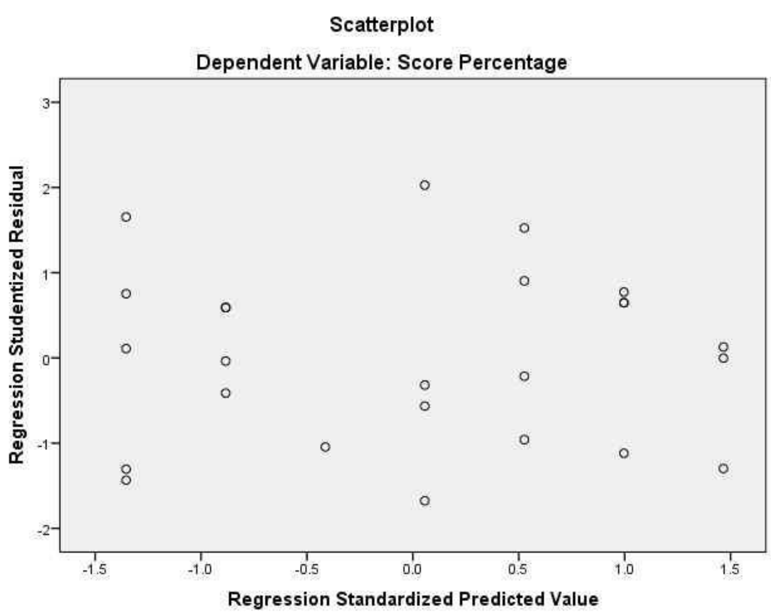
Plot 1


Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Score Percentage
Expected Cum Prob
Observed Cum Prob

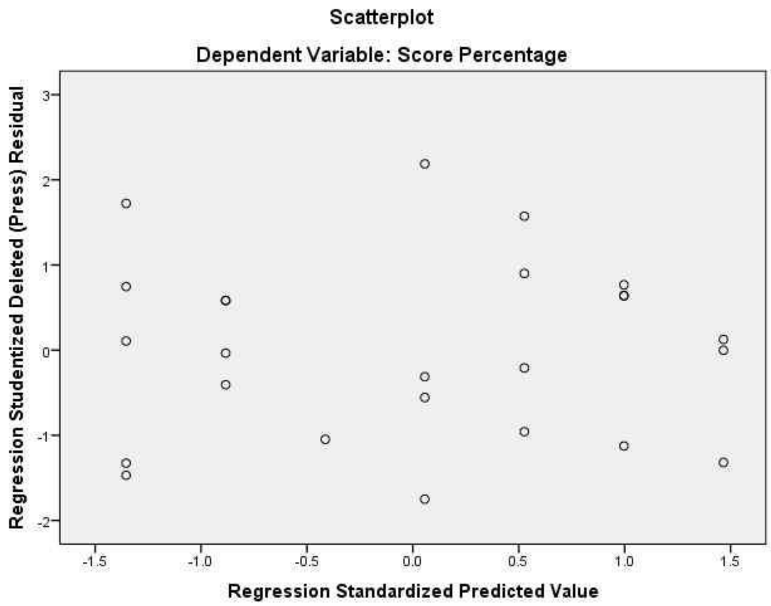
Plot 2


Scatterplot
Dependent Variable: Score Percentage
Regression Standardized Residual
Regression Standardized Predicted Value

Plot 3

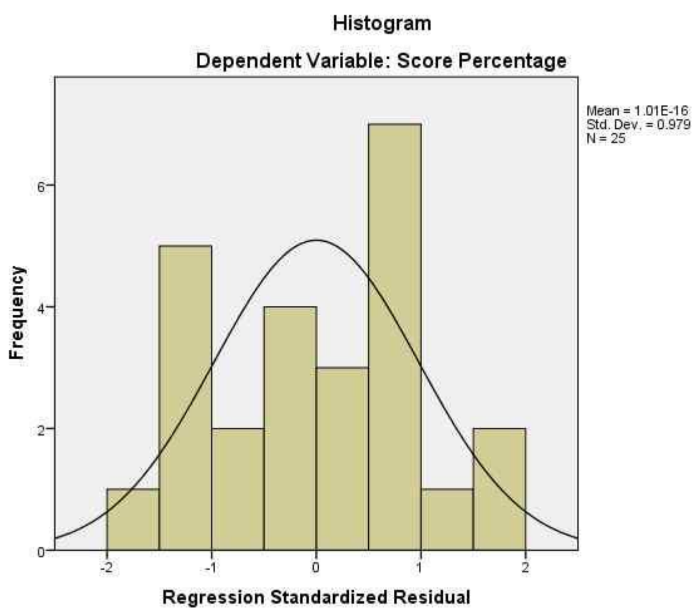

Scatterplot
Dependent Variable: Score Percentage
Regression Studentized Residual
Regression Standardized Predicted Value

Plot 4

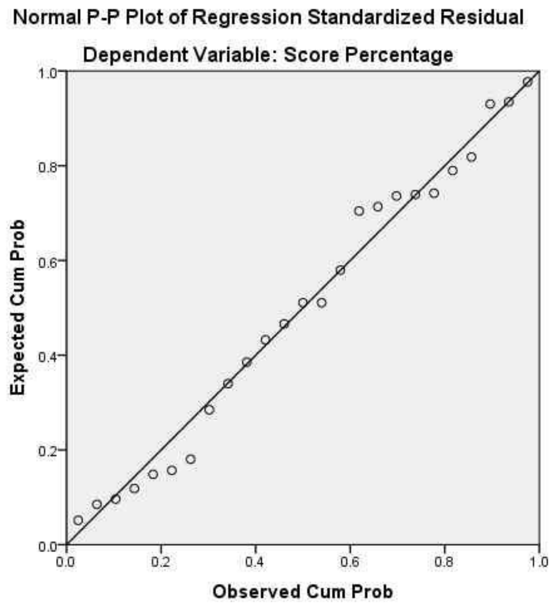


Plot 5

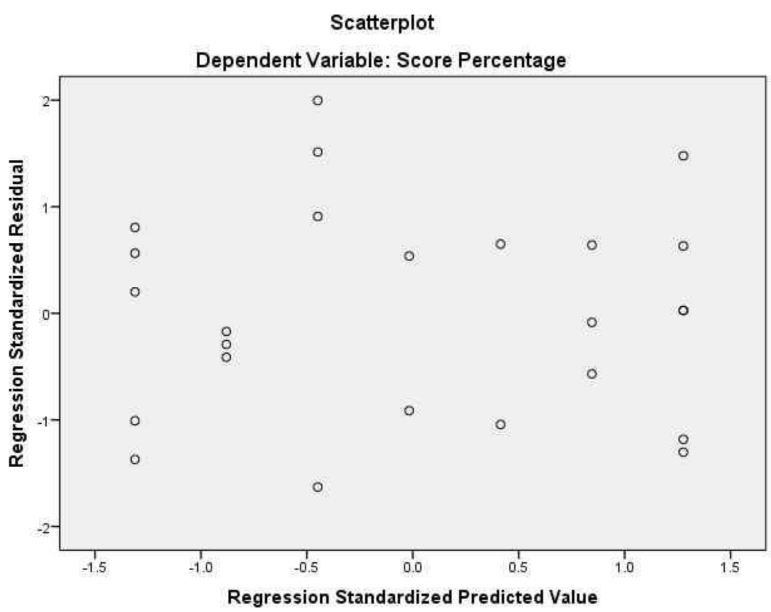
Item 8



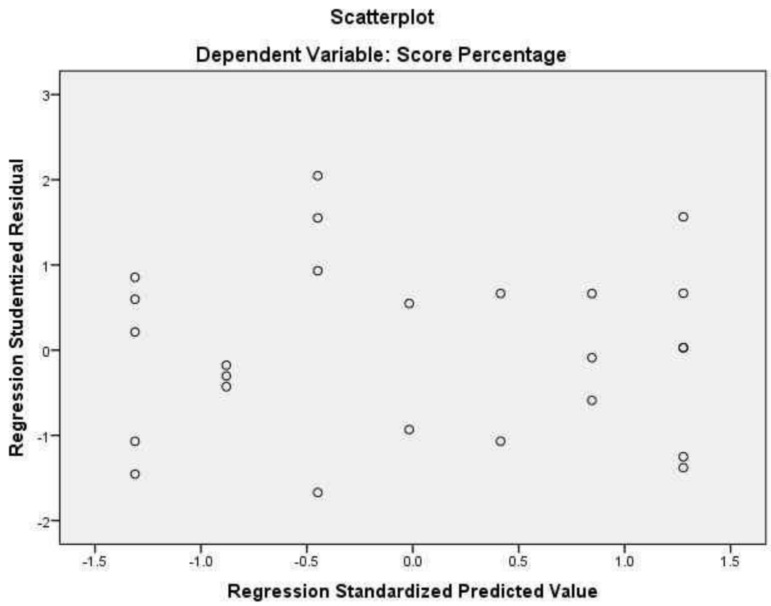
Plot 1


Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Score Percentage
Expected Cum Prob
Observed Cum Prob
0.0
0.2
0.4
0.6
0.8
1.0

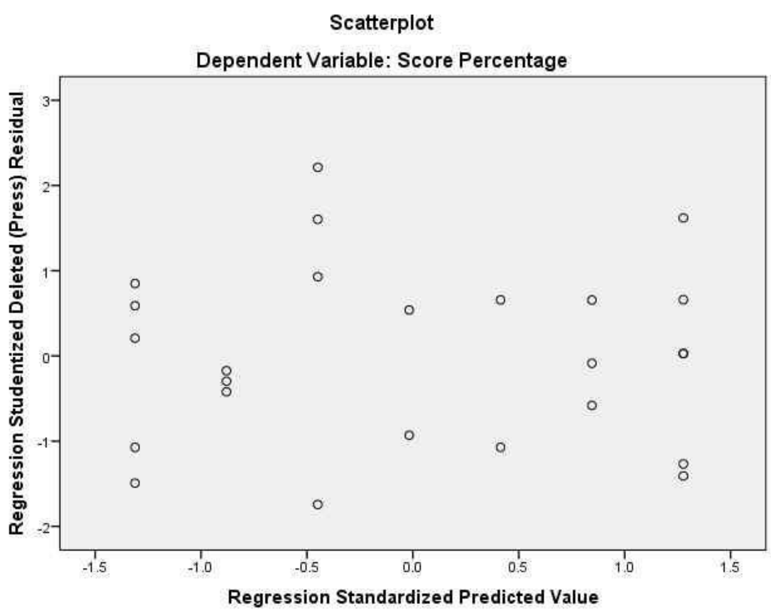
Plot 2


Scatterplot
Dependent Variable: Score Percentage
Regression Standardized Residual
Regression Standardized Predicted Value
2
1
0
-1
-2
-1.5
-1.0
-0.5
0.0
0.5
1.0
1.5

Plot 3

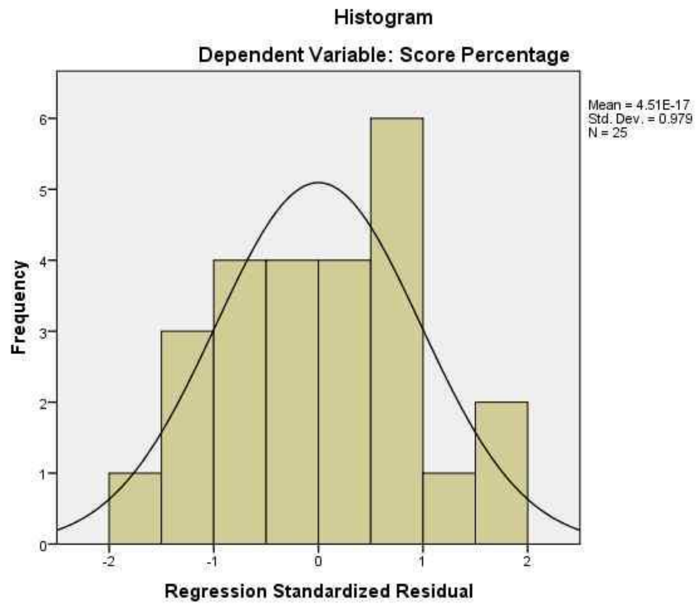


Plot 4

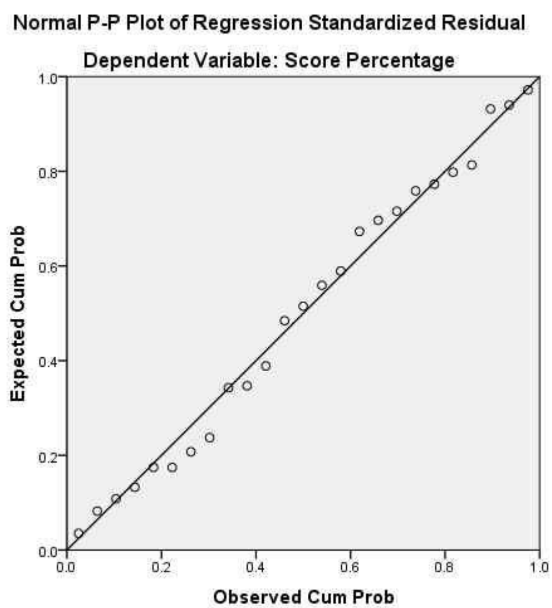


Plot 5

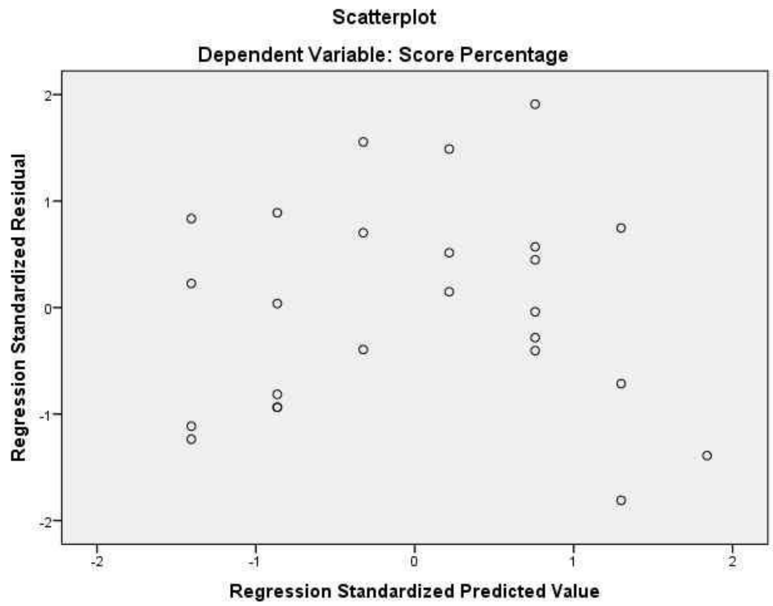
Item 9


Histogram
Dependent Variable: Score Percentage
Mean = 4.51E-17
Std. Dev. = 0.979
N = 25
Frequency
Regression Standardized Residual

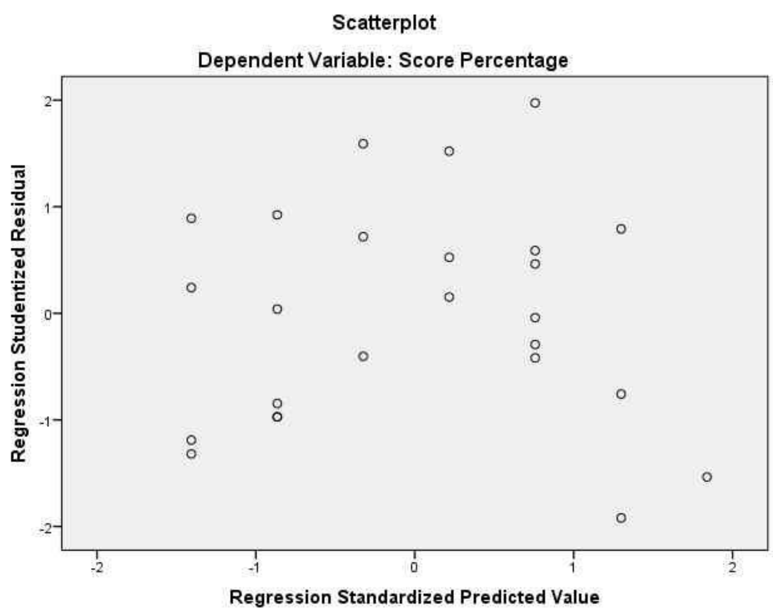
Plot 1


Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Score Percentage
Expected Cum Prob
Observed Cum Prob

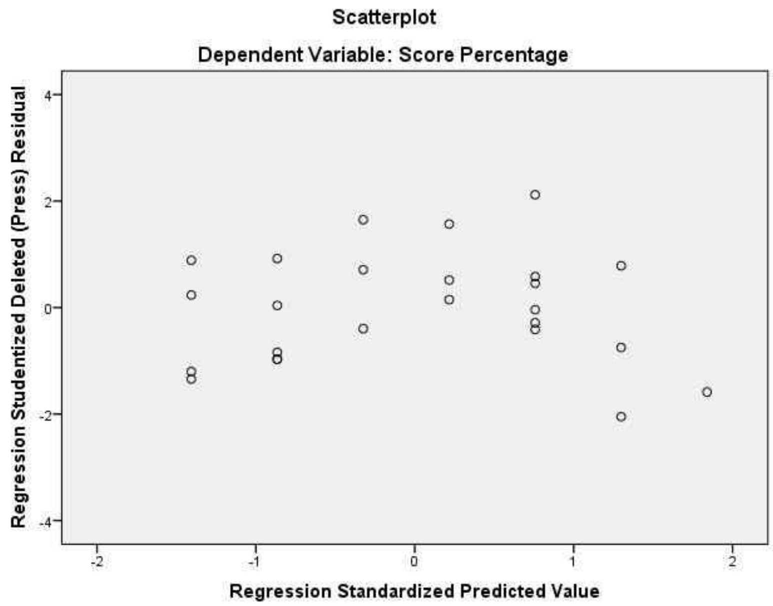
Plot 2


Scatterplot
Dependent Variable: Score Percentage
Regression Standardized Residual
Regression Standardized Predicted Value

Plot 3

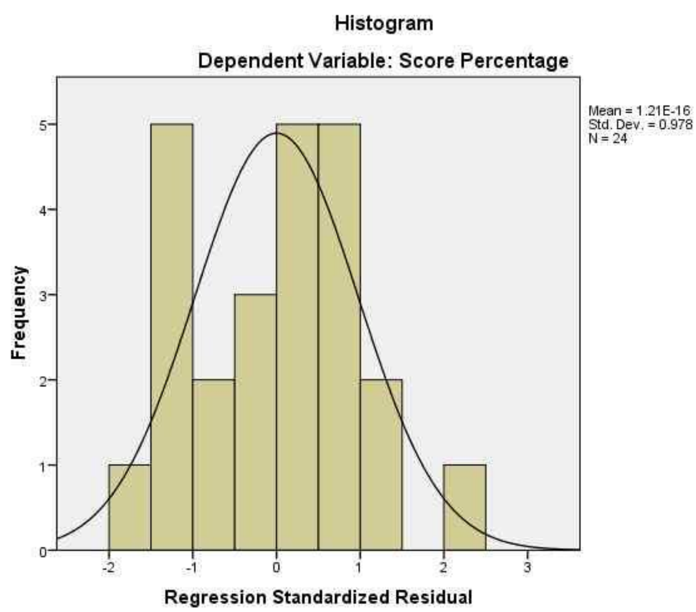

Scatterplot
Dependent Variable: Score Percentage
Regression Studentized Residual
Regression Standardized Predicted Value

Plot 4

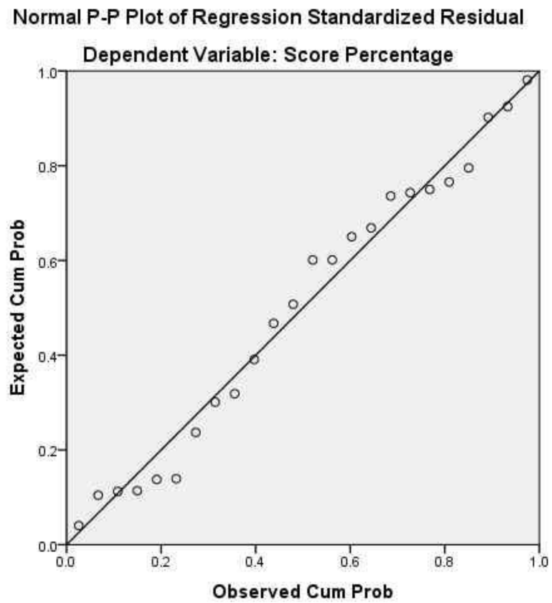


Plot 5

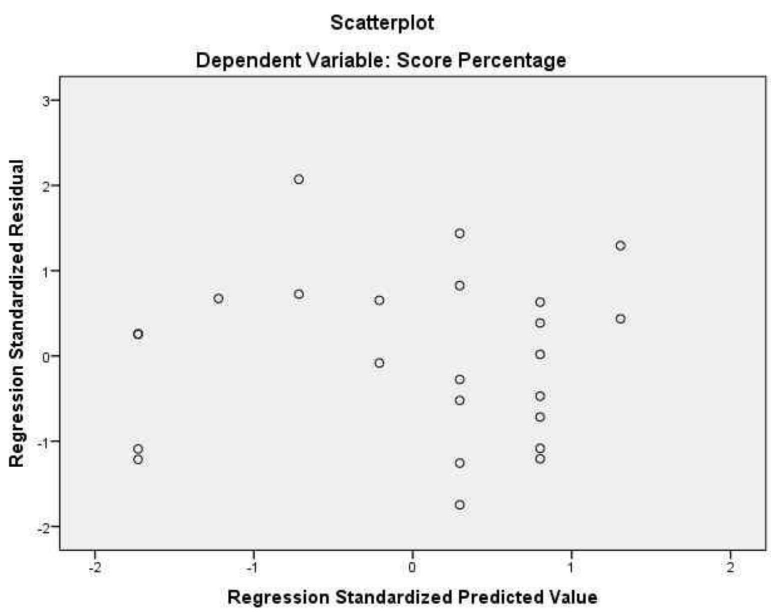
Item 10



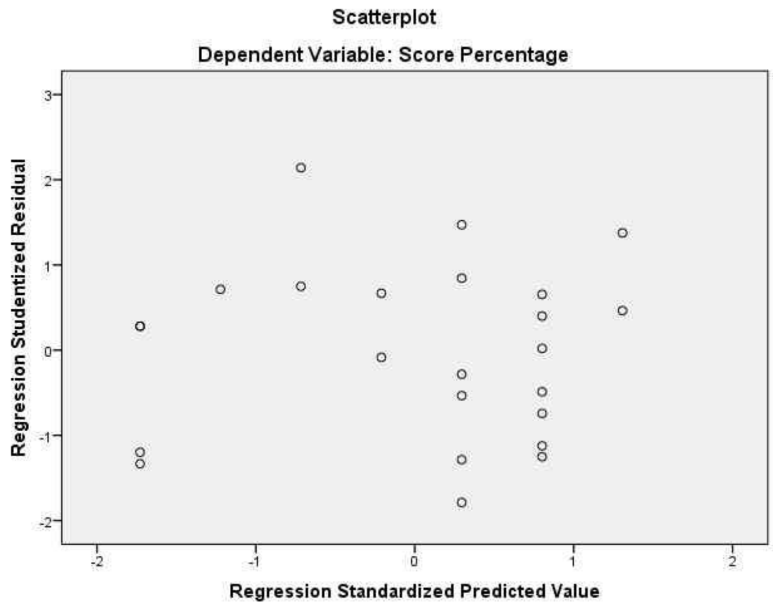
Plot 1


Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Score Percentage
Expected Cum Prob
Observed Cum Prob
0.0
0.2
0.4
0.6
0.8
1.0

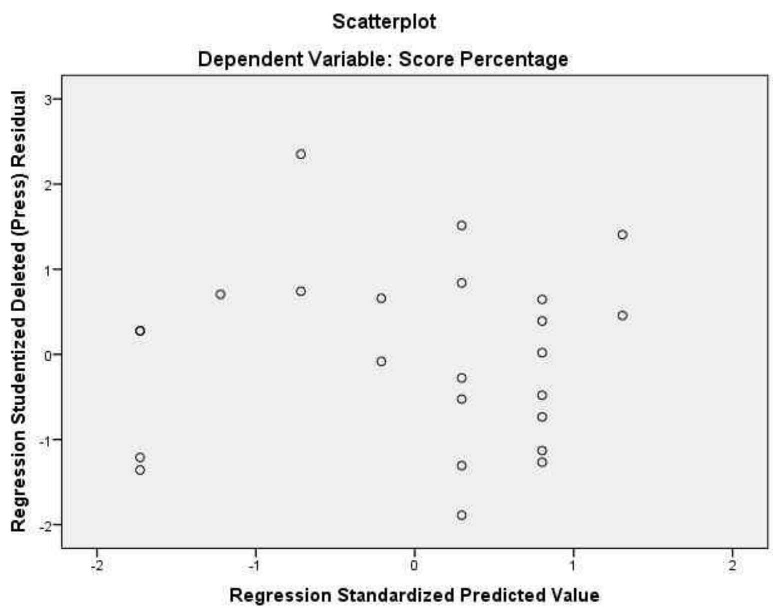
Plot 2


Scatterplot
Dependent Variable: Score Percentage
Regression Standardized Residual
Regression Standardized Predicted Value
-2
-1
0
1
2
3

Plot 3

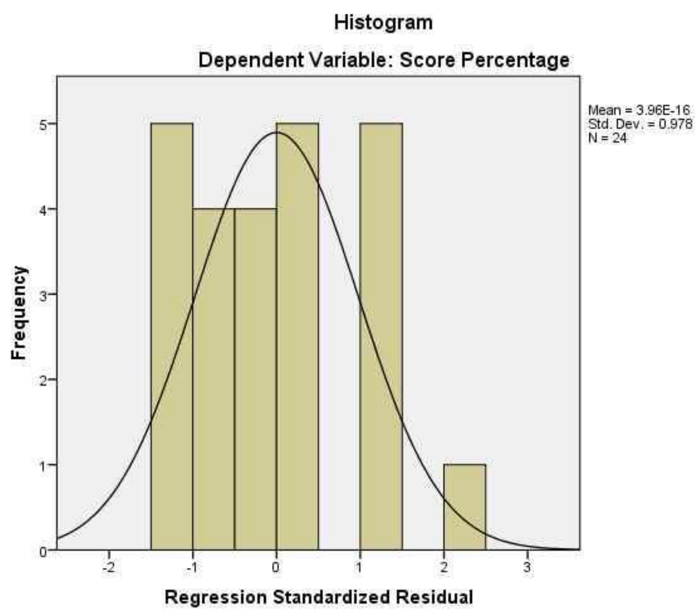


Plot 4

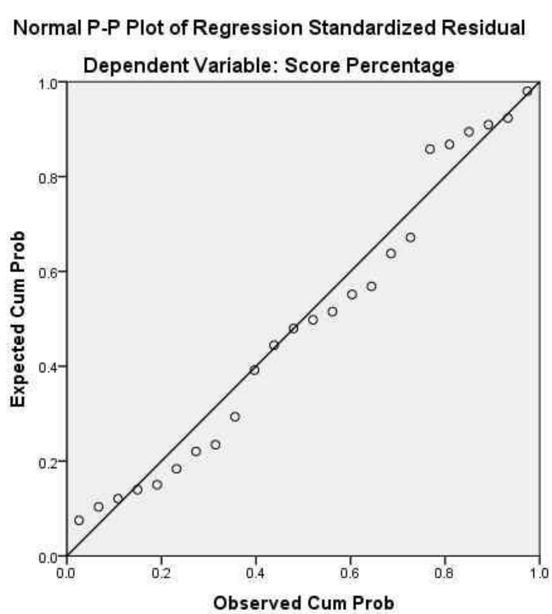


Plot 5

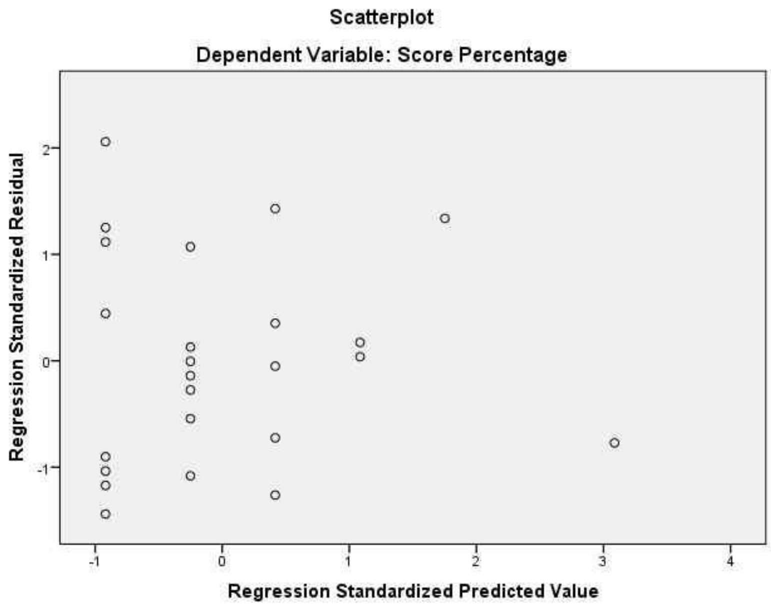
Item 11


Histogram
Dependent Variable: Score Percentage
Mean = 3.96E-16
Std. Dev. = 0.978
N = 24
Frequency
Regression Standardized Residual

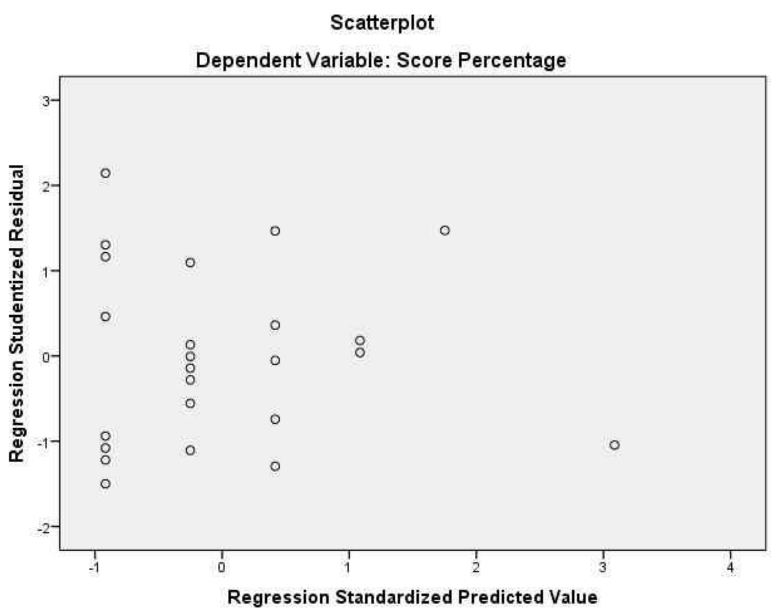
Plot 1


Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Score Percentage
Expected Cum Prob
Observed Cum Prob

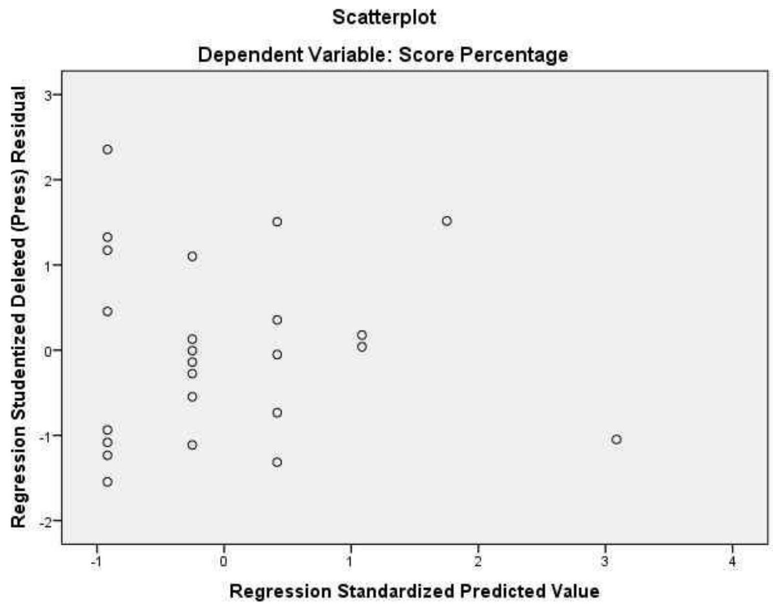
Plot 2


Scatterplot
Dependent Variable: Score Percentage
Regression Standardized Residual
Regression Standardized Predicted Value

Plot 3

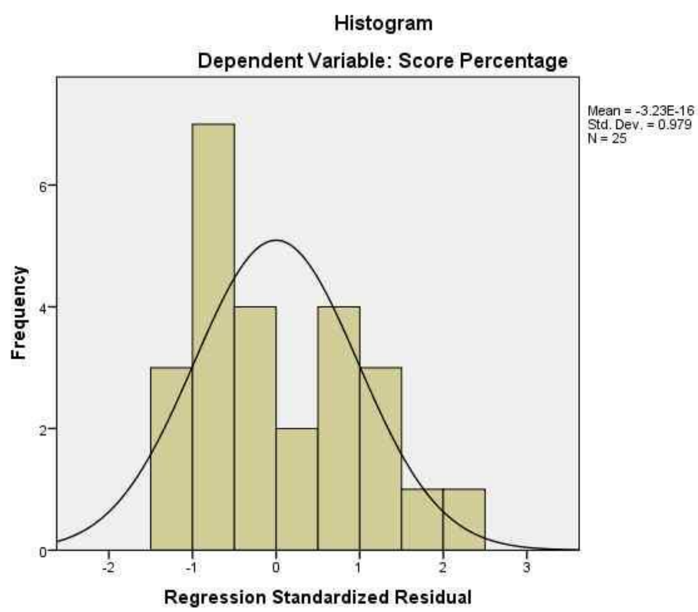

Scatterplot
Dependent Variable: Score Percentage
Regression Studentized Residual
Regression Standardized Predicted Value

Plot 4

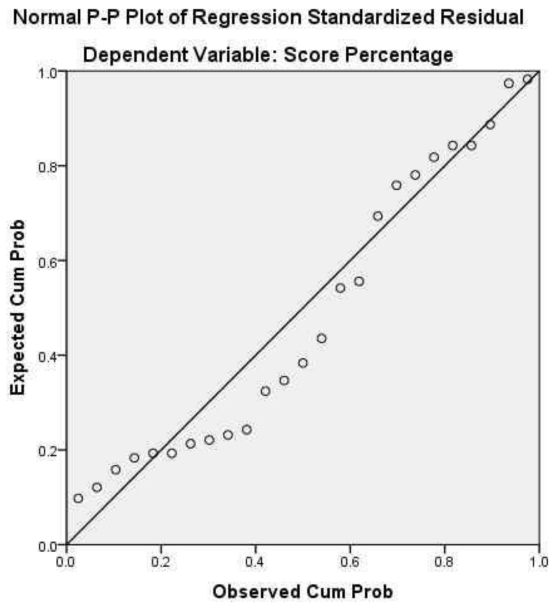


Plot 5

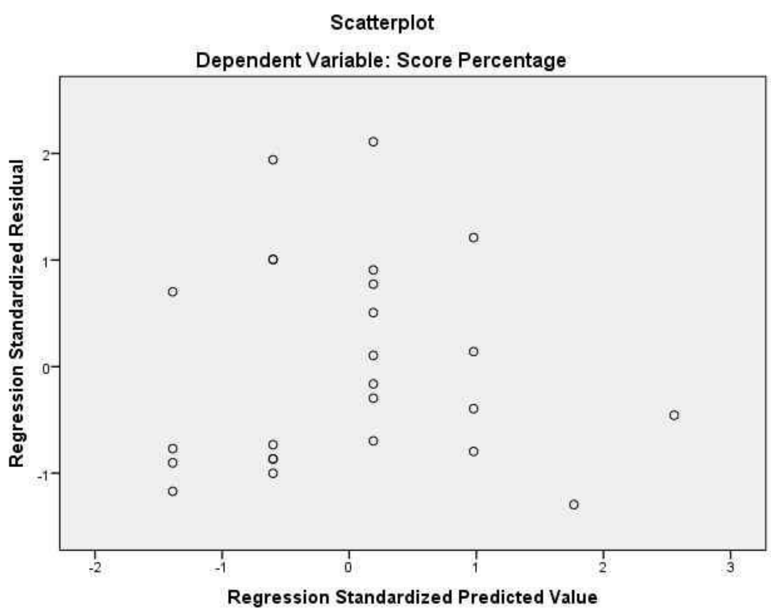
Item 12



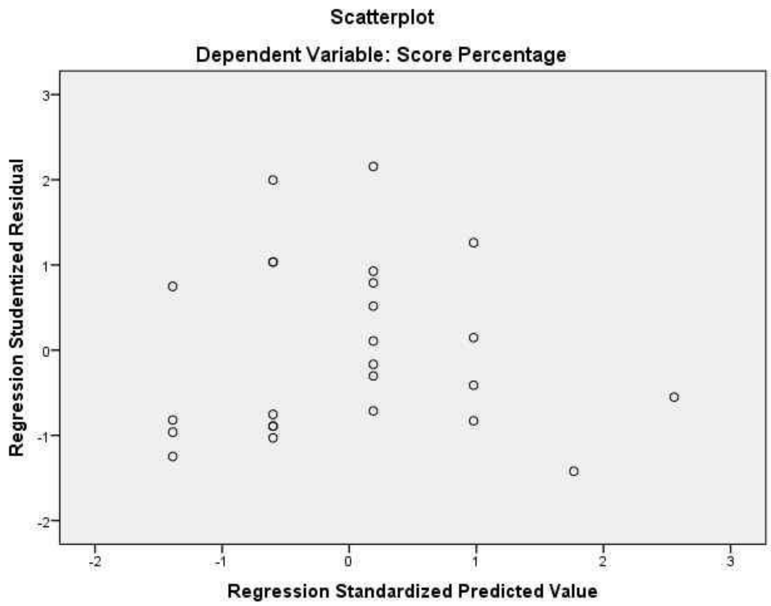
Plot 1


Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Score Percentage
Expected Cum Prob
Observed Cum Prob
1.0
0.8
0.6
0.4
0.2
0.0
0.0
0.2
0.4
0.6
0.8
1.0

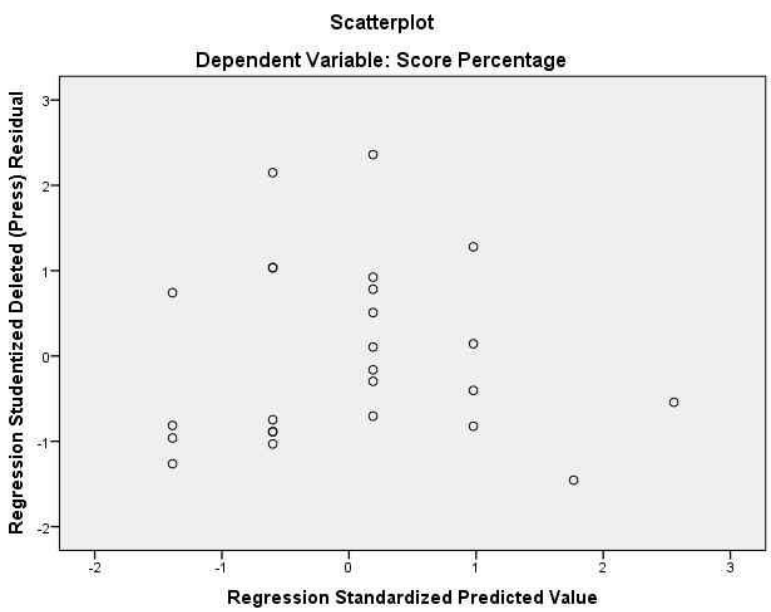
Plot 2


Scatterplot
Dependent Variable: Score Percentage
Regression Standardized Residual
Regression Standardized Predicted Value
2
1
0
-1
-2
-1
0
1
2
3

Plot 3

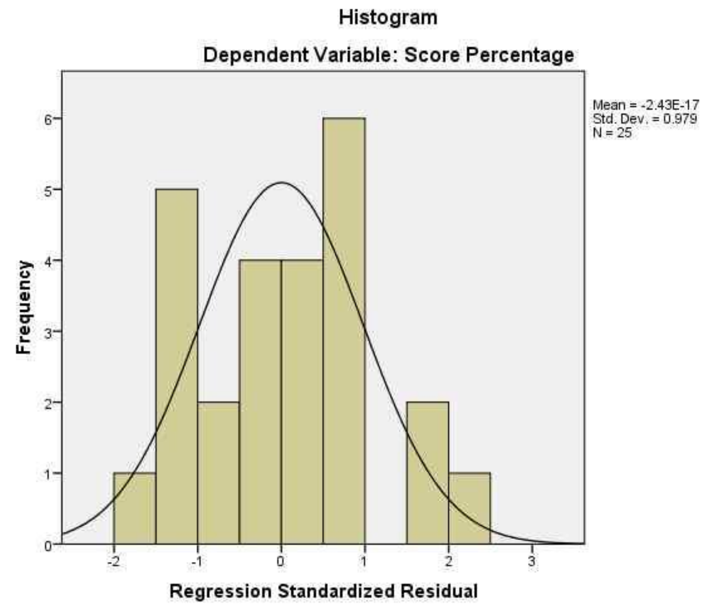


Plot 4

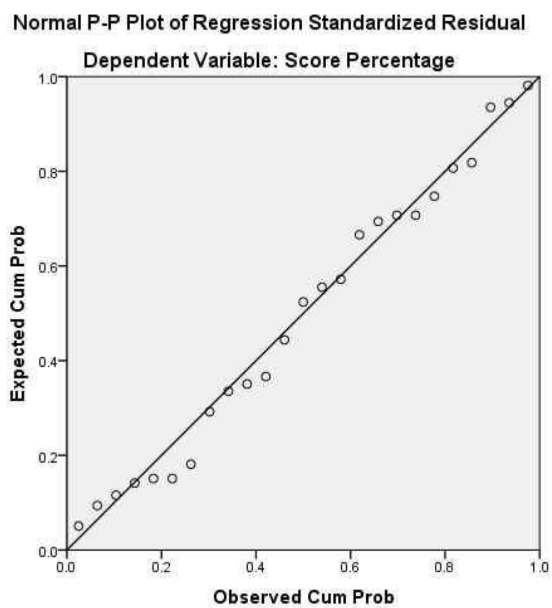


Plot 5

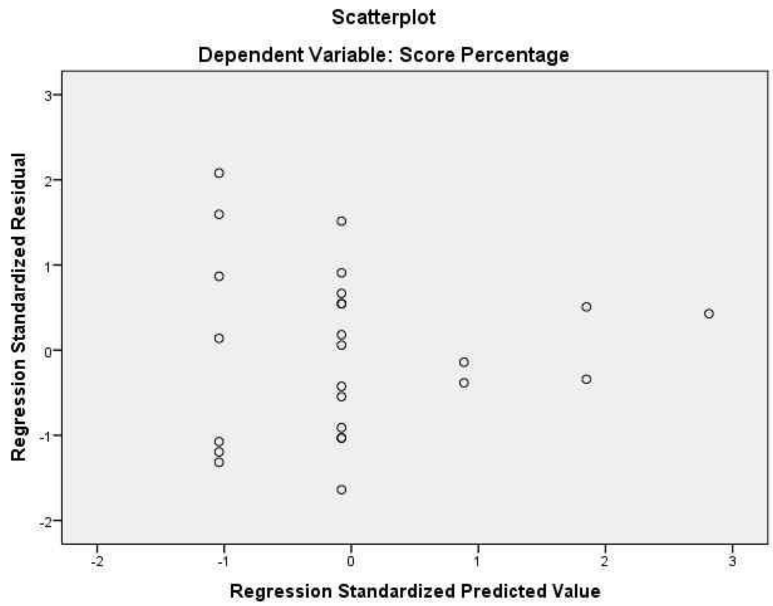
Item 13


Histogram
Dependent Variable: Score Percentage
Mean = -2.43E-17
Std. Dev. = 0.979
N = 25
Frequency
Regression Standardized Residual

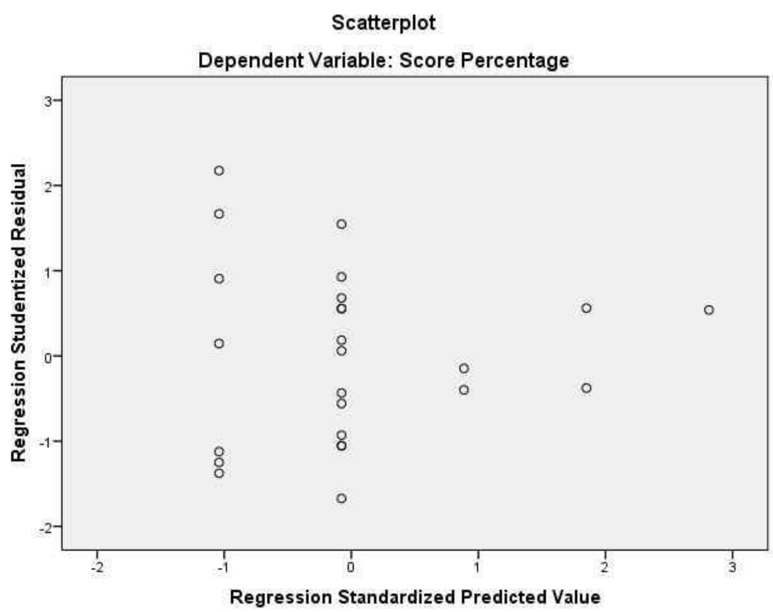
Plot 1


Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Score Percentage
Expected Cum Prob
Observed Cum Prob

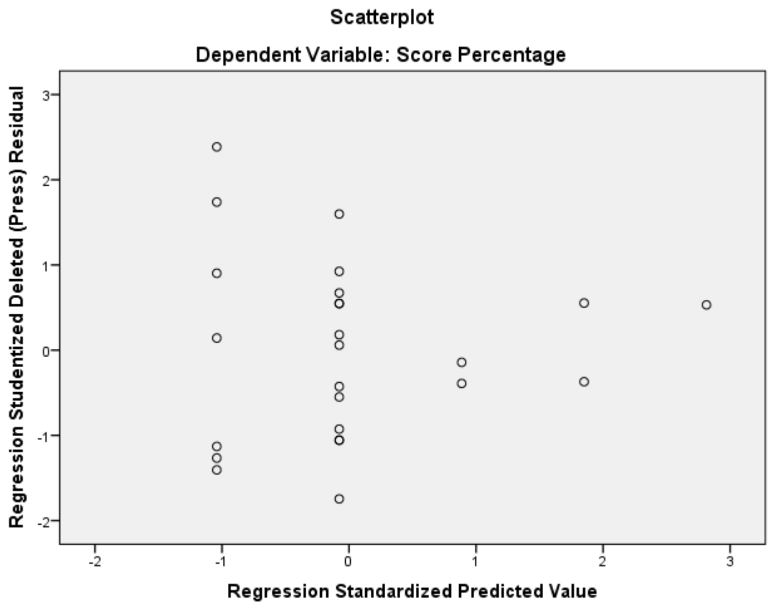
Plot 2


Scatterplot
Dependent Variable: Score Percentage
Regression Standardized Residual
Regression Standardized Predicted Value

Plot 3

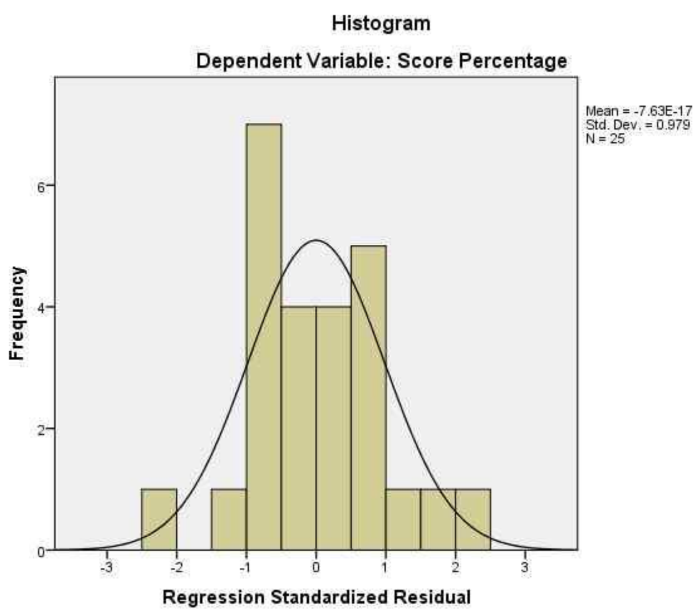

Scatterplot
Dependent Variable: Score Percentage
Regression Studentized Residual
Regression Standardized Predicted Value

Plot 4

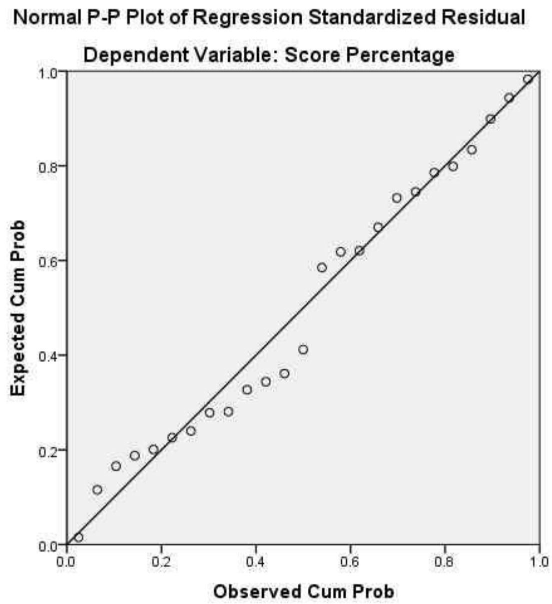


Plot 5

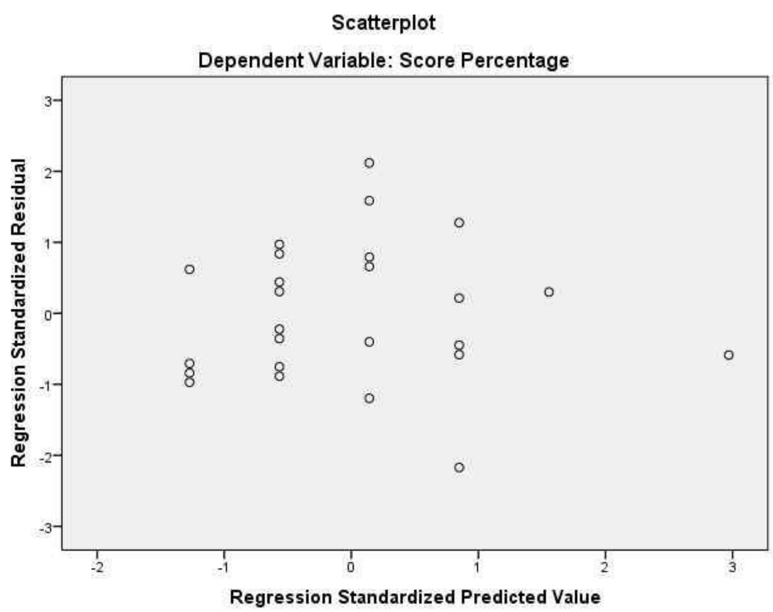
Item 14



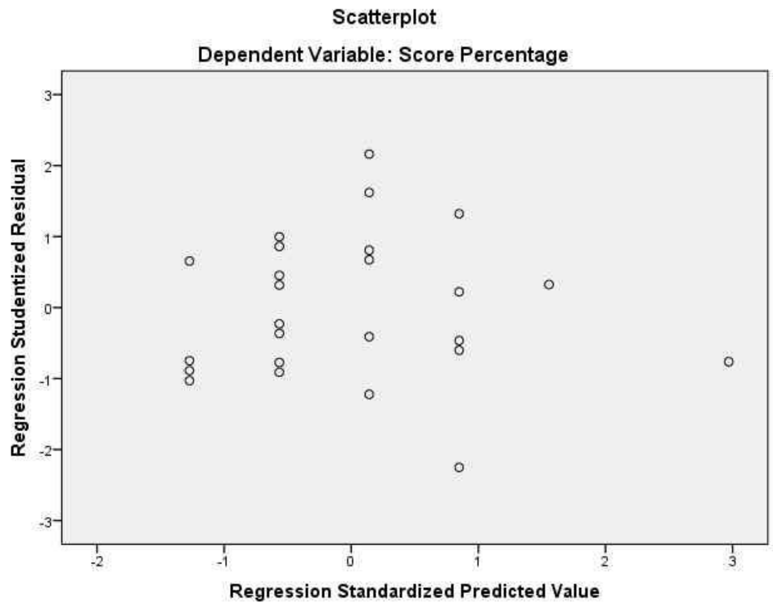
Plot 1


Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Score Percentage
Expected Cum Prob
Observed Cum Prob
0.0
0.2
0.4
0.6
0.8
1.0

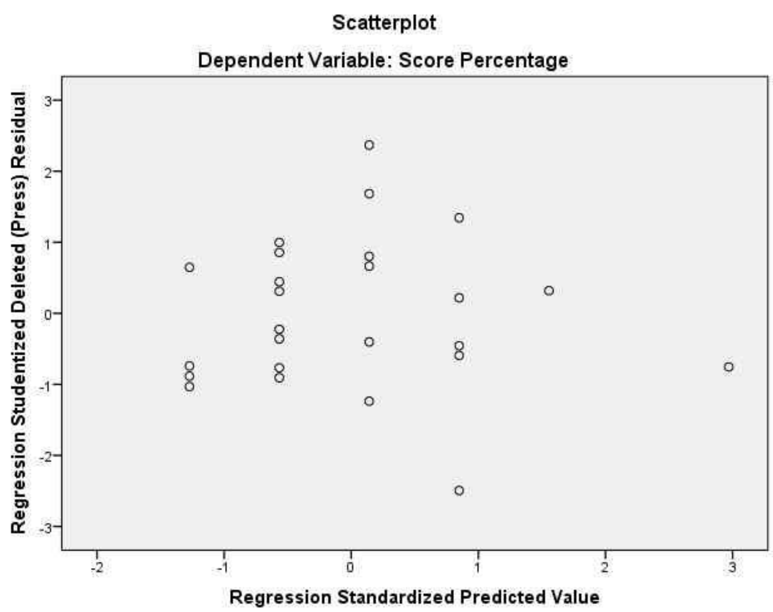
Plot 2


Scatterplot
Dependent Variable: Score Percentage
Regression Standardized Residual
Regression Standardized Predicted Value
-3
-2
-1
0
1
2
3

Plot 3

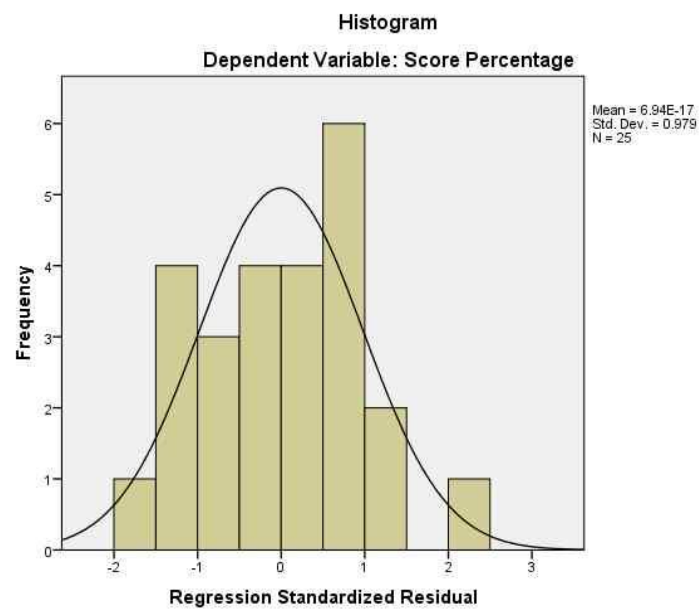


Plot 4

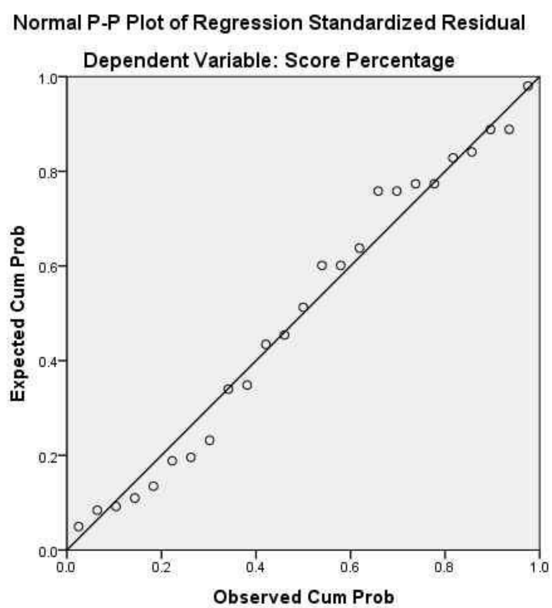


Plot 5

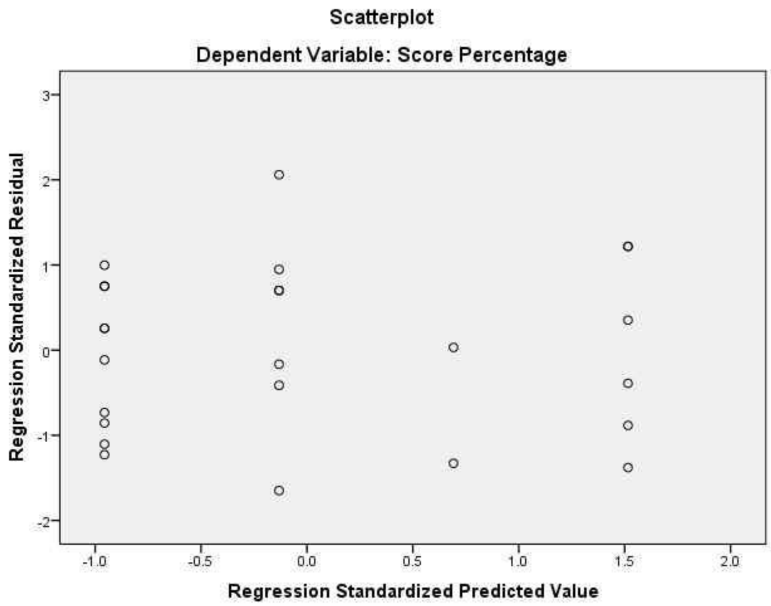
Item 15


Histogram
Dependent Variable: Score Percentage
Mean = 6.94E-17
Std. Dev. = 0.979
N = 25
Frequency
Regression Standardized Residual

Plot 1

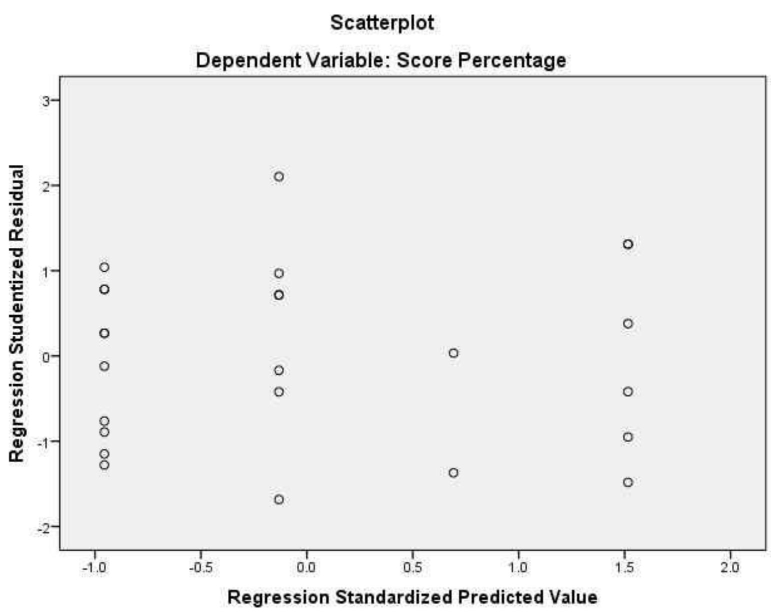

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Score Percentage
Expected Cum Prob
Observed Cum Prob

Plot 2



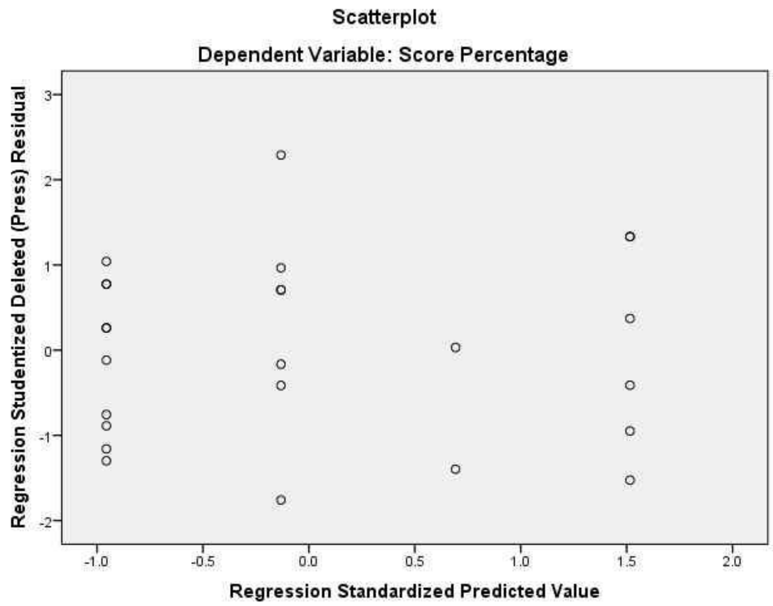
Scatterplot
Dependent Variable: Score Percentage
Regression Standardized Residual
Regression Standardized Predicted Value

Plot 3



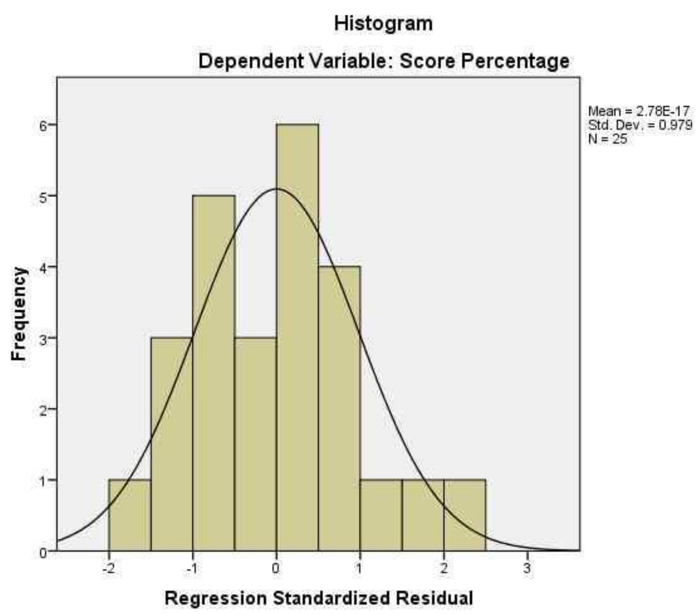
Scatterplot
Dependent Variable: Score Percentage
Regression Studentized Residual
Regression Standardized Predicted Value

Plot 4

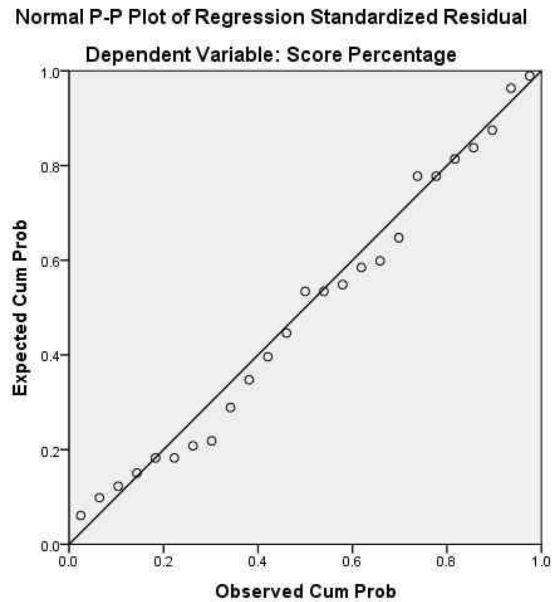


Plot 5

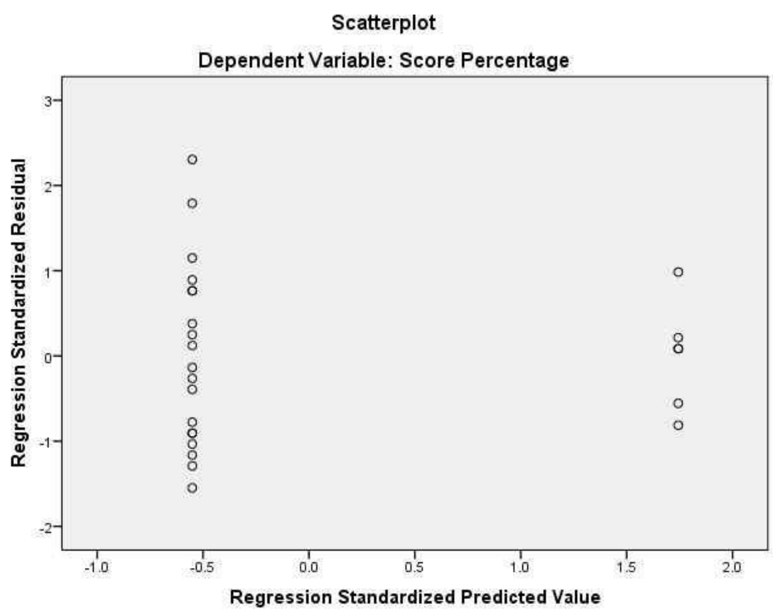
Item 16



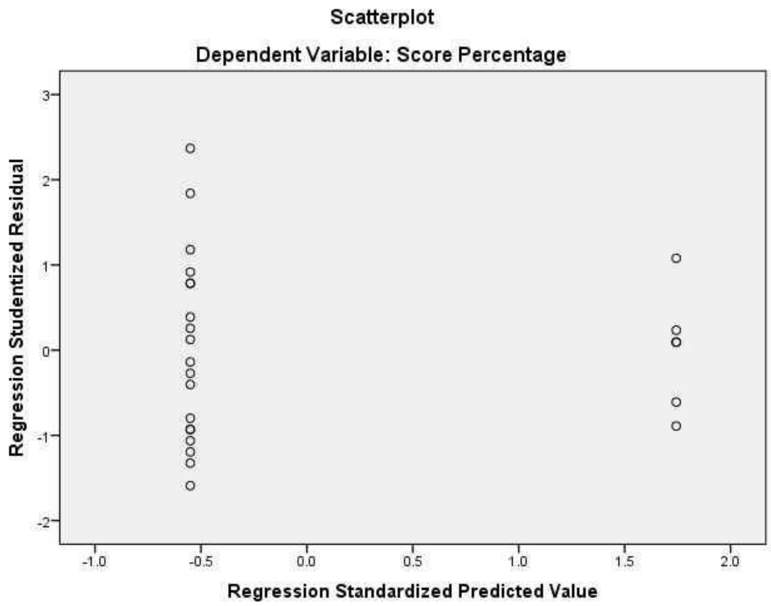
Plot 1


Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Score Percentage
Expected Cum Prob
Observed Cum Prob
0.0
0.2
0.4
0.6
0.8
1.0

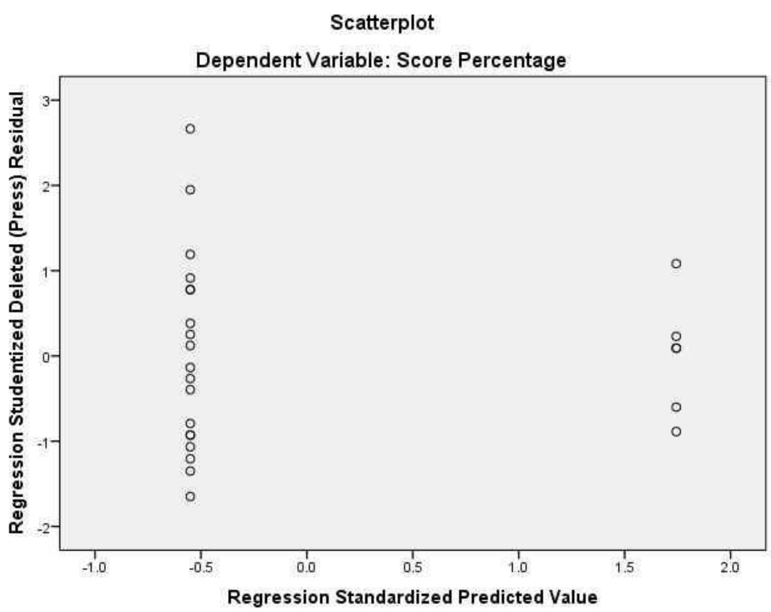
Plot 2


Scatterplot
Dependent Variable: Score Percentage
Regression Standardized Residual
Regression Standardized Predicted Value
3
2
1
0
-1
-2
-1.0
-0.5
0.0
0.5
1.0
1.5
2.0

Plot 3

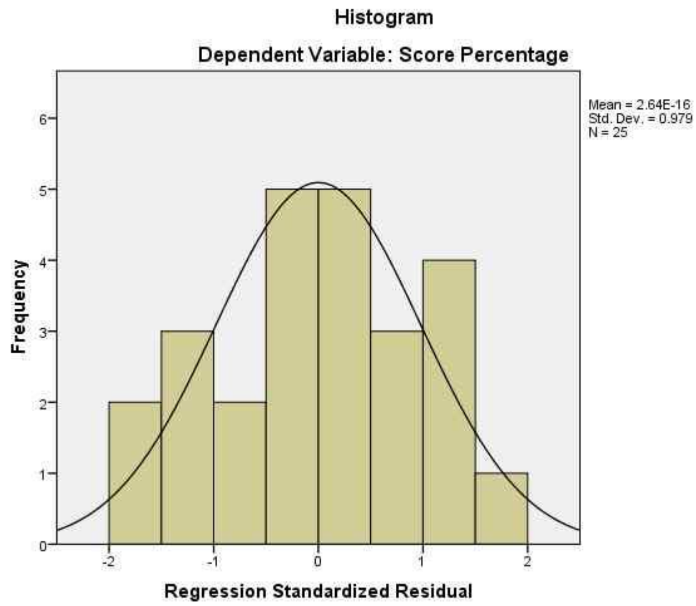


Plot 4

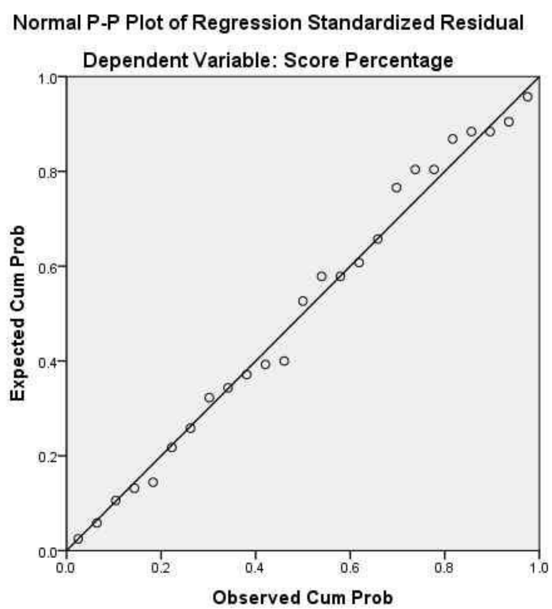


Plot 5

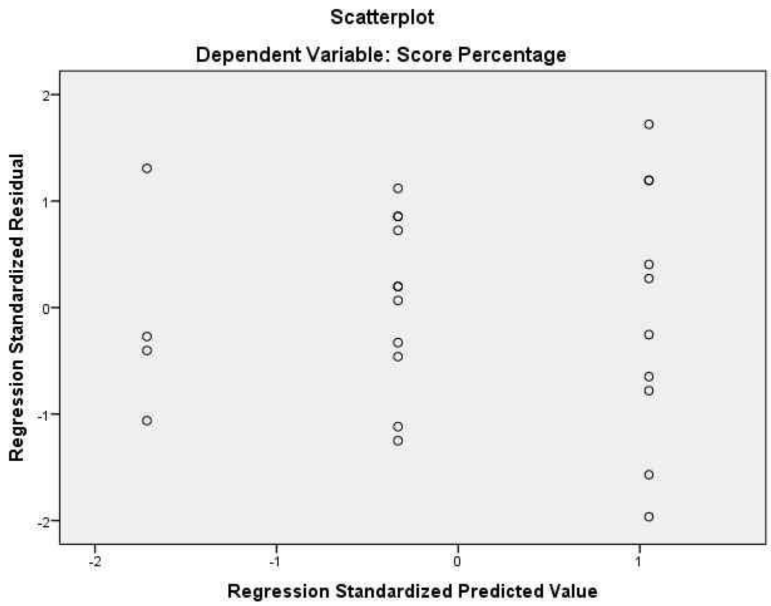
Item 17


Histogram
Dependent Variable: Score Percentage
Mean = 2.64E-16
Std. Dev. = 0.979
N = 25
Frequency
Regression Standardized Residual

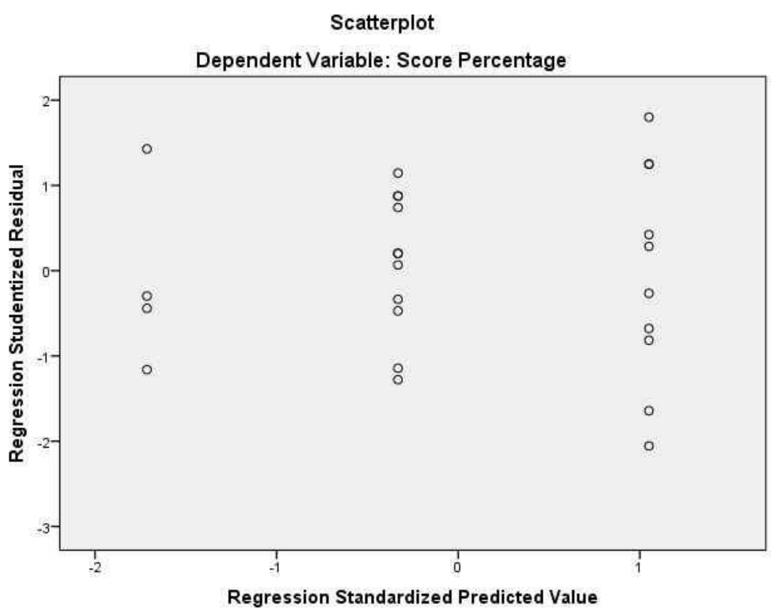
Plot 1


Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Score Percentage
Expected Cum Prob
Observed Cum Prob

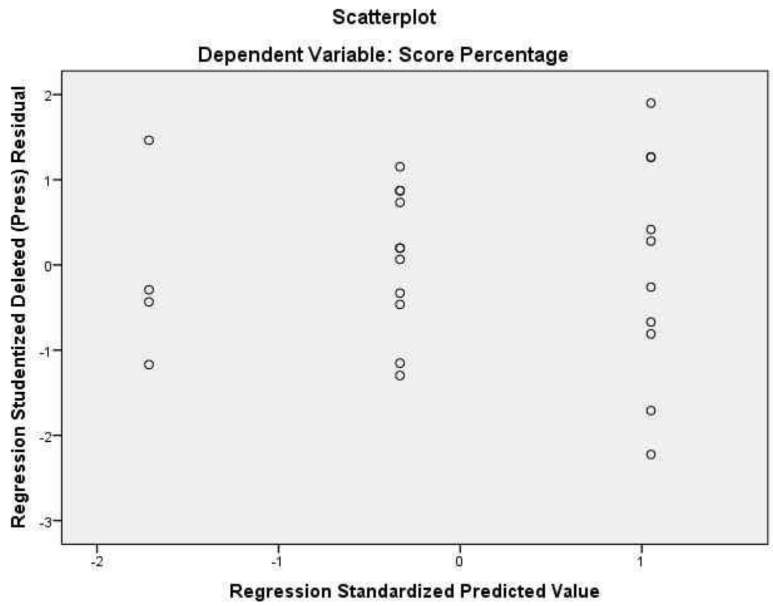
Plot 2


Scatterplot
Dependent Variable: Score Percentage
Regression Standardized Residual
Regression Standardized Predicted Value
2
1
0
-1
-2
-2
-1
0
1

Plot 3

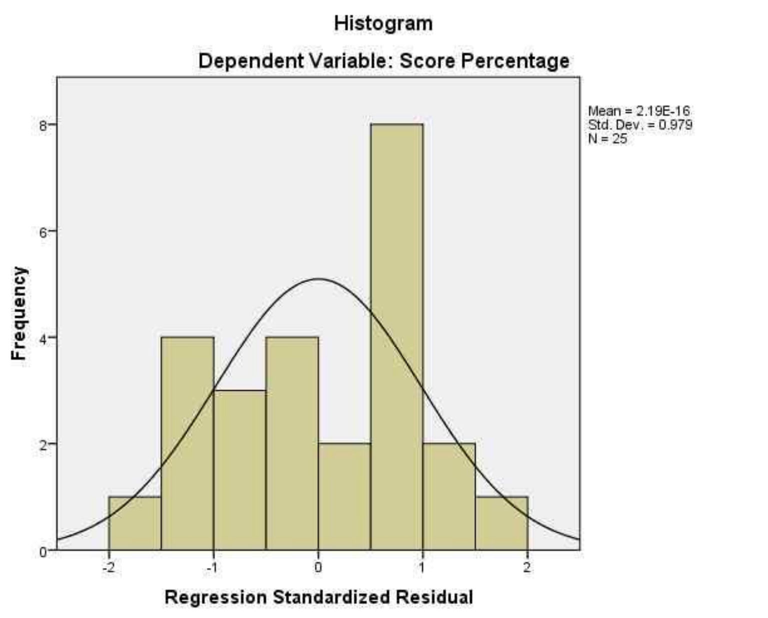

Scatterplot
Dependent Variable: Score Percentage
Regression Studentized Residual
Regression Standardized Predicted Value
2
1
0
-1
-2
-3
-2
-1
0
1

Plot 4

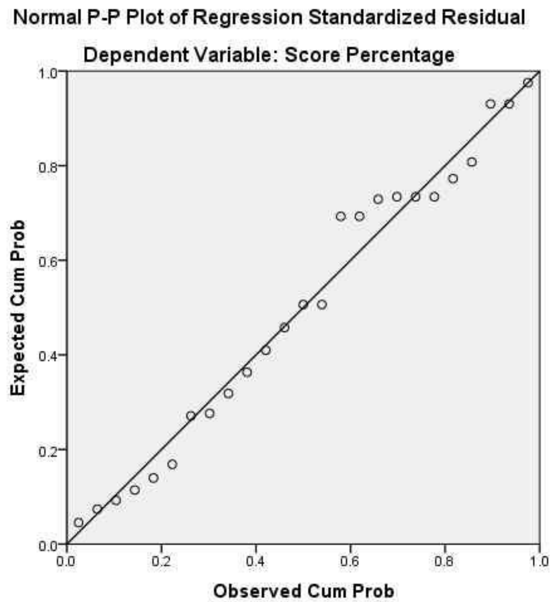


Plot 5

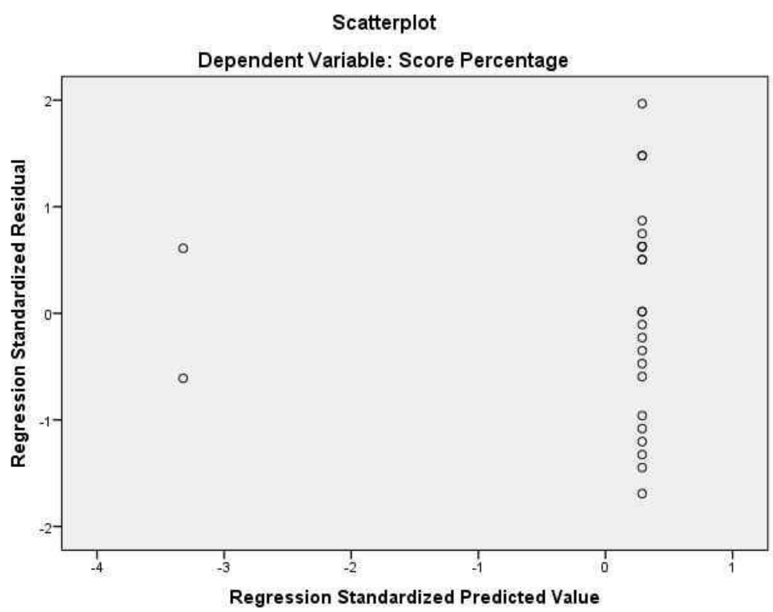
Item 18



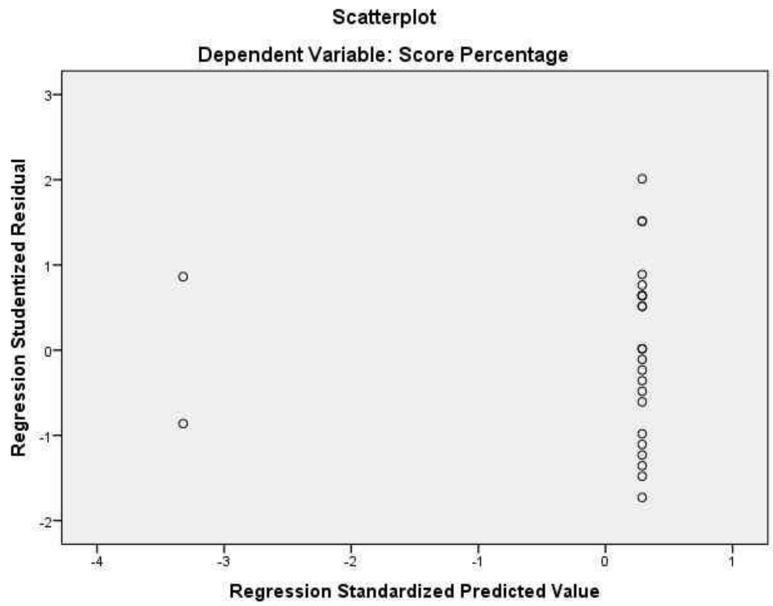
Plot 1


Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Score Percentage
Expected Cum Prob
Observed Cum Prob
0.0
0.2
0.4
0.6
0.8
1.0

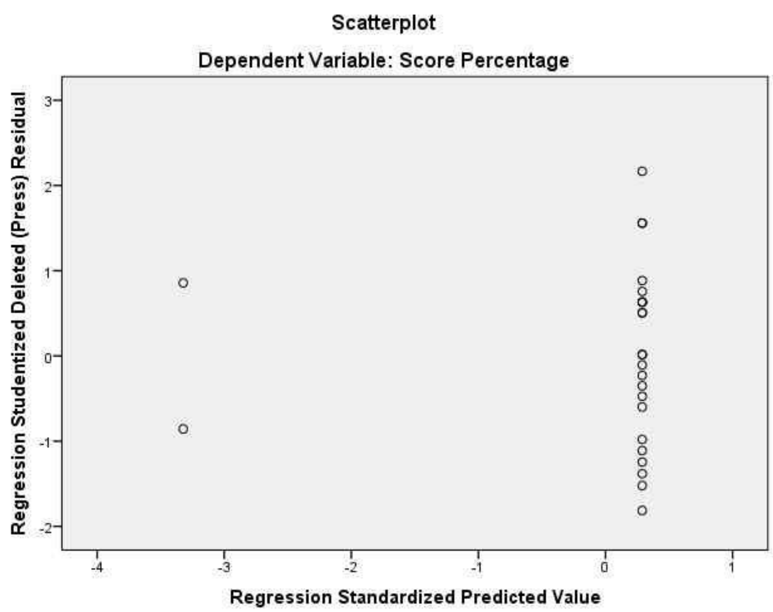
Plot 2


Scatterplot
Dependent Variable: Score Percentage
Regression Standardized Residual
Regression Standardized Predicted Value
-4
-3
-2
-1
0
1
2

Plot 3

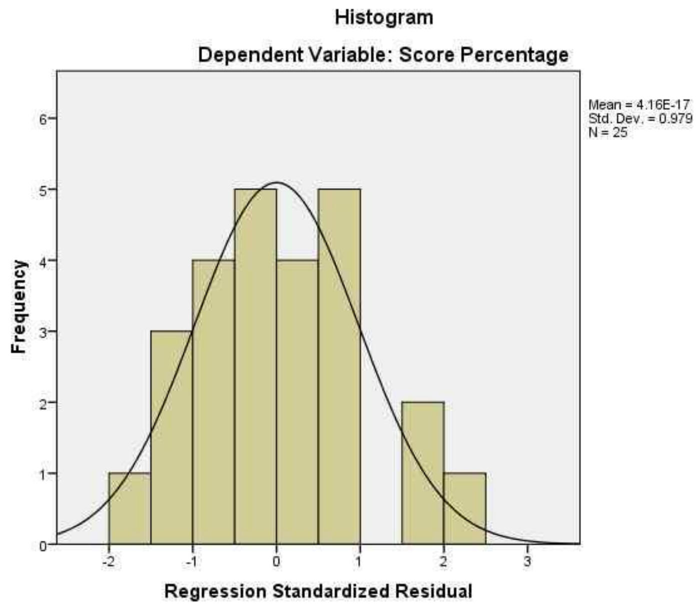


Plot 4

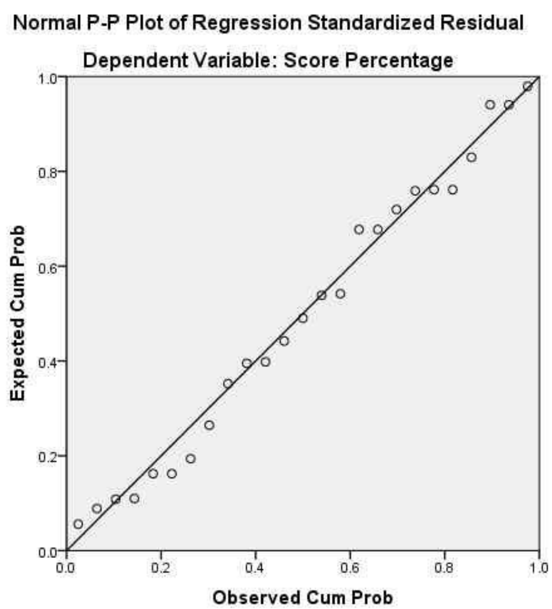


Plot 5

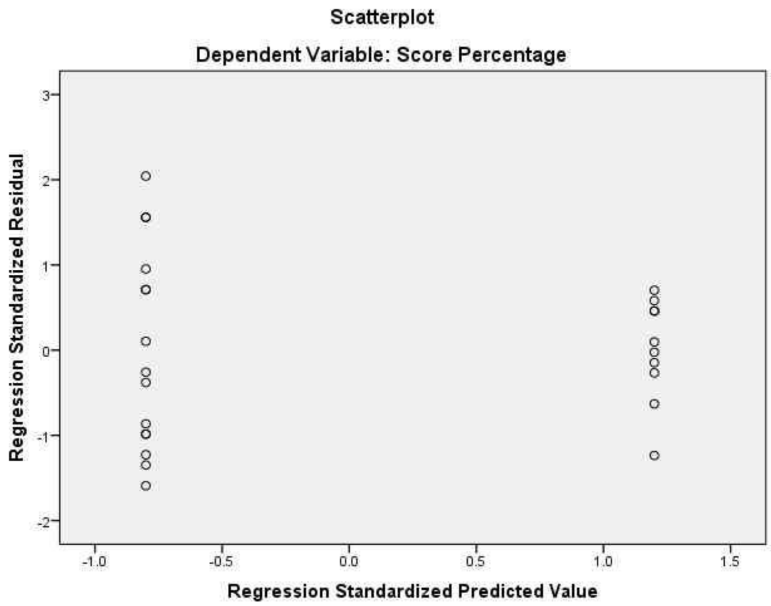
Item 19


Histogram
Dependent Variable: Score Percentage
Mean = 4.16E-17
Std. Dev. = 0.979
N = 25
Frequency
Regression Standardized Residual

Plot 1

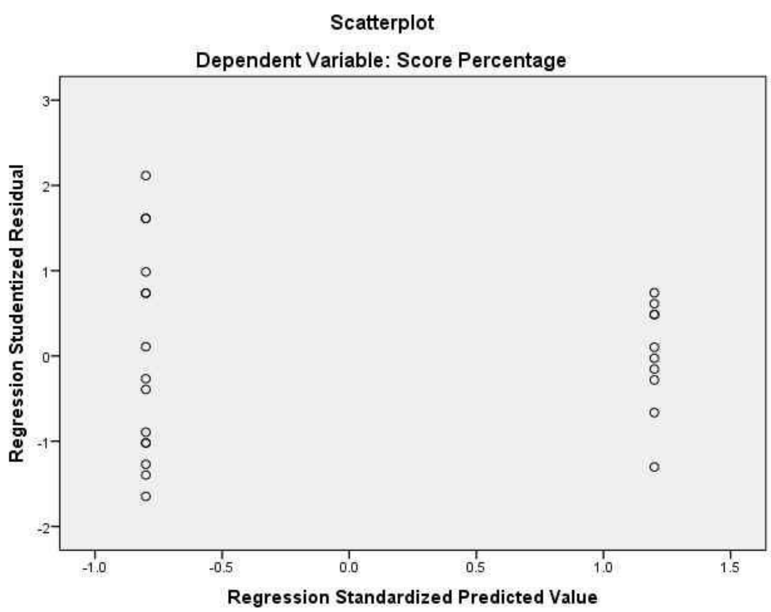

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Score Percentage
Expected Cum Prob
Observed Cum Prob

Plot 2



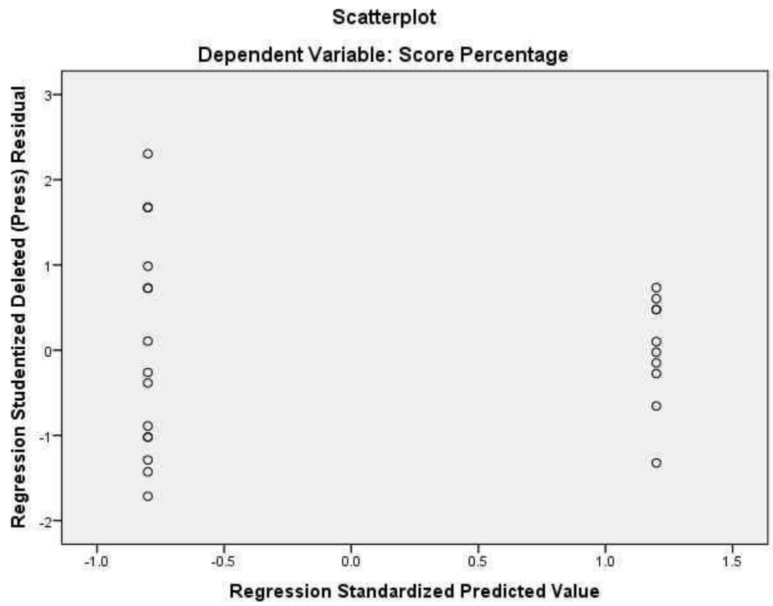
Scatterplot
Dependent Variable: Score Percentage
Regression Standardized Residual
Regression Standardized Predicted Value
3
2
1
0
-1
-2
-1.0
-0.5
0.0
0.5
1.0
1.5

Plot 3



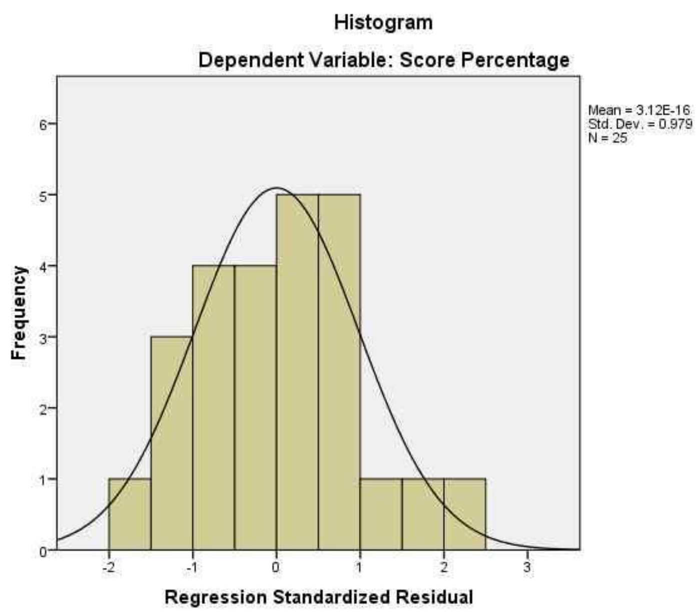
Scatterplot
Dependent Variable: Score Percentage
Regression Studentized Residual
Regression Standardized Predicted Value
3
2
1
0
-1
-2
-1.0
-0.5
0.0
0.5
1.0
1.5

Plot 4

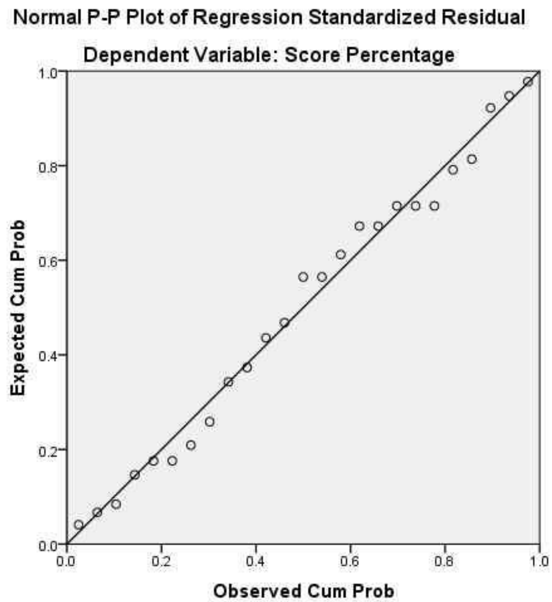


Plot 5

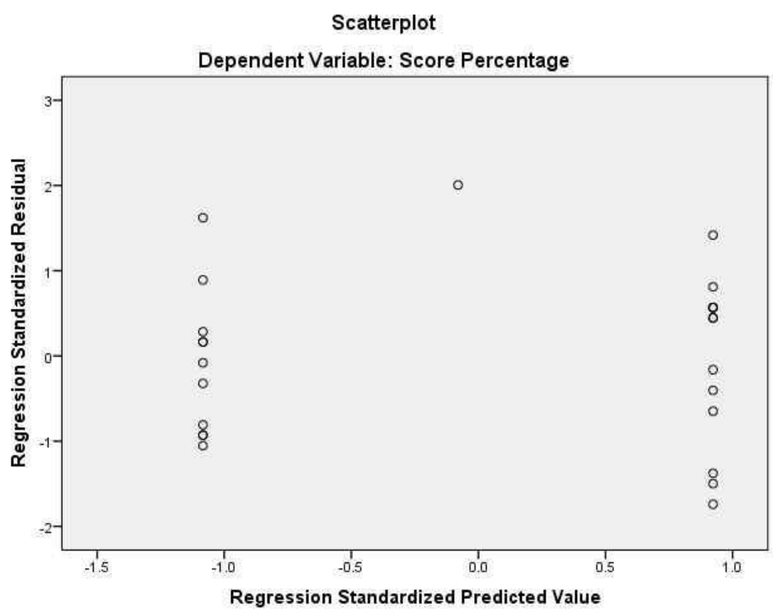
Item 20



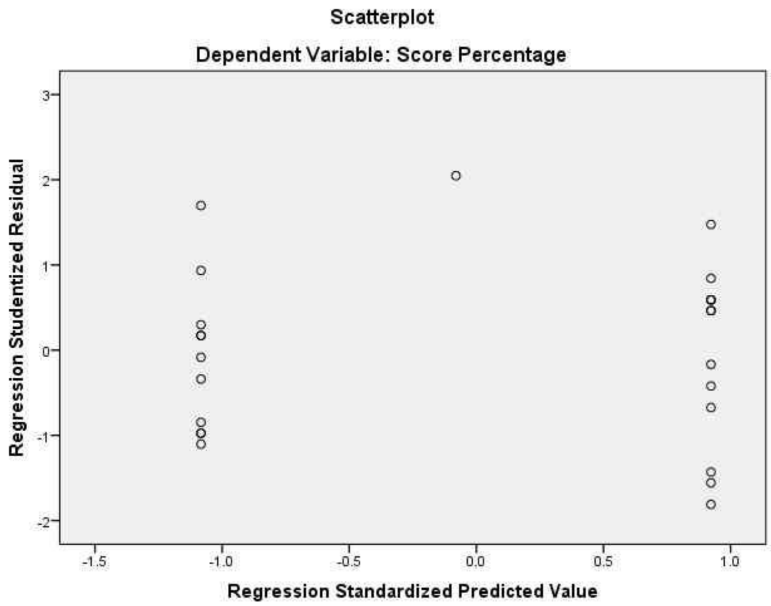
Plot 1


Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Score Percentage
Expected Cum Prob
Observed Cum Prob
0.0
0.2
0.4
0.6
0.8
1.0

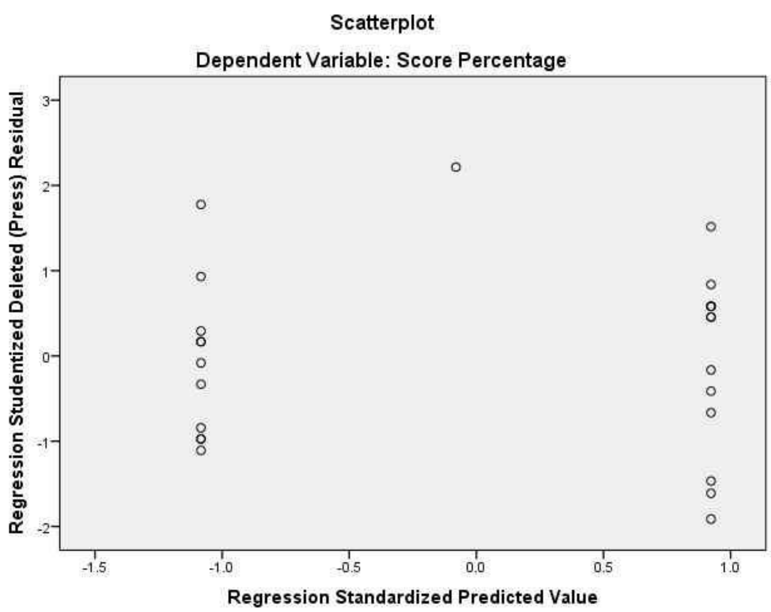
Plot 2


Scatterplot
Dependent Variable: Score Percentage
Regression Standardized Residual
Regression Standardized Predicted Value
3
2
1
0
-1
-2
-1.5
-1.0
-0.5
0.0
0.5
1.0

Plot 3

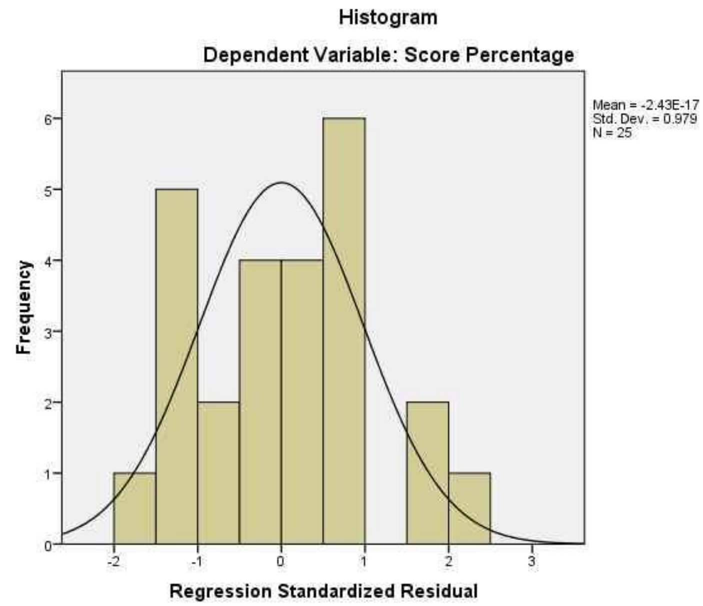


Plot 4

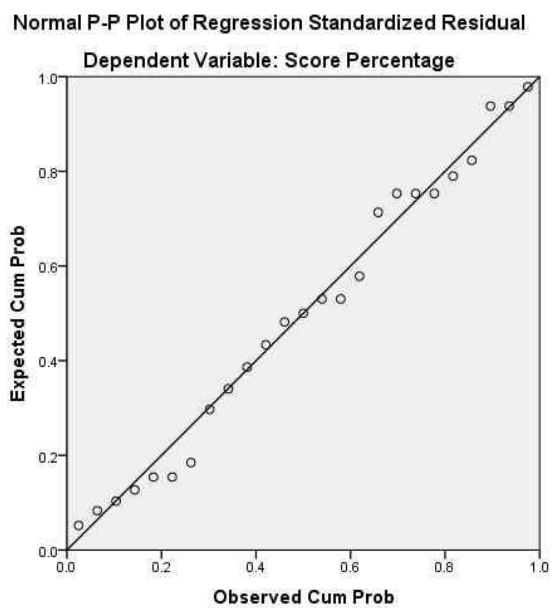


Plot 5

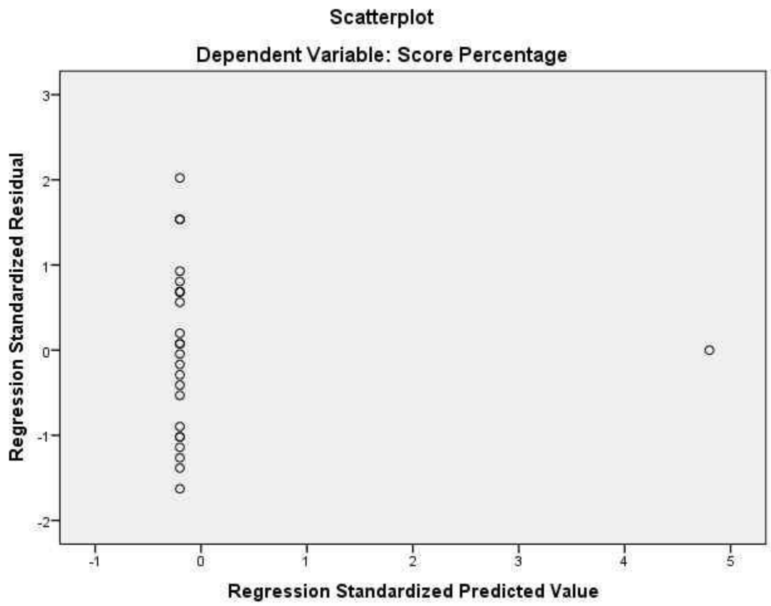
Item 21


Histogram
Dependent Variable: Score Percentage
Mean = -2.43E-17
Std. Dev. = 0.979
N = 25
Frequency
Regression Standardized Residual

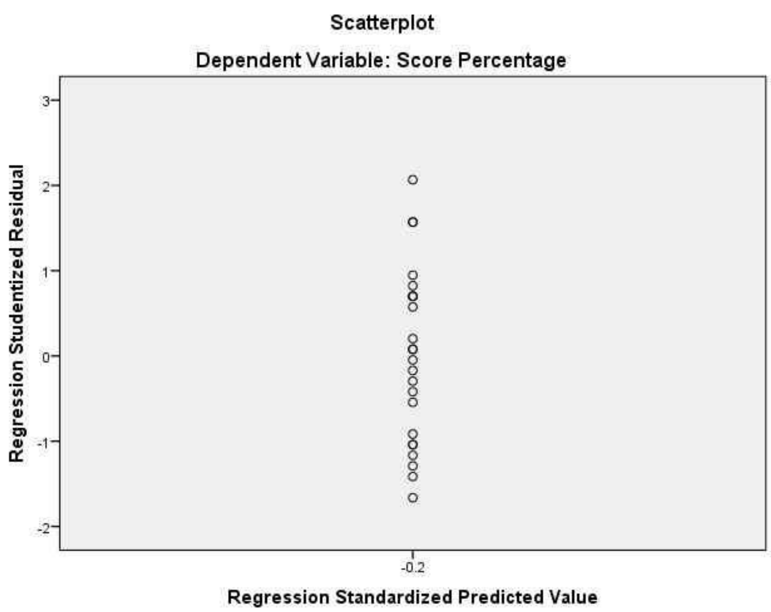
Plot 1


Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Score Percentage
Expected Cum Prob
Observed Cum Prob

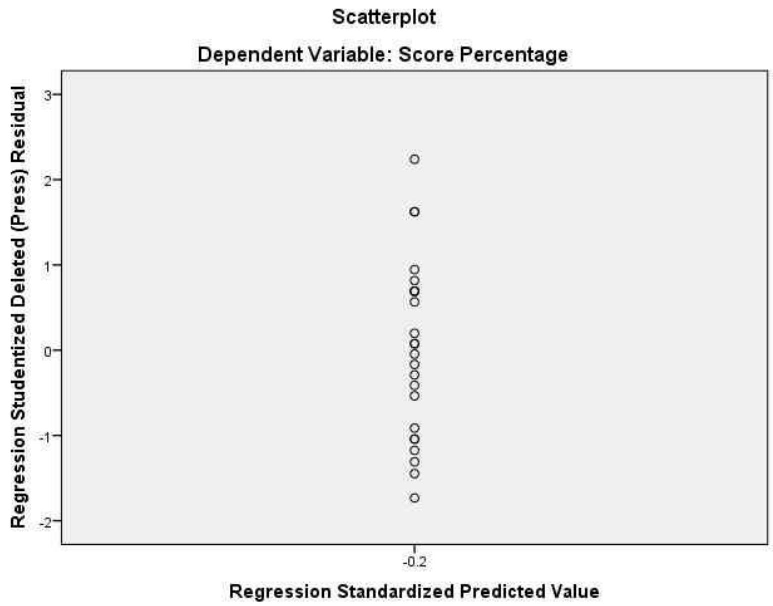
Plot 2


Scatterplot
Dependent Variable: Score Percentage
Regression Standardized Residual
Regression Standardized Predicted Value

Plot 3

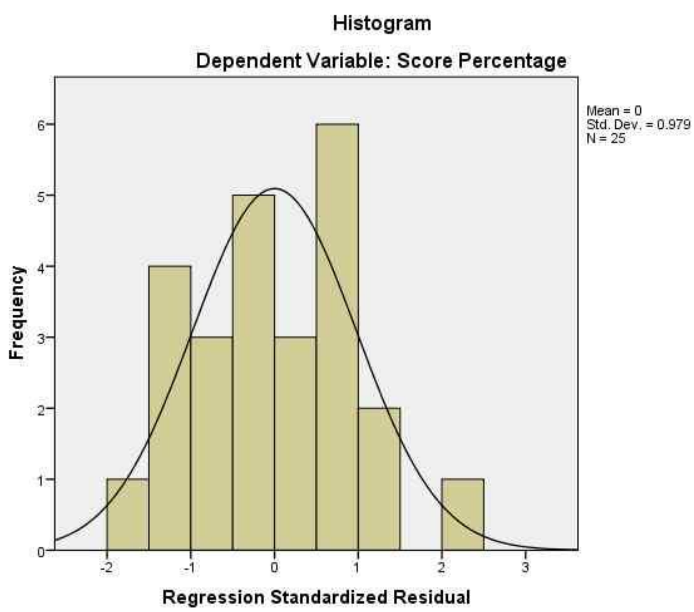

Scatterplot
Dependent Variable: Score Percentage
Regression Studentized Residual
Regression Standardized Predicted Value

Plot 4

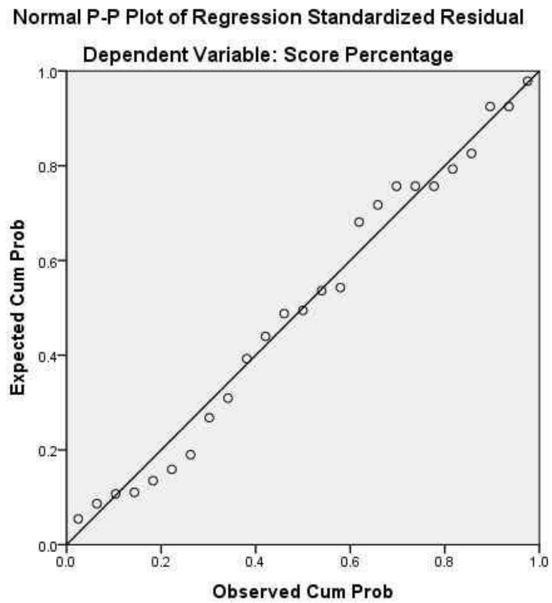


Plot 5

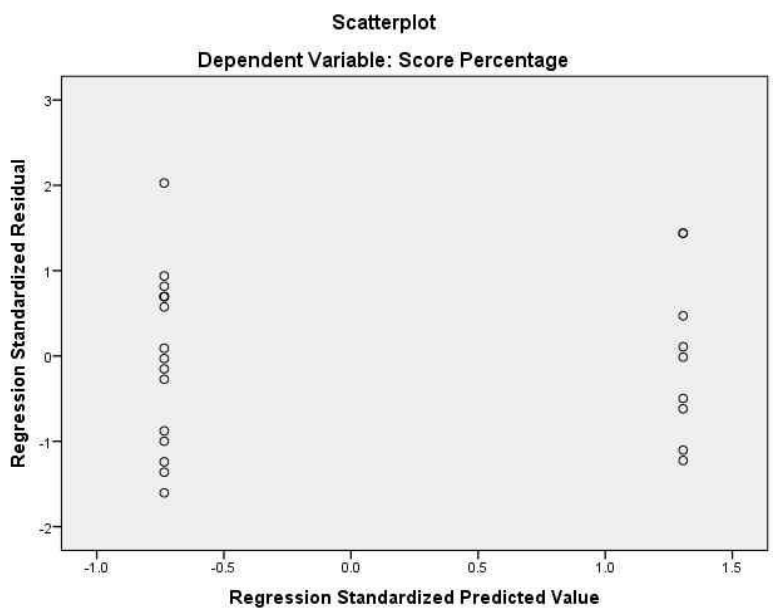
Item 22



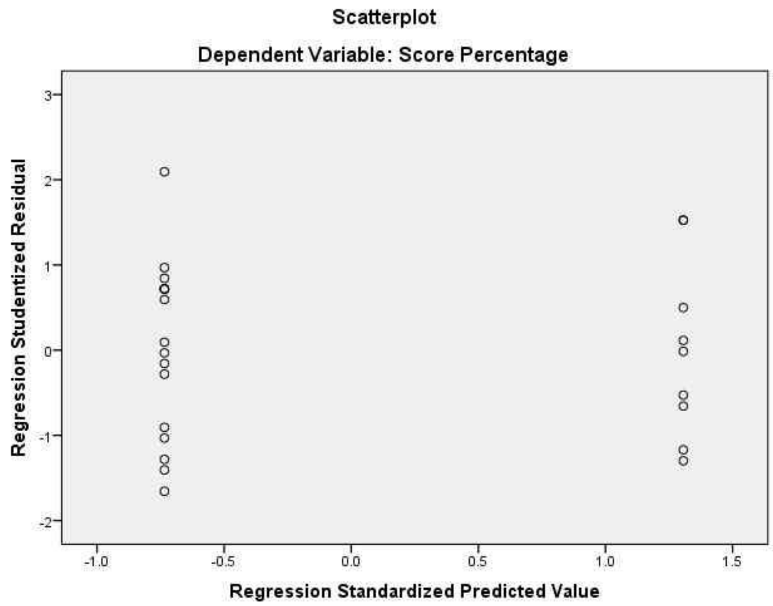
Plot 1


Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Score Percentage
Expected Cum Prob
Observed Cum Prob
0.0
0.2
0.4
0.6
0.8
1.0

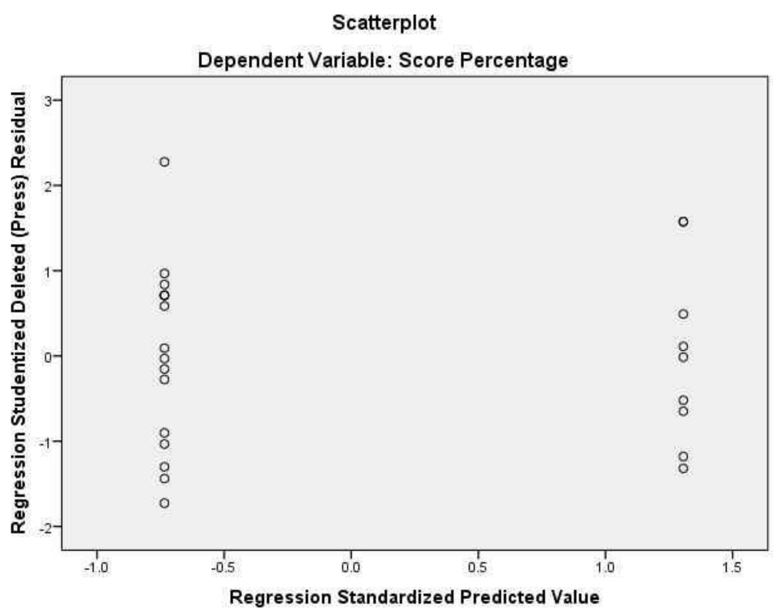
Plot 2


Scatterplot
Dependent Variable: Score Percentage
Regression Standardized Residual
Regression Standardized Predicted Value
-1.0
-0.5
0.0
0.5
1.0
1.5
-2
-1
0
1
2
3

Plot 3

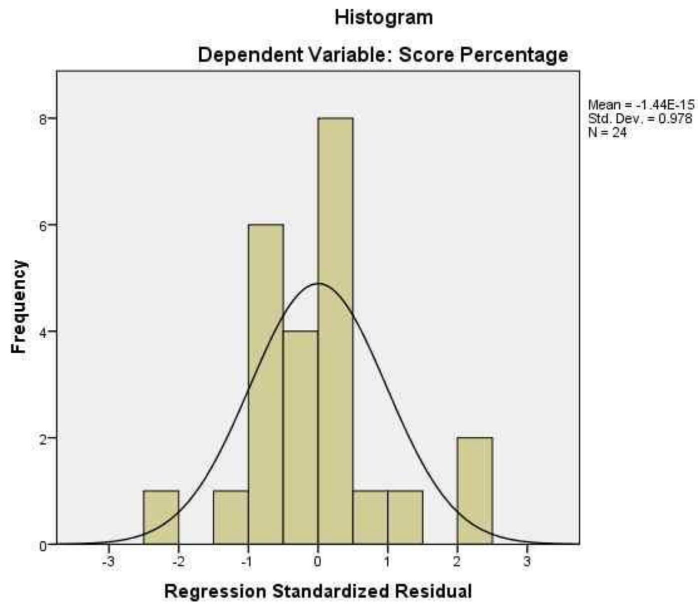


Plot 4

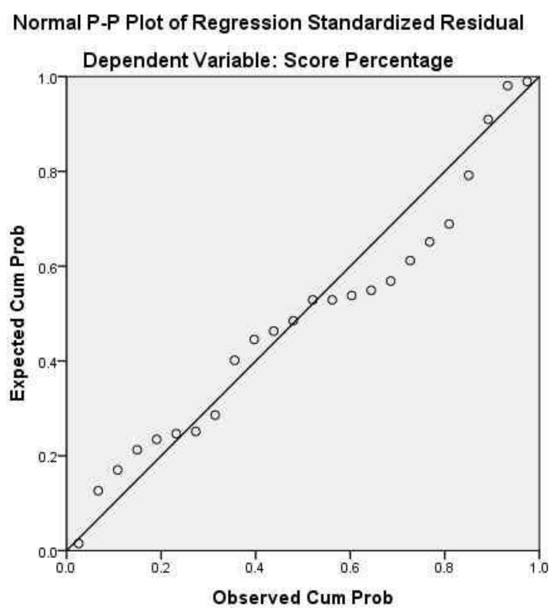


Plot 5

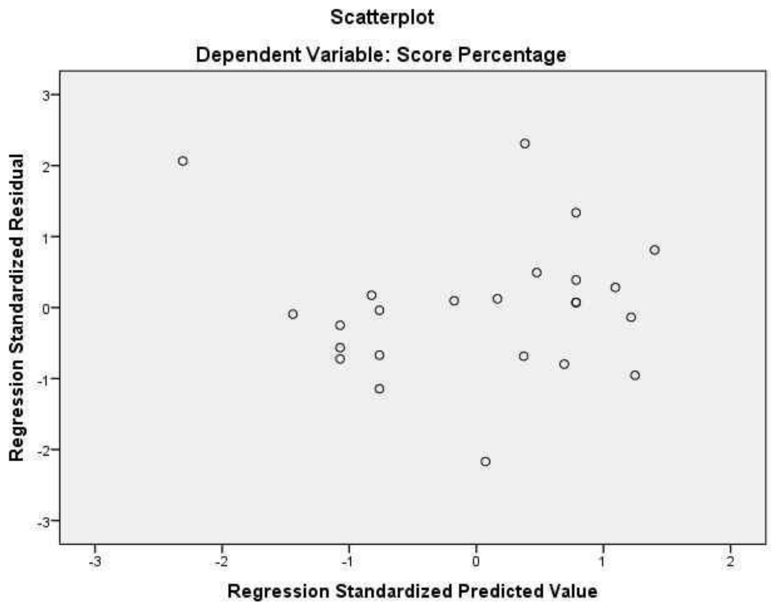
Item MajorGPA


Histogram
Dependent Variable: Score Percentage
Mean = -1.44E-15
Std. Dev. = 0.978
N = 24
Frequency
0
2
4
6
8
-3
-2
-1
0
1
2
3
Regression Standardized Residual

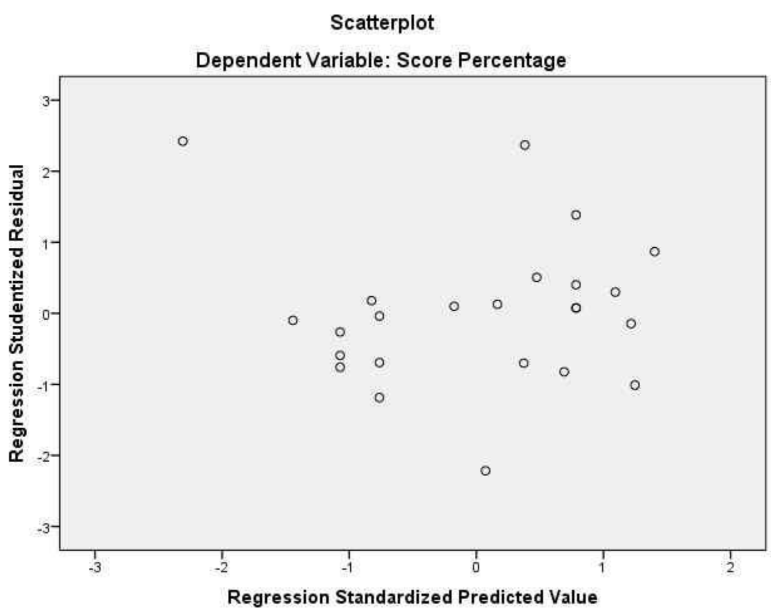
Plot 1


Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Score Percentage
Expected Cum Prob
Observed Cum Prob
0.0
0.2
0.4
0.6
0.8
1.0

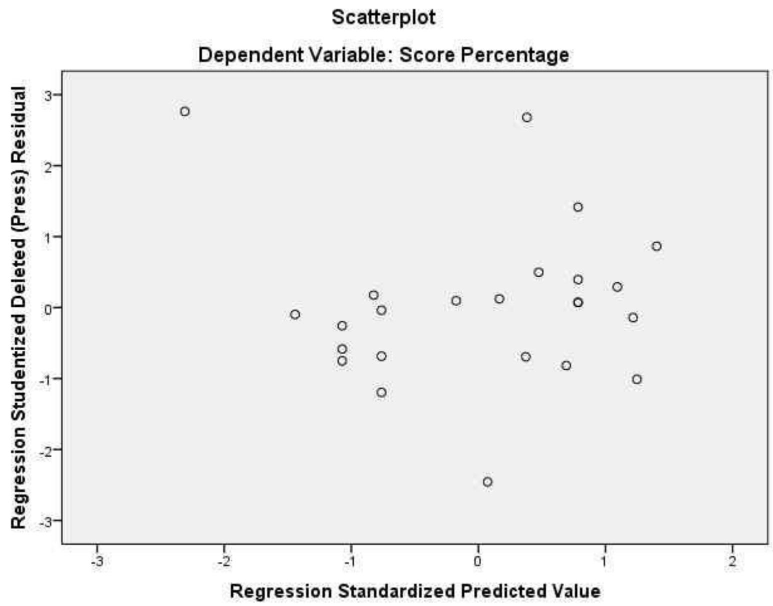
Plot 2


Scatterplot
Dependent Variable: Score Percentage
Regression Standardized Residual
Regression Standardized Predicted Value
3
2
1
0
-1
-2
-3
-3
-2
-1
0
1
2

Plot 3

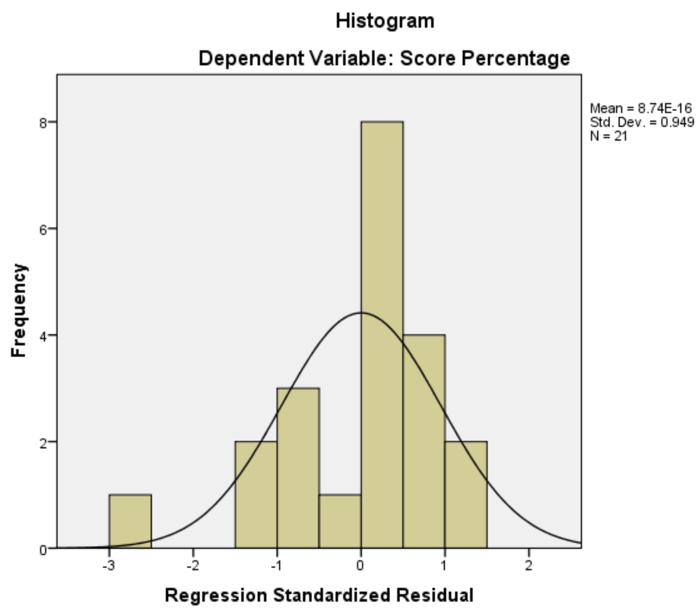

Scatterplot
Dependent Variable: Score Percentage
Regression Studentized Residual
Regression Standardized Predicted Value
3
2
1
0
-1
-2
-3
-3
-2
-1
0
1
2

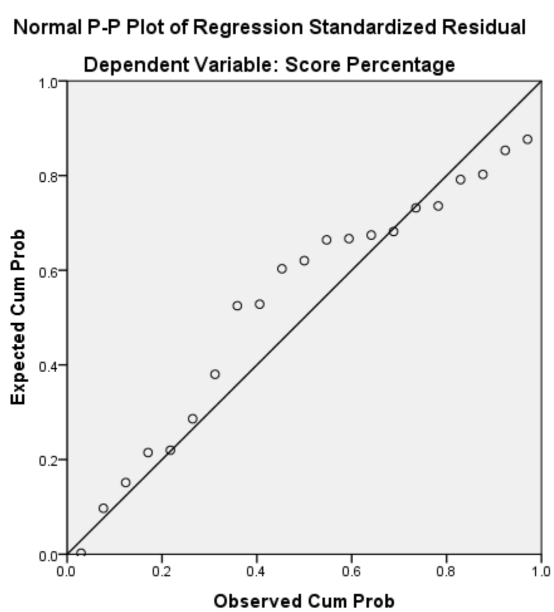
Plot 4

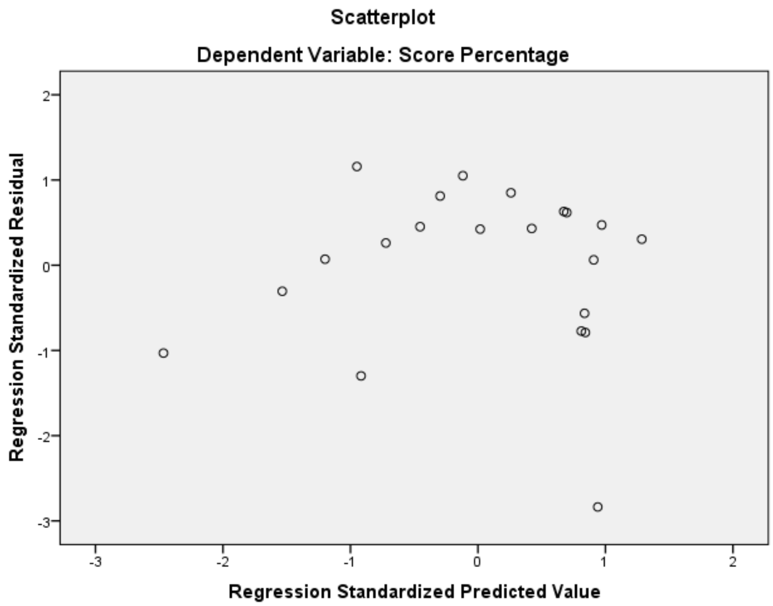

Scatterplot
Dependent Variable: Score Percentage
Regression Studentized Deleted (Press) Residual
3
2
1
0
-1
-2
-3
-3
-2
-1
0
1
2
Regression Standardized Predicted Value

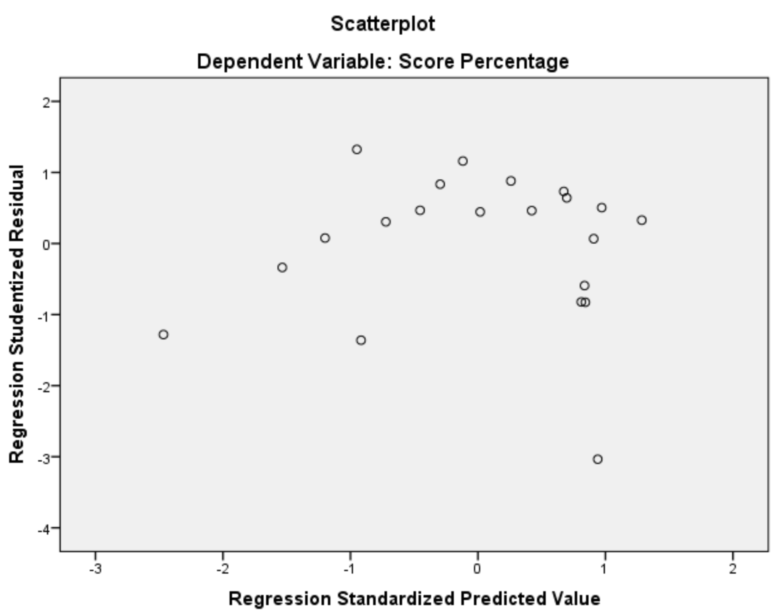
Plot 5

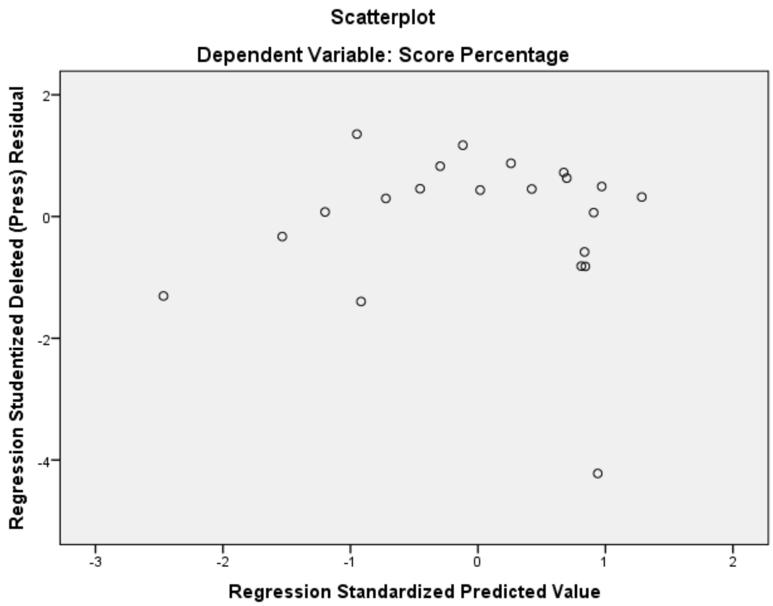
Class A Total Score and Major GPA



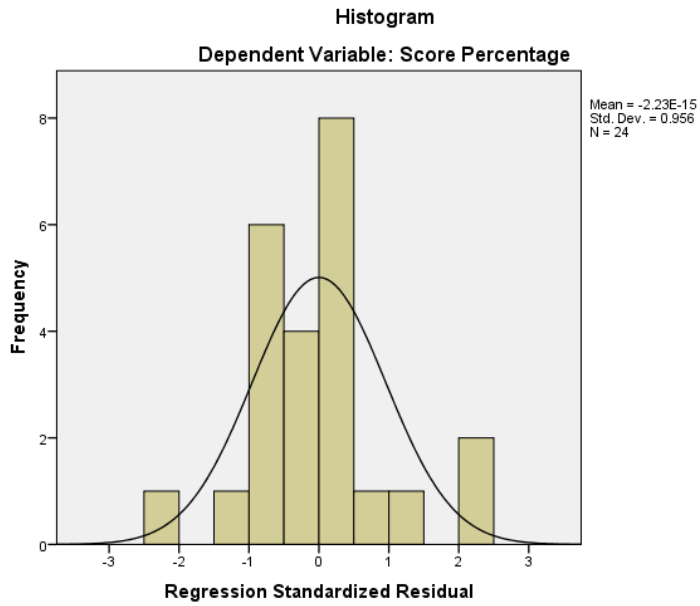


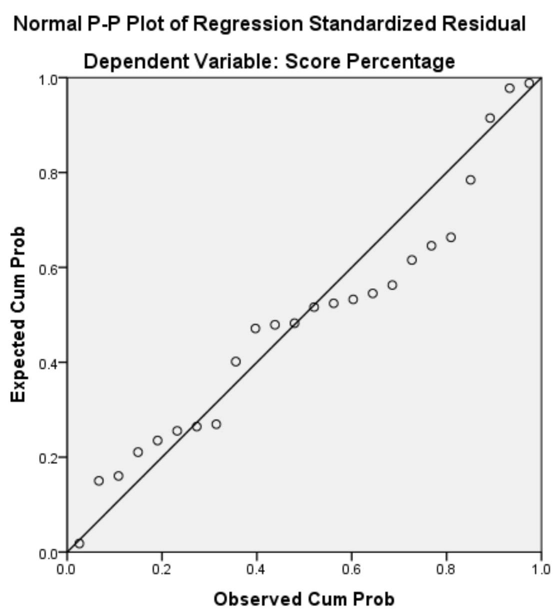

Scatterplot
Dependent Variable: Score Percentage
Regression Standardized Residual
Regression Standardized Predicted Value
2
1
0
-1
-2
-3
-3
-2
-1
0
1
2

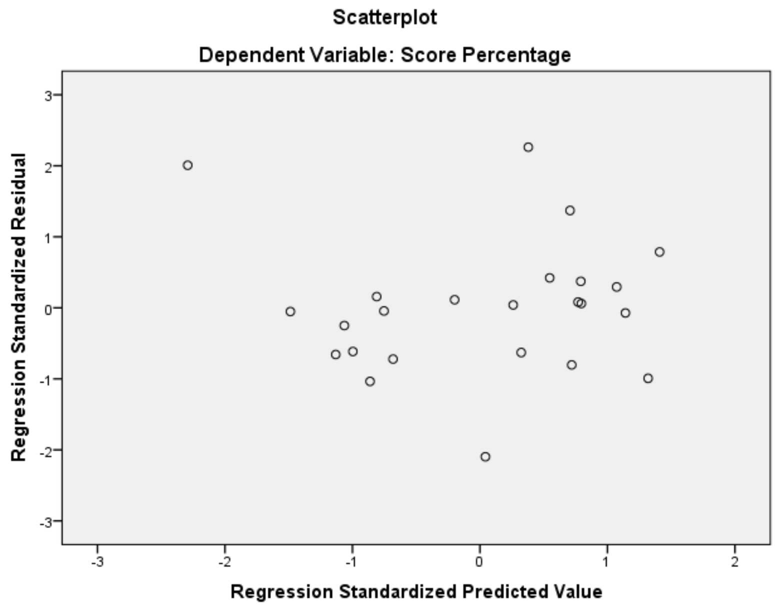

Scatterplot
Dependent Variable: Score Percentage
Regression Studentized Residual
Regression Standardized Predicted Value
2
1
0
-1
-2
-3
-4
-3
-2
-1
0
1
2

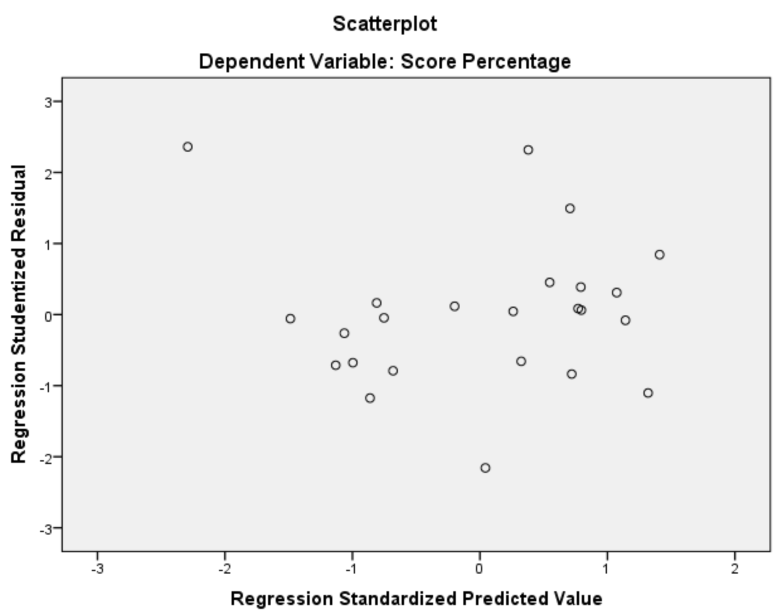


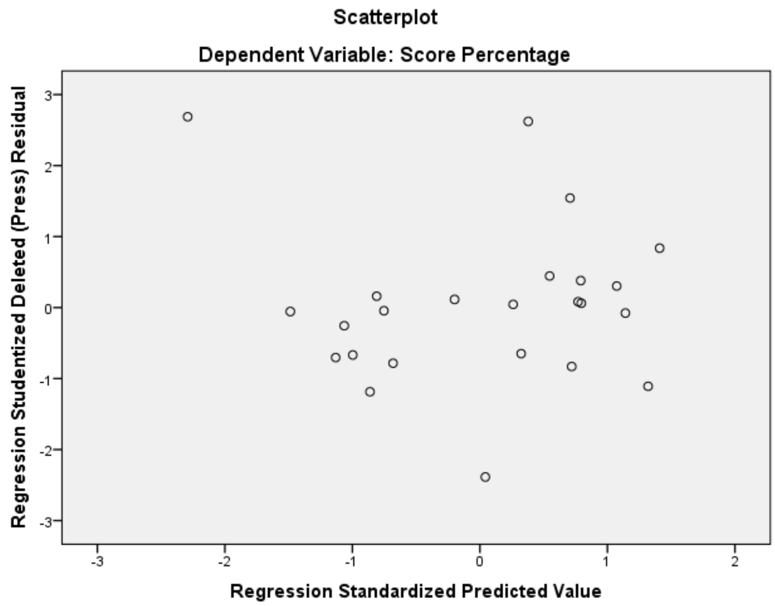
Class B Total Score and Major GPA


Histogram
Dependent Variable: Score Percentage
Mean = -2.23E-15
Std. Dev. = 0.956
N = 24
Frequency
Regression Standardized Residual

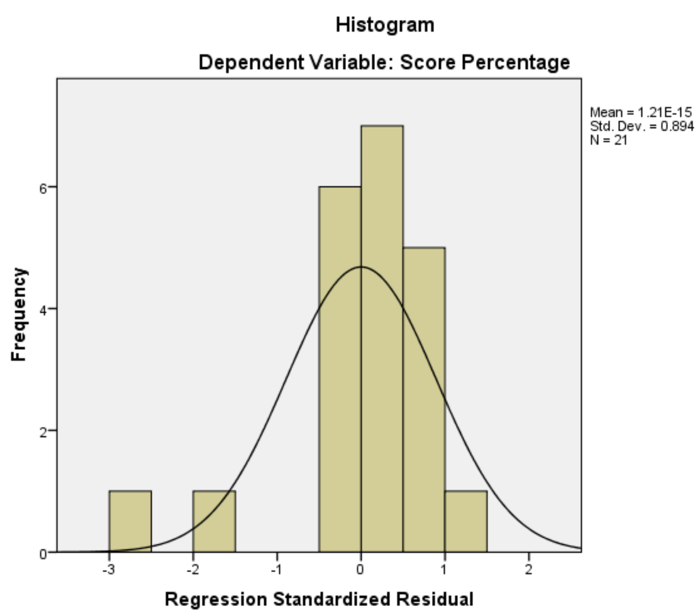

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Score Percentage
Expected Cum Prob
Observed Cum Prob

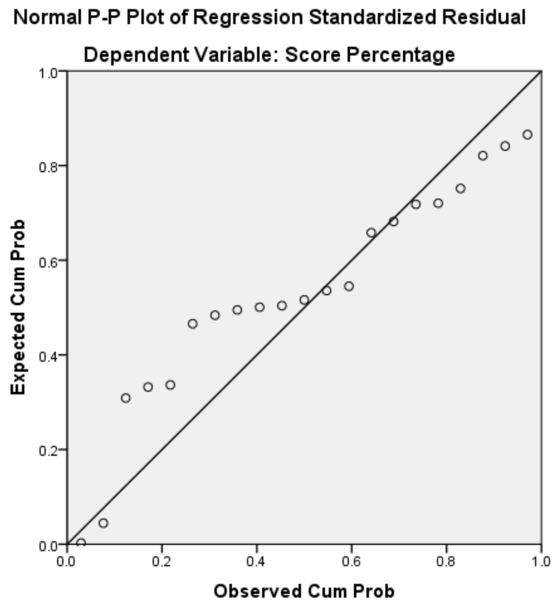

Scatterplot
Dependent Variable: Score Percentage
Regression Standardized Residual
Regression Standardized Predicted Value
3
2
1
0
-1
-2
-3
-3
-2
-1
0
1
2

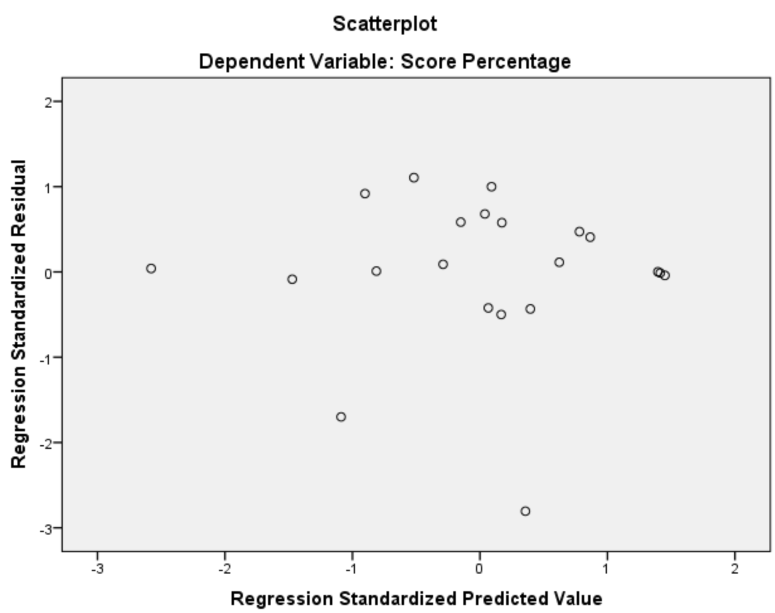

Scatterplot
Dependent Variable: Score Percentage
Regression Studentized Residual
Regression Standardized Predicted Value
3
2
1
0
-1
-2
-3
-3
-2
-1
0
1
2

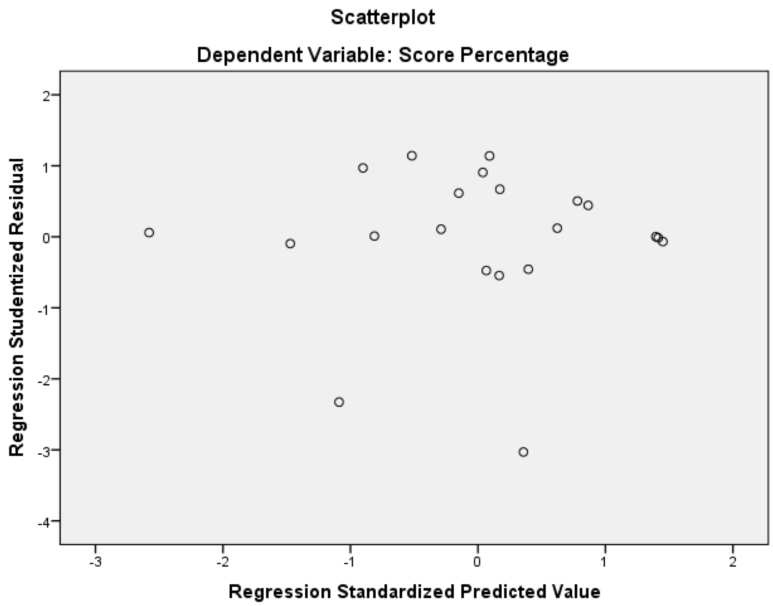


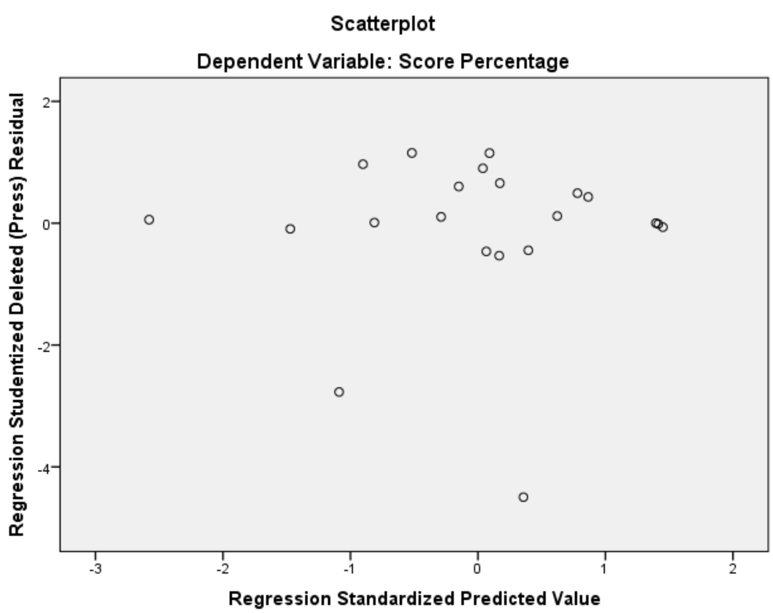
Class A Subscales and Major GPA



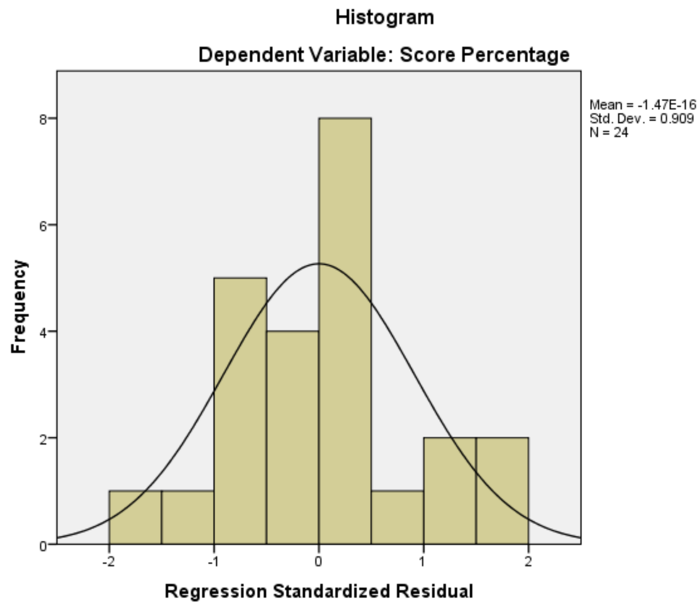

Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Score Percentage
Expected Cum Prob
1.0
0.8
0.6
0.4
0.2
0.0
0.0
0.2
0.4
0.6
0.8
1.0
Observed Cum Prob

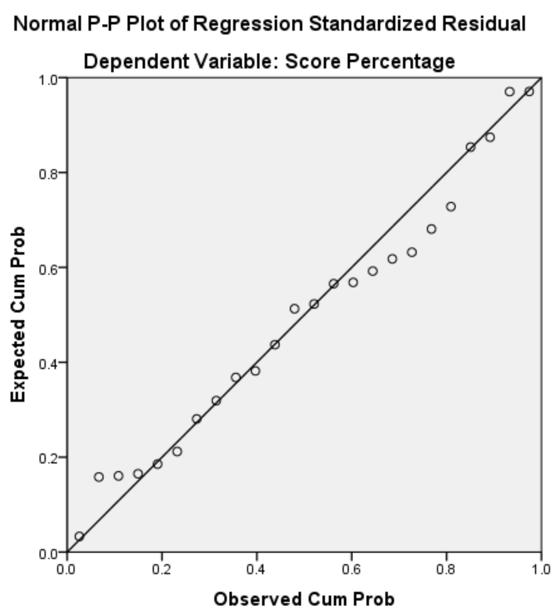

Scatterplot
Dependent Variable: Score Percentage
Regression Standardized Residual
2
1
0
-1
-2
-3
-3
-2
-1
0
1
2
Regression Standardized Predicted Value

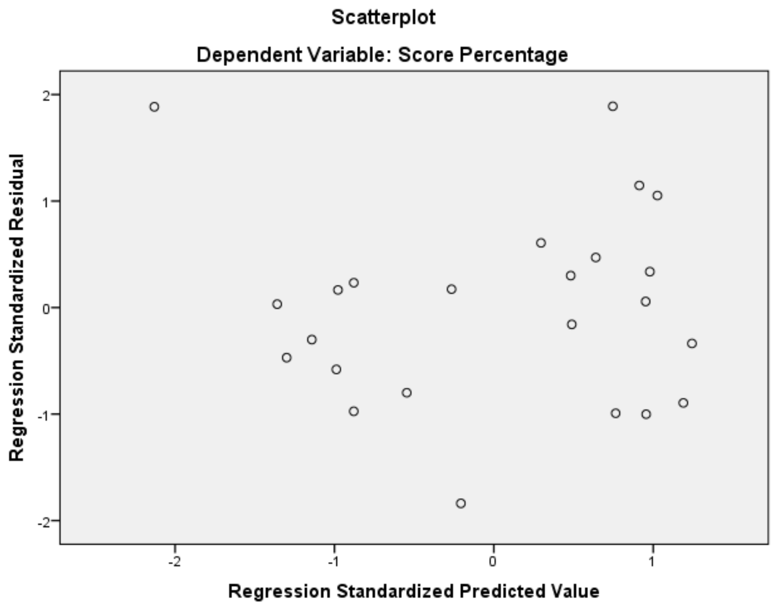


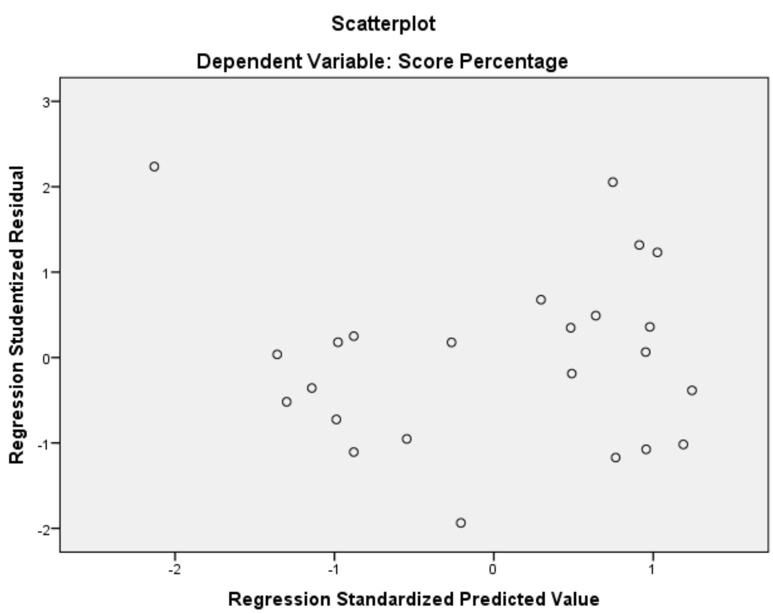


Class B Subscales and Major GPA

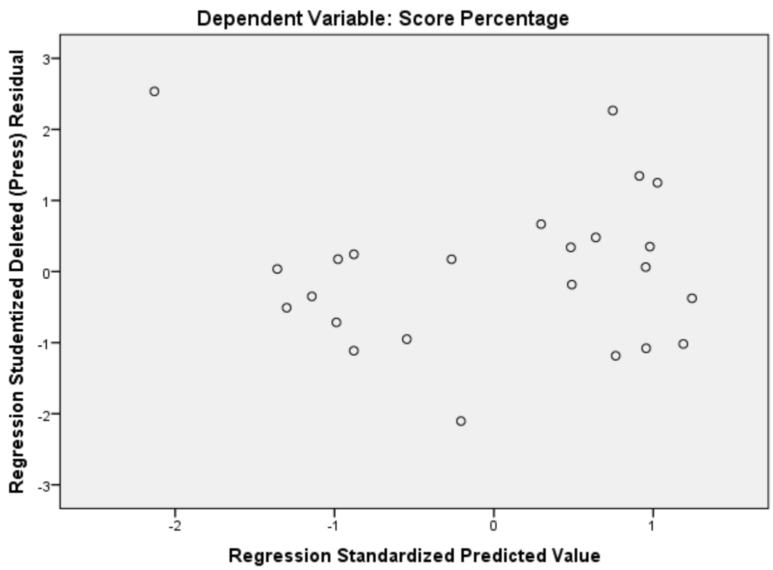

Histogram
Dependent Variable: Score Percentage
Mean = -1.47E-16
Std. Dev. = 0.909
N = 24
Frequency
Regression Standardized Residual


Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Score Percentage
Expected Cum Prob
Observed Cum Prob


Scatterplot
Dependent Variable: Score Percentage
Regression Standardized Residual
2
1
0
-1
-2
-2
-1
0
1
Regression Standardized Predicted Value


Scatterplot
Dependent Variable: Score Percentage
Regression Studentized Residual
3
2
1
0
-1
-2
-2
-1
0
1
Regression Standardized Predicted Value

Scatterplot



Appendix E Item Analysis for All Items

Class A Item Analysis

ITEM ANALYSIS

ITEM ANALYSIS

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Item	Option (Score)	Difficulty	Std. Dev.	Discrimin.
q1	Overall	5.5000	0.8575	0.2934
	1.0(6.0)	0.6667	0.4851	0.2132
	2.0(5.0)	0.2222	0.4278	-0.1517
	3.0(4.0)	0.0556	0.2357	0.1388
	4.0(3.0)	0.0556	0.2357	-0.4962
	5.0(2.0)	0.0000	0.0000	NaN
	6.0(1.0)	0.0000	0.0000	NaN
	7.0(0.0)	0.0000	0.0000	NaN

Item	Option (Score)	Difficulty	Std. Dev.	Discrimin.
q2	Overall	3.8889	1.7112	-0.0088
	1.0(6.0)	0.2222	0.4278	-0.0266
	2.0(5.0)	0.1667	0.3835	-0.2990
	3.0(4.0)	0.1667	0.3835	0.2052
	4.0(3.0)	0.3333	0.4851	0.2132
	5.0(2.0)	0.0000	0.0000	NaN
	6.0(1.0)	0.0556	0.2357	-0.0444
	7.0(0.0)	0.0556	0.2357	-0.4962

Item	Option (Score)	Difficulty	Std. Dev.	Discrimin.
q3	Overall	4.6111	0.6978	-0.4456
	1.0(3.0)	0.0556	0.2357	0.2079
	2.0(4.0)	0.3333	0.4851	0.1680
	3.0(5.0)	0.4444	0.5113	-0.2238
	4.0(6.0)	0.0556	0.2357	-0.2940
	5.0(5.0)	0.1111	0.3234	-0.0296
	6.0(4.0)	0.0000	0.0000	NaN
	7.0(3.0)	0.0000	0.0000	NaN

Item	Option (Score)	Difficulty	Std. Dev.	Discrimin.
q4	Overall	5.0000	1.0847	0.2193
	1.0(6.0)	0.4444	0.5113	0.1653
	2.0(5.0)	0.2222	0.4278	-0.0266

	3.0(4.0)	0.2222	0.4278	-0.0266
	4.0(3.0)	0.1111	0.3234	-0.3916
	5.0(2.0)	0.0000	0.0000	NaN
	6.0(1.0)	0.0000	0.0000	NaN
	7.0(0.0)	0.0000	0.0000	NaN

Item	Option (Score)	Difficulty	Std. Dev.	Discrimin.
q5	Overall	3.9444	1.6618	0.5575
	1.0(6.0)	0.1667	0.3835	0.6396
	2.0(5.0)	0.2222	0.4278	-0.0642
	3.0(4.0)	0.3333	0.4851	-0.0996
	4.0(3.0)	0.1111	0.3234	-0.1786
	5.0(2.0)	0.0556	0.2357	-0.2940
	6.0(1.0)	0.0556	0.2357	0.0241
	7.0(0.0)	0.0556	0.2357	-0.4962

Item	Option (Score)	Difficulty	Std. Dev.	Discrimin.
q6	Overall	4.2222	1.3528	0.1300
	1.0(0.0)	0.0000	0.0000	NaN
	2.0(1.0)	0.0556	0.2357	-0.3165
	3.0(2.0)	0.0000	0.0000	NaN
	4.0(3.0)	0.2778	0.4609	0.0632
	5.0(4.0)	0.1667	0.3835	-0.1607
	6.0(5.0)	0.3333	0.4851	-0.1216
	7.0(6.0)	0.1667	0.3835	0.2481

Item	Option (Score)	Difficulty	Std. Dev.	Discrimin.
q7	Overall	3.3333	2.0292	0.5751
	1.0(6.0)	0.1667	0.3835	0.4352
	2.0(5.0)	0.1667	0.3835	0.1058
	3.0(4.0)	0.2222	0.4278	0.2146
	4.0(3.0)	0.1111	0.3234	-0.1126
	5.0(2.0)	0.0000	0.0000	NaN
	6.0(1.0)	0.2778	0.4609	-0.6333
	7.0(0.0)	0.0556	0.2357	-0.1582

Item	Option (Score)	Difficulty	Std. Dev.	Discrimin.
q8	Overall	3.3889	1.9140	0.2596
	1.0(6.0)	0.2222	0.4278	0.4083
	2.0(5.0)	0.0556	0.2357	-0.4962
	3.0(4.0)	0.2222	0.4278	0.2146
	4.0(3.0)	0.1667	0.3835	0.0352
	5.0(2.0)	0.0556	0.2357	-0.2940
	6.0(1.0)	0.2778	0.4609	-0.3527
	7.0(0.0)	0.0000	0.0000	NaN

Item	Option (Score)	Difficulty	Std. Dev.	Discrimin.
q9	Overall	2.3333	1.6450	0.5393
	1.0(0.0)	0.1111	0.3234	-0.4728
	2.0(1.0)	0.3333	0.4851	-0.3717
	3.0(2.0)	0.0556	0.2357	-0.2035
	4.0(3.0)	0.2222	0.4278	0.2917

	5.0(4.0)	0.1667	0.3835	0.4063
	6.0(5.0)	0.1111	0.3234	0.1040
	7.0(6.0)	0.0000	0.0000	NaN

Item	Option (Score)	Difficulty	Std. Dev.	Discrimin.
q10	Overall	2.7222	1.6380	-0.4725
	1.0(0.0)	0.1111	0.3234	0.3914
	2.0(1.0)	0.0556	0.2357	-0.0672
	3.0(2.0)	0.3333	0.4851	-0.3394
	4.0(3.0)	0.2222	0.4278	0.3434
	5.0(4.0)	0.1111	0.3234	-0.1951
	6.0(5.0)	0.1111	0.3234	0.0538
	7.0(6.0)	0.0556	0.2357	-0.4962

Item	Option (Score)	Difficulty	Std. Dev.	Discrimin.
q11	Overall	3.7778	1.6290	0.1222
	1.0(6.0)	0.1667	0.3835	0.5224
	2.0(5.0)	0.2222	0.4278	-0.0391
	3.0(4.0)	0.1667	0.3835	-0.2990
	4.0(3.0)	0.2222	0.4278	-0.4956
	5.0(2.0)	0.1111	0.3234	0.2556
	6.0(1.0)	0.1111	0.3234	-0.0296
	7.0(0.0)	0.0000	0.0000	NaN

Item	Option (Score)	Difficulty	Std. Dev.	Discrimin.
q12	Overall	4.4444	1.1991	0.1170
	1.0(6.0)	0.2222	0.4278	0.5785
	2.0(5.0)	0.2778	0.4609	-0.4432
	3.0(4.0)	0.2778	0.4609	-0.3414
	4.0(3.0)	0.1667	0.3835	0.1768
	5.0(2.0)	0.0556	0.2357	-0.0672
	6.0(1.0)	0.0000	0.0000	NaN
	7.0(0.0)	0.0000	0.0000	NaN

Item	Option (Score)	Difficulty	Std. Dev.	Discrimin.
q13	Overall	5.2778	0.7519	0.2587
	1.0(6.0)	0.4444	0.5113	0.2621
	2.0(5.0)	0.3889	0.5016	-0.1841
	3.0(4.0)	0.1667	0.3835	-0.2576
	4.0(3.0)	0.0000	0.0000	NaN
	5.0(2.0)	0.0000	0.0000	NaN
	6.0(1.0)	0.0000	0.0000	NaN
	7.0(0.0)	0.0000	0.0000	NaN

Item	Option (Score)	Difficulty	Std. Dev.	Discrimin.
q14	Overall	3.8889	1.9670	0.0597
	1.0(6.0)	0.2778	0.4609	0.1340
	2.0(5.0)	0.1667	0.3835	-0.2576
	3.0(4.0)	0.1667	0.3835	0.0916
	4.0(3.0)	0.1667	0.3835	0.3485
	5.0(2.0)	0.1111	0.3234	-0.3590
	6.0(1.0)	0.0000	0.0000	NaN

```
                 7.0(0.0)      0.1111      0.3234     -0.2773

Item         Option (Score)  Difficulty   Std. Dev.  Discrimin.
---------   ---------------  ----------  ----------  ----------
q15                 Overall      2.0000      2.6568     -0.1606
                   1.0(0.0)      0.2778      0.4609      0.3488
                   2.0(2.0)      0.1111      0.3234     -0.2773
                   3.0(4.0)      0.0000      0.0000         NaN
                   4.0(6.0)      0.2778      0.4609      0.0985
                   5.0(4.0)      0.0000      0.0000         NaN
                   6.0(2.0)      0.0556      0.2357     -0.0444
                   7.0(0.0)      0.2778      0.4609     -0.3754

Item         Option (Score)  Difficulty   Std. Dev.  Discrimin.
---------   ---------------  ----------  ----------  ----------
q16                 Overall      5.0000      2.3009      0.2582
                   1.0(0.0)      0.1111      0.3234     -0.3590
                   2.0(6.0)      0.8333      0.3835      0.4207
                   3.0(0.0)      0.0000      0.0000         NaN
                   4.0(0.0)      0.0556      0.2357     -0.2940

Item         Option (Score)  Difficulty   Std. Dev.  Discrimin.
---------   ---------------  ----------  ----------  ----------
q17                 Overall      3.3333      2.0292     -0.4833
                   1.0(0.0)      0.1667      0.3835      0.3918
                   2.0(3.0)      0.5556      0.5113     -0.2341
                   3.0(6.0)      0.2778      0.4609     -0.1812
                   4.0(0.0)      0.0000      0.0000         NaN

Item         Option (Score)  Difficulty   Std. Dev.  Discrimin.
---------   ---------------  ----------  ----------  ----------
q18                 Overall      0.0000      0.0000         NaN
                   1.0(0.0)      0.1111      0.3234      0.2894
                   2.0(0.0)      0.0556      0.2357     -0.0900
                   3.0(0.0)      0.8333      0.3835     -0.2576
                   4.0(6.0)      0.0000      0.0000         NaN

Item         Option (Score)  Difficulty   Std. Dev.  Discrimin.
---------   ---------------  ----------  ----------  ----------
q19                 Overall      4.0000      2.9104     -0.0567
                   1.0(0.0)      0.3333      0.4851     -0.2528
                   2.0(6.0)      0.6667      0.4851      0.1680
                   3.0(0.0)      0.0000      0.0000         NaN
                   4.0(0.0)      0.0000      0.0000         NaN

Item         Option (Score)  Difficulty   Std. Dev.  Discrimin.
---------   ---------------  ----------  ----------  ----------
q20                 Overall      4.0000      2.7225      0.4781
                   1.0(0.0)      0.2778      0.4609     -0.6554
                   2.0(0.0)      0.0000      0.0000         NaN
                   3.0(6.0)      0.6111      0.5016      0.5820
                   4.0(3.0)      0.1111      0.3234     -0.0794
                   5.0(0.0)      0.0000      0.0000         NaN

Item         Option (Score)  Difficulty   Std. Dev.  Discrimin.
---------   ---------------  ----------  ----------  ----------
q21                 Overall      1.6667      2.7653      0.2770
```

Item	Option (Score)	Difficulty	Std. Dev.	Discrimin.
	1.0(0.0)	0.7222	0.4609	-0.5330
	2.0(6.0)	0.2778	0.4609	0.4699

Item	Option (Score)	Difficulty	Std. Dev.	Discrimin.
q22	Overall	5.6667	1.4142	0.1488
	1.0(0.0)	0.0556	0.2357	-0.2940
	2.0(6.0)	0.9444	0.2357	0.2541

TEST LEVEL STATISTICS

==

Number of Items = 22

Number of Examinees = 18

Min = 61.0000

Max = 104.0000

Mean = 82.0000

Median = 82.0000

Standard Deviation = 10.9222

Interquartile Range = 16.5000

Skewness = 0.0436

Kurtosis = -0.2171

KR21 = 3.0116

TEST LEVEL STATISTICS

===

Number of Items = 22

Number of Examinees = 20

Min = 61.0000

Max = 104.0000

Mean = 82.9000

Median = 83.5000

Standard Deviation = 10.9347

Interquartile Range = 16.0000

Skewness = -0.0531

Kurtosis = -0.3295

KR21 = 3.0583

Class B Item Analysis

Class B Item Analysis

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==========================================================================
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Item        Option (Score)  Difficulty  Std. Dev.   Discrimin.
---------   --------------- ----------  ----------  ----------
q1                 Overall      4.6667      1.5275      0.3761
                  1.0(6.0)      0.3810      0.4976      0.2098
                  2.0(5.0)      0.2857      0.4629      0.0854
                  3.0(4.0)      0.1429      0.3586     -0.0556
                  4.0(3.0)      0.0476      0.2182     -0.0383
                  5.0(2.0)      0.0952      0.3008     -0.2652
                  6.0(1.0)      0.0476      0.2182     -0.4377
                  7.0(0.0)      0.0000      0.0000         NaN

Item        Option (Score)  Difficulty  Std. Dev.   Discrimin.
---------   --------------- ----------  ----------  ----------
q2                 Overall      4.4762      1.3274      0.2688
                  1.0(6.0)      0.2381      0.4364      0.3943
                  2.0(5.0)      0.3333      0.4830     -0.2351
                  3.0(4.0)      0.1905      0.4024     -0.1857
                  4.0(3.0)      0.1905      0.4024      0.1315
                  5.0(2.0)      0.0000      0.0000         NaN
                  6.0(1.0)      0.0476      0.2182     -0.4377
                  7.0(0.0)      0.0000      0.0000         NaN

Item        Option (Score)  Difficulty  Std. Dev.   Discrimin.
---------   --------------- ----------  ----------  ----------
q3                 Overall      4.4286      0.8701     -0.1070
                  1.0(3.0)      0.0476      0.2182      0.2741
                  2.0(4.0)      0.1905      0.4024      0.1015
                  3.0(5.0)      0.2857      0.4629      0.0333
                  4.0(6.0)      0.0952      0.3008      0.0919
                  5.0(5.0)      0.0952      0.3008     -0.1600
                  6.0(4.0)      0.1905      0.4024     -0.4581
                  7.0(3.0)      0.0952      0.3008      0.0786

Item        Option (Score)  Difficulty  Std. Dev.   Discrimin.
---------   --------------- ----------  ----------  ----------
q4                 Overall      4.5238      1.5368      0.5229
                  1.0(6.0)      0.2857      0.4629      0.4732
                  2.0(5.0)      0.3333      0.4830     -0.0797
                  3.0(4.0)      0.1905      0.4024     -0.0774
                  4.0(3.0)      0.0952      0.3008     -0.1337
                  5.0(2.0)      0.0476      0.2182     -0.4377
                  6.0(1.0)      0.0000      0.0000         NaN
                  7.0(0.0)      0.0476      0.2182     -0.3293

Item        Option (Score)  Difficulty  Std. Dev.   Discrimin.
---------   --------------- ----------  ----------  ----------
q5                 Overall      4.6190      1.4655      0.4674
                  1.0(6.0)      0.2857      0.4629      0.2339
                  2.0(5.0)      0.3333      0.4830      0.1861
```

	3.0(4.0)	0.2857	0.4629	-0.1898
	4.0(3.0)	0.0000	0.0000	NaN
	5.0(2.0)	0.0476	0.2182	-0.4377
	6.0(1.0)	0.0000	0.0000	NaN
	7.0(0.0)	0.0476	0.2182	-0.3293

Item	Option (Score)	Difficulty	Std. Dev.	Discrimin.
q6	Overall	4.9048	0.8309	0.6146
	1.0(0.0)	0.0000	0.0000	NaN
	2.0(1.0)	0.0000	0.0000	NaN
	3.0(2.0)	0.0000	0.0000	NaN
	4.0(3.0)	0.0476	0.2182	-0.3474
	5.0(4.0)	0.2381	0.4364	-0.3217
	6.0(5.0)	0.4762	0.5118	-0.1835
	7.0(6.0)	0.2381	0.4364	0.6029

Item	Option (Score)	Difficulty	Std. Dev.	Discrimin.
q7	Overall	3.0952	2.1191	0.5574
	1.0(6.0)	0.1905	0.4024	0.5374
	2.0(5.0)	0.1905	0.4024	-0.0080
	3.0(4.0)	0.0000	0.0000	NaN
	4.0(3.0)	0.1429	0.3586	0.1680
	5.0(2.0)	0.1905	0.4024	-0.1168
	6.0(1.0)	0.1905	0.4024	-0.3419
	7.0(0.0)	0.0952	0.3008	-0.4999

Item	Option (Score)	Difficulty	Std. Dev.	Discrimin.
q8	Overall	3.2381	2.3217	0.0611
	1.0(6.0)	0.2381	0.4364	0.0870
	2.0(5.0)	0.1429	0.3586	0.0000
	3.0(4.0)	0.1429	0.3586	0.0446
	4.0(3.0)	0.0952	0.3008	-0.0013
	5.0(2.0)	0.0476	0.2182	0.2741
	6.0(1.0)	0.1429	0.3586	-0.1774
	7.0(0.0)	0.1905	0.4024	-0.2933

Item	Option (Score)	Difficulty	Std. Dev.	Discrimin.
q9	Overall	3.5714	1.8048	0.1071
	1.0(0.0)	0.0000	0.0000	NaN
	2.0(1.0)	0.1429	0.3586	0.0782
	3.0(2.0)	0.2381	0.4364	-0.3753
	4.0(3.0)	0.0952	0.3008	-0.2258
	5.0(4.0)	0.1429	0.3586	0.0894
	6.0(5.0)	0.1905	0.4024	0.1215
	7.0(6.0)	0.1905	0.4024	0.1416

Item	Option (Score)	Difficulty	Std. Dev.	Discrimin.
q10	Overall	3.3333	2.0083	-0.3460
	1.0(0.0)	0.1905	0.4024	0.1817
	2.0(1.0)	0.0476	0.2182	-0.0931
	3.0(2.0)	0.0476	0.2182	-0.3474
	4.0(3.0)	0.0952	0.3008	0.2661

	5.0(4.0)	0.2381	0.4364	-0.0505
	6.0(5.0)	0.3333	0.4830	-0.0055
	7.0(6.0)	0.0476	0.2182	-0.4377

Item	Option (Score)	Difficulty	Std. Dev.	Discrimin.
q11	Overall	4.6190	1.4310	0.6060
	1.0(6.0)	0.2857	0.4629	0.5001
	2.0(5.0)	0.3333	0.4830	0.0028
	3.0(4.0)	0.2381	0.4364	-0.2228
	4.0(3.0)	0.0952	0.3008	-0.3176
	5.0(2.0)	0.0000	0.0000	NaN
	6.0(1.0)	0.0000	0.0000	NaN
	7.0(0.0)	0.0476	0.2182	-0.4377

Item	Option (Score)	Difficulty	Std. Dev.	Discrimin.
q12	Overall	4.2381	1.3381	0.2735
	1.0(6.0)	0.1905	0.4024	0.2623
	2.0(5.0)	0.2381	0.4364	0.0227
	3.0(4.0)	0.3333	0.4830	-0.2351
	4.0(3.0)	0.1429	0.3586	0.1118
	5.0(2.0)	0.0476	0.2182	-0.0383
	6.0(1.0)	0.0476	0.2182	-0.4377
	7.0(0.0)	0.0000	0.0000	NaN

Item	Option (Score)	Difficulty	Std. Dev.	Discrimin.
q13	Overall	4.7619	1.0443	0.4749
	1.0(6.0)	0.1905	0.4024	0.3433
	2.0(5.0)	0.5714	0.5071	-0.0853
	3.0(4.0)	0.0952	0.3008	0.1989
	4.0(3.0)	0.0952	0.3008	-0.3568
	5.0(2.0)	0.0476	0.2182	-0.4377
	6.0(1.0)	0.0000	0.0000	NaN
	7.0(0.0)	0.0000	0.0000	NaN

Item	Option (Score)	Difficulty	Std. Dev.	Discrimin.
q14	Overall	4.1905	1.4703	0.2892
	1.0(6.0)	0.1429	0.3586	0.4287
	2.0(5.0)	0.3810	0.4976	-0.1525
	3.0(4.0)	0.1905	0.4024	-0.1759
	4.0(3.0)	0.1905	0.4024	0.0516
	5.0(2.0)	0.0476	0.2182	0.0349
	6.0(1.0)	0.0000	0.0000	NaN
	7.0(0.0)	0.0476	0.2182	-0.4377

Item	Option (Score)	Difficulty	Std. Dev.	Discrimin.
q15	Overall	2.3333	2.4563	-0.3806
	1.0(0.0)	0.2381	0.4364	0.4037
	2.0(2.0)	0.1429	0.3586	-0.0223
	3.0(4.0)	0.0000	0.0000	NaN
	4.0(6.0)	0.2381	0.4364	-0.1233
	5.0(4.0)	0.0476	0.2182	-0.3293
	6.0(3.0)	0.1429	0.3586	-0.0334

	7.0(0.0)	0.1905	0.4024	-0.2347

Item	Option (Score)	Difficulty	Std. Dev.	Discrimin.
q16	Overall	4.2857	2.7775	0.4855
	1.0(0.0)	0.2857	0.4629	-0.6666
	2.0(6.0)	0.7143	0.4629	0.6235
	3.0(0.0)	0.0000	0.0000	NaN
	4.0(0.0)	0.0000	0.0000	NaN

Item	Option (Score)	Difficulty	Std. Dev.	Discrimin.
q17	Overall	3.7143	2.1010	-0.0353
	1.0(0.0)	0.0952	0.3008	0.1053
	2.0(3.0)	0.4762	0.5118	-0.3668
	3.0(6.0)	0.3810	0.4976	0.2262
	4.0(0.0)	0.0476	0.2182	-0.0200

Item	Option (Score)	Difficulty	Std. Dev.	Discrimin.
q18	Overall	0.0000	0.0000	NaN
	1.0(0.0)	0.0476	0.2182	-0.3293
	2.0(0.0)	0.0000	0.0000	NaN
	3.0(0.0)	0.9524	0.2182	0.2979
	4.0(6.0)	0.0000	0.0000	NaN

Item	Option (Score)	Difficulty	Std. Dev.	Discrimin.
q19	Overall	3.4286	3.0426	0.1036
	1.0(0.0)	0.2381	0.4364	-0.1686
	2.0(6.0)	0.5714	0.5071	0.3044
	3.0(0.0)	0.1429	0.3586	-0.1553
	4.0(0.0)	0.0476	0.2182	-0.3293

Item	Option (Score)	Difficulty	Std. Dev.	Discrimin.
q20	Overall	3.4286	3.0426	0.0696
	1.0(0.0)	0.1905	0.4024	-0.2835
	2.0(0.0)	0.2381	0.4364	-0.1596
	3.0(6.0)	0.5714	0.5071	0.2721
	4.0(3.0)	0.0000	0.0000	NaN
	5.0(0.0)	0.0000	0.0000	NaN

Item	Option (Score)	Difficulty	Std. Dev.	Discrimin.
q21	Overall	0.2857	1.3093	-0.0705
	1.0(0.0)	0.9524	0.2182	-0.0514
	2.0(6.0)	0.0476	0.2182	0.0166

Item	Option (Score)	Difficulty	Std. Dev.	Discrimin.
q22	Overall	4.0000	2.8983	0.0516
	1.0(0.0)	0.3333	0.4830	-0.3161
	2.0(6.0)	0.6667	0.4830	0.2450

TEST LEVEL STATISTICS

==

Number of Items = 22

Number of Examinees = 21

Min = 57.0000

Max = 105.0000

Mean = 80.1429

Median = 80.0000

Standard Deviation = 12.5191

Interquartile Range = 15.0000

Skewness = -0.0988

Kurtosis = -0.2815

KR21 = 2.4634

Appendix F: Regression Item Analysis for All Items

Class A

Item 1

Case	ZRE_1	SRE_1	SDR_1	COO_1	LEV_1	DFB0_1	DFB1_1	SDB0_1	SDB1_1
1	-2.11717	-2.16455	-2.36205	0.10605	0.00485	-9.05058	1.16782	-0.24224	0.16810
2	-1.82657	-1.88697	-2.00169	0.11969	0.02453	9.77260	-2.31456	0.25427	-0.32388
3	-1.82657	-1.88697	-2.00169	0.11969	0.02453	9.77260	-2.31456	0.25427	-0.32388
4	-1.32920	-1.37315	-1.40038	0.06338	0.02453	7.11154	-1.68431	0.17789	-0.22658
5	-1.41301	-1.51142	-1.55548	0.16464	0.08752	-21.32842	3.62583	-0.53839	0.49223
6	-0.73235	-0.75657	-0.74963	0.01924	0.02453	3.91826	-0.92801	0.09522	-0.12129
7	-0.23498	-0.24275	-0.23793	0.00198	0.02453	1.25720	-0.29776	0.03022	-0.03850
8	0.85924	0.88765	0.88359	0.02649	0.02453	-4.59715	1.08880	-0.11224	0.14297
9	-0.03603	-0.03722	-0.03644	0.00005	0.02453	0.19277	-0.04566	0.00463	-0.00590
10	0.16292	0.16831	0.16486	0.00095	0.02453	-0.87166	0.20644	-0.02094	0.02667
11	-0.11984	-0.12819	-0.12553	0.00118	0.08752	-1.80890	0.30751	-0.04345	0.03972
12	0.66029	0.68213	0.67433	0.01564	0.02453	-3.53272	0.83670	-0.08566	0.10911
13	0.56865	0.58138	0.57319	0.00765	0.00485	2.43090	-0.31366	0.05878	-0.04079
14	0.27806	0.29742	0.29170	0.00638	0.08752	4.19711	-0.71351	0.10096	-0.09231
15	-0.03603	-0.03722	-0.03644	0.00005	0.02453	0.19277	-0.04566	0.00463	-0.00590
16	-0.12767	-0.13053	-0.12783	0.00039	0.00485	-0.54578	0.07042	-0.01311	0.00910
17	-0.12767	-0.13053	-0.12783	0.00039	0.00485	-0.54578	0.07042	-0.01311	0.00910
18	0.75977	0.78489	0.77842	0.02071	0.02453	-4.06493	0.96275	-0.09888	0.12595
19	0.56865	0.58138	0.57319	0.00765	0.00485	2.43090	-0.31366	0.05878	-0.04079
20	0.28589	0.34443	0.33801	0.02678	0.27256	9.25159	-1.64229	0.22269	-0.21260
21	0.86707	0.88648	0.88238	0.01779	0.00485	3.70662	-0.47827	0.09049	-0.06280
22	1.15767	1.19595	1.20729	0.04808	0.02453	-6.19378	1.46695	-0.15336	0.19534

23	1.15767	1.19595	1.20729	0.04808	0.02453	-6.19378	1.46695	-0.15336	0.19534
24	0.86707	0.88648	0.88238	0.01779	0.00485	3.70662	-0.47827	0.09049	-0.06280
25	0.57648	0.61663	0.60849	0.02740	0.08752	8.70162	-1.47927	0.21061	-0.19255
26	1.15767	1.19595	1.20729	0.04808	0.02453	-6.19378	1.46695	-0.15336	0.19534

Item 2

Case	ZRE_2	SRE_2	SDR_2	COO_2	LEV_2	DFB0_2	DFB1_2	SDB0_2	SDB1_2
1	-1.89322	-1.94253	-2.07143	0.09956	0.01166	1.22412	-0.89769	0.07067	-0.22954
2	-1.89322	-1.94253	-2.07143	0.09956	0.01166	1.22412	-0.89769	0.07067	-0.22954
3	-1.67294	-1.75757	-1.84328	0.16022	0.05552	5.21667	-1.81449	0.29621	-0.45631
4	-1.38313	-1.41915	-1.45151	0.05314	0.01166	0.89430	-0.65582	0.04952	-0.16084
5	-1.09331	-1.11518	-1.12114	0.02513	0.00039	-1.81641	0.09315	-0.09887	0.02246
6	-0.99129	-1.01112	-1.01162	0.02066	0.00039	-1.64691	0.08446	-0.08921	0.02026
7	-0.04065	-0.04271	-0.04181	0.00009	0.05552	0.12677	-0.04409	0.00672	-0.01035
8	0.64100	0.65383	0.64584	0.00864	0.00039	1.06495	-0.05461	0.05695	-0.01294
9	-0.49743	-0.51311	-0.50508	0.00842	0.02169	-2.01539	0.32506	-0.10741	0.07673
10	-0.73394	-0.82083	-0.81507	0.08448	0.16204	-7.55507	1.54108	-0.40617	0.36694
11	0.01266	0.01306	0.01278	0.00001	0.02169	0.05128	-0.00827	0.00272	-0.00194
12	0.21669	0.22352	0.21904	0.00160	0.02169	0.87794	-0.14160	0.04658	-0.03327
13	0.86127	0.88371	0.87953	0.02061	0.01166	-0.55688	0.40838	-0.03001	0.09746
14	0.64100	0.65383	0.64584	0.00864	0.00039	1.06495	-0.05461	0.05695	-0.01294
15	-0.05689	-0.05837	-0.05715	0.00009	0.01166	0.03678	-0.02697	0.00195	-0.00633
16	0.36742	0.38601	0.37906	0.00773	0.05552	-1.14571	0.39851	-0.06091	0.09384
17	0.36742	0.38601	0.37906	0.00773	0.05552	-1.14571	0.39851	-0.06091	0.09384
18	0.53898	0.54977	0.54161	0.00611	0.00039	0.89546	-0.04592	0.04776	-0.01085
19	0.42073	0.43398	0.42652	0.00603	0.02169	1.70461	-0.27494	0.09070	-0.06479
20	0.06597	0.07997	0.07830	0.00150	0.28109	1.01220	-0.21435	0.05366	-0.05032
21	1.16733	1.19773	1.20921	0.03785	0.01166	-0.75477	0.55350	-0.04126	0.13399

22	0.72678	0.74968	0.74264	0.01798	0.02169	2.94461	-0.47494	0.15793	-0.11282
23	1.38760	1.45780	1.49482	0.11023	0.05552	-4.32690	1.50501	-0.24021	0.37005
24	0.72678	0.74968	0.74264	0.01798	0.02169	2.94461	-0.47494	0.15793	-0.11282
25	0.72678	0.74968	0.74264	0.01798	0.02169	2.94461	-0.47494	0.15793	-0.11282
26	1.38760	1.45780	1.49482	0.11023	0.05552	-4.32690	1.50501	-0.24021	0.37005

Item 3

Case	ZRE_3	SRE_3	SDR_3	COO_3	LEV_3	DFB0_3	DFB1_3	SDB0_3	SDB1_3
1	-1.89086	-1.94308	-2.07213	0.10572	0.01457	9.30909	-2.58586	0.19866	-0.25702
2	-2.14199	-2.22805	-2.44908	0.20345	0.03730	-25.21113	4.80212	-0.55456	0.49197
3	-1.89086	-1.94308	-2.07213	0.10572	0.01457	9.30909	-2.58586	0.19866	-0.25702
4	-1.40337	-1.44213	-1.47722	0.05823	0.01457	6.90909	-1.91919	0.14162	-0.18323
5	-0.91588	-0.94118	-0.93885	0.02480	0.01457	4.50909	-1.25253	0.09001	-0.11645
6	-0.81839	-0.84099	-0.83569	0.01980	0.01457	4.02909	-1.11919	0.08012	-0.10365
7	-0.58203	-0.60541	-0.59725	0.01502	0.03730	-6.85047	1.30485	-0.13524	0.11998
8	0.74157	0.76205	0.75520	0.01626	0.01457	-3.65091	1.01414	-0.07240	0.09367
9	-0.38704	-0.40258	-0.39545	0.00664	0.03730	-4.55539	0.86769	-0.08954	0.07944
10	-0.19204	-0.19976	-0.19571	0.00164	0.03730	-2.26031	0.43053	-0.04432	0.03931
11	0.35158	0.36129	0.35465	0.00365	0.01457	-1.73091	0.48081	-0.03400	0.04399
12	0.54658	0.56167	0.55350	0.00883	0.01457	-2.69091	0.74747	-0.05306	0.06865
13	0.74157	0.76205	0.75520	0.01626	0.01457	-3.65091	1.01414	-0.07240	0.09367
14	0.49044	0.51015	0.50213	0.01067	0.03730	5.77248	-1.09952	0.11370	-0.10087
15	0.11522	0.13108	0.12836	0.00253	0.18881	-3.01248	0.69519	-0.05904	0.06345
16	-0.19204	-0.19976	-0.19571	0.00164	0.03730	-2.26031	0.43053	-0.04432	0.03931
17	0.05909	0.06072	0.05945	0.00010	0.01457	-0.29091	0.08081	-0.00570	0.00737
18	0.64407	0.66186	0.65392	0.01227	0.01457	-3.17091	0.88081	-0.06269	0.08111
19	0.49044	0.51015	0.50213	0.01067	0.03730	5.77248	-1.09952	0.11370	-0.10087
20	1.03406	1.06262	1.06562	0.03162	0.01457	-5.09091	1.41414	-0.10216	0.13217

21	1.03406	1.06262	1.06562	0.03162	0.01457	-5.09091	1.41414	-0.10216	0.13217
22	0.53180	0.63357	0.62549	0.08417	0.25699	19.94135	-4.10557	0.39396	-0.37777
23	1.03406	1.06262	1.06562	0.03162	0.01457	-5.09091	1.41414	-0.10216	0.13217
24	1.03406	1.06262	1.06562	0.03162	0.01457	-5.09091	1.41414	-0.10216	0.13217
25	0.78293	0.81439	0.80849	0.02718	0.03730	9.21510	-1.75526	0.18307	-0.16241
26	0.78293	0.81439	0.80849	0.02718	0.03730	9.21510	-1.75526	0.18307	-0.16241

Item 4

Case	ZRE_4	SRE_4	SDR_4	COO_4	LEV_4	DFB0_4	DFB1_4	SDB0_4	SDB1_4
1	-1.93330	-2.00517	-2.15885	0.15225	0.03040	-14.51920	2.36838	-0.47565	0.39042
2	-2.01877	-2.06064	-2.23188	0.08899	0.00023	-1.87461	-0.20829	-0.06178	-0.03454
3	-2.10424	-2.19609	-2.41600	0.21510	0.04190	11.91551	-3.06399	0.39887	-0.51611
4	-1.44966	-1.50355	-1.54858	0.08561	0.03040	-10.88705	1.77590	-0.34119	0.28005
5	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
6	-0.95477	-0.97457	-0.97346	0.01991	0.00023	-0.88659	-0.09851	-0.02695	-0.01507
7	-0.55660	-0.58089	-0.57234	0.01505	0.04190	3.15181	-0.81047	0.09449	-0.12226
8	0.50740	0.52955	0.52110	0.01251	0.04190	-2.87323	0.73883	-0.08603	0.11132
9	-0.27767	-0.28343	-0.27769	0.00168	0.00023	-0.25785	-0.02865	-0.00769	-0.00430
10	0.08672	0.09533	0.09325	0.00095	0.13241	1.36973	-0.24904	0.04077	-0.03730
11	0.29143	0.30227	0.29621	0.00346	0.03040	2.18868	-0.35702	0.06526	-0.05357
12	0.31395	0.32765	0.32120	0.00479	0.04190	-1.77776	0.45714	-0.05303	0.06861
13	0.67834	0.70356	0.69562	0.01874	0.03040	5.09440	-0.83100	0.15326	-0.12580
14	0.67834	0.70356	0.69562	0.01874	0.03040	5.09440	-0.83100	0.15326	-0.12580
15	-0.27767	-0.28343	-0.27769	0.00168	0.00023	-0.25785	-0.02865	-0.00769	-0.00430
16	-0.16969	-0.17710	-0.17332	0.00140	0.04190	0.96089	-0.24709	0.02861	-0.03703
17	0.08672	0.09533	0.09325	0.00095	0.13241	1.36973	-0.24904	0.04077	-0.03730
18	0.49615	0.50644	0.49809	0.00538	0.00023	0.46072	0.05119	0.01379	0.00771
19	0.50740	0.52955	0.52110	0.01251	0.04190	-2.87323	0.73883	-0.08603	0.11132

20	1.05400	1.15860	1.16772	0.13983	0.13241	16.64751	-3.02682	0.51054	-0.46709
21	0.79758	0.83240	0.82665	0.03090	0.04190	-4.51642	1.16136	-0.13648	0.17659
22	0.79758	0.83240	0.82665	0.03090	0.04190	-4.51642	1.16136	-0.13648	0.17659
23	0.96853	1.00453	1.00474	0.03821	0.03040	7.27369	-1.18649	0.22137	-0.18170
24	0.79758	0.83240	0.82665	0.03090	0.04190	-4.51642	1.16136	-0.13648	0.17659
25	0.88305	0.90137	0.89755	0.01703	0.00023	0.82000	0.09111	0.02485	0.01389
26	0.79758	0.83240	0.82665	0.03090	0.04190	-4.51642	1.16136	-0.13648	0.17659

Item 5

Case	ZRE_5	SRE_5	SDR_5	COO_5	LEV_5	DFB0_5	DFB1_5	SDB0_5	SDB1_5
1	-2.02542	-2.06821	-2.24194	0.09132	0.00095	-4.13453	0.28846	-0.22405	0.07060
2	-1.96824	-2.01888	-2.17678	0.10622	0.00954	0.94282	-0.89568	0.05082	-0.21806
3	-1.91107	-2.00461	-2.15812	0.20151	0.05115	6.03127	-2.10616	0.32460	-0.51198
4	-1.54184	-1.57441	-1.63015	0.05292	0.00095	-3.14739	0.21959	-0.16291	0.05134
5	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
6	-0.90437	-0.92763	-0.92471	0.02242	0.00954	0.43320	-0.41154	0.02159	-0.09263
7	-0.36361	-0.38141	-0.37421	0.00729	0.05115	1.14755	-0.40073	0.05629	-0.08877
8	0.41440	0.46722	0.45914	0.02960	0.17334	4.84469	-0.97134	0.23800	-0.21553
9	-0.28453	-0.29054	-0.28467	0.00180	0.00095	-0.58081	0.04052	-0.02845	0.00896
10	-0.14827	-0.15337	-0.15007	0.00082	0.02539	-0.69338	0.11195	-0.03392	0.02474
11	0.19905	0.20326	0.19897	0.00088	0.00095	0.40633	-0.02835	0.01988	-0.00627
12	0.33531	0.34684	0.34011	0.00421	0.02539	1.56810	-0.25318	0.07687	-0.05606
13	0.58592	0.59830	0.58975	0.00764	0.00095	1.19605	-0.08345	0.05894	-0.01857
14	0.70027	0.73454	0.72697	0.02706	0.05115	-2.21001	0.77175	-0.10934	0.17246
15	-0.39887	-0.42589	-0.41818	0.01270	0.08285	-3.08485	0.57970	-0.15143	0.12852
16	-0.09109	-0.09302	-0.09099	0.00018	0.00095	-0.18595	0.01297	-0.00909	0.00287
17	-0.14827	-0.15337	-0.15007	0.00082	0.02539	-0.69338	0.11195	-0.03392	0.02474
18	0.48920	0.49954	0.49123	0.00533	0.00095	0.99862	-0.06967	0.04909	-0.01547

19	0.70027	0.73454	0.72697	0.02706	0.05115	-2.21001	0.77175	-0.10934	0.17246
20	0.64737	0.79497	0.78840	0.16051	0.29686	11.33366	-2.35562	0.56191	-0.52749
21	0.99041	1.03889	1.04077	0.05412	0.05115	-3.12571	1.09152	-0.15654	0.24690
22	0.99041	1.03889	1.04077	0.05412	0.05115	-3.12571	1.09152	-0.15654	0.24690
23	0.93324	0.95725	0.95544	0.02388	0.00954	-0.44704	0.42468	-0.02231	0.09571
24	0.93324	0.95725	0.95544	0.02388	0.00954	-0.44704	0.42468	-0.02231	0.09571
25	0.93324	0.95725	0.95544	0.02388	0.00954	-0.44704	0.42468	-0.02231	0.09571
26	0.93324	0.95725	0.95544	0.02388	0.00954	-0.44704	0.42468	-0.02231	0.09571

Item 6

Case	ZRE_6	SRE_6	SDR_6	COO_6	LEV_6	DFB0_6	DFB1_6	SDB0_6	SDB1_6
1	-1.90685	-2.04677	-2.22248	0.31867	0.09038	-16.61528	3.17910	-0.83901	0.71717
2	-2.01052	-2.12064	-2.32285	0.25306	0.05949	7.75597	-2.62604	0.39508	-0.59760
3	-2.01052	-2.12064	-2.32285	0.25306	0.05949	7.75597	-2.62604	0.39508	-0.59760
4	-1.46139	-1.51435	-1.56325	0.08462	0.02706	-7.54064	1.24249	-0.36199	0.26647
5	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
6	-0.89573	-0.92819	-0.92515	0.03179	0.02706	-4.62190	0.76156	-0.21423	0.15770
7	-0.47618	-0.48940	-0.48077	0.00674	0.01162	0.35706	-0.26093	0.01631	-0.05325
8	0.56085	0.57642	0.56747	0.00935	0.01162	-0.42054	0.30732	-0.01925	0.06286
9	-0.23580	-0.24435	-0.23905	0.00220	0.02706	-1.21670	0.20048	-0.05536	0.04075
10	-0.09908	-0.10183	-0.09951	0.00029	0.01162	0.07429	-0.05429	0.00338	-0.01102
11	0.23558	0.24412	0.23883	0.00220	0.02706	1.21558	-0.20029	0.05530	-0.04071
12	0.42413	0.43950	0.43130	0.00713	0.02706	2.18849	-0.36060	0.09987	-0.07352
13	0.66452	0.75849	0.75093	0.08711	0.19077	8.93491	-1.82007	0.41137	-0.37436
14	0.56085	0.57642	0.56747	0.00935	0.01162	-0.42054	0.30732	-0.01925	0.06286
15	-0.28763	-0.29562	-0.28939	0.00246	0.01162	0.21567	-0.15761	0.00982	-0.03205
16	-0.07316	-0.07477	-0.07306	0.00012	0.00080	-0.15646	0.01043	-0.00711	0.00212
17	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!

18	0.49249	0.50330	0.49458	0.00562	0.00080	1.05321	-0.07021	0.04813	-0.01433
19	0.53493	0.56423	0.55529	0.01791	0.05949	-2.06362	0.69870	-0.09445	0.14286
20	0.84368	0.86710	0.86202	0.02116	0.01162	-0.63261	0.46229	-0.02925	0.09548
21	0.84368	0.86710	0.86202	0.02116	0.01162	-0.63261	0.46229	-0.02925	0.09548
22	0.84368	0.86710	0.86202	0.02116	0.01162	-0.63261	0.46229	-0.02925	0.09548
23	0.81776	0.86255	0.85734	0.04187	0.05949	-3.15468	1.06812	-0.14582	0.22057
24	0.86960	0.88867	0.88426	0.01751	0.00080	1.85966	-0.12398	0.08605	-0.02563
25	0.94735	1.08131	1.08569	0.17703	0.19077	12.73772	-2.59472	0.59476	-0.54125
26	0.81776	0.86255	0.85734	0.04187	0.05949	-3.15468	1.06812	-0.14582	0.22057

Item 7

Case	ZRE_7	SRE_7	SDR_7	COO_7	LEV_7	DFB0_7	DFB1_7	SDB0_7	SDB1_7
1	-2.20407	-2.25648	-2.53008	0.12251	0.00243	-1.75866	-0.41873	-0.13383	-0.12780
2	-2.12503	-2.20354	-2.45259	0.18271	0.02651	1.65665	-1.36674	0.12514	-0.41409
3	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
4	-1.68923	-1.72940	-1.82248	0.07196	0.00243	-1.34786	-0.32092	-0.09640	-0.09206
5	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
6	-1.07142	-1.09690	-1.10251	0.02895	0.00243	-0.85490	-0.20355	-0.05832	-0.05569
7	-0.47754	-0.49518	-0.48609	0.00923	0.02651	0.37228	-0.30713	0.02480	-0.08207
8	0.33894	0.36301	0.35538	0.00969	0.08474	2.02957	-0.41578	0.13485	-0.11080
9	-0.27160	-0.28164	-0.27537	0.00298	0.02651	0.21174	-0.17468	0.01405	-0.04649
10	-0.14471	-0.14815	-0.14465	0.00053	0.00243	-0.11547	-0.02749	-0.00765	-0.00731
11	0.08515	0.08726	0.08517	0.00019	0.00411	0.20095	-0.02107	0.01331	-0.00560
12	0.13301	0.14245	0.13909	0.00149	0.08474	0.79643	-0.16316	0.05277	-0.04336
13	0.33894	0.36301	0.35538	0.00969	0.08474	2.02957	-0.41578	0.13485	-0.11080
14	0.49703	0.50929	0.50012	0.00648	0.00411	1.17293	-0.12297	0.07817	-0.03287
15	-0.42969	-0.44029	-0.43168	0.00484	0.00411	-1.01402	0.10631	-0.06747	0.02837
16	-0.38184	-0.40895	-0.40070	0.01230	0.08474	-2.28642	0.46840	-0.15204	0.12493

17	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
18	0.47310	0.48435	0.47534	0.00564	0.00243	0.37749	0.08988	0.02514	0.02401
19	0.73415	0.78253	0.77505	0.04168	0.07634	-1.84446	0.84664	-0.12398	0.22826
20	0.64785	0.69385	0.68503	0.03540	0.08474	3.87928	-0.79471	0.25993	-0.21358
21	0.96401	0.99963	0.99961	0.03760	0.02651	-0.75154	0.62002	-0.05100	0.16877
22	1.04306	1.11179	1.11841	0.08413	0.07634	-2.62054	1.20287	-0.17891	0.32938
23	1.04306	1.11179	1.11841	0.08413	0.07634	-2.62054	1.20287	-0.17891	0.32938
24	0.56880	0.63881	0.62956	0.05332	0.16369	4.81146	-1.06632	0.32182	-0.28606
25	0.96401	0.99963	0.99961	0.03760	0.02651	-0.75154	0.62002	-0.05100	0.16877
26	0.96401	0.99963	0.99961	0.03760	0.02651	-0.75154	0.62002	-0.05100	0.16877

Item 8

Case	ZRE_8	SRE_8	SDR_8	COO_8	LEV_8	DFB0_8	DFB1_8	SDB0_8	SDB1_8
1	-2.21439	-2.26854	-2.54798	0.12738	0.00369	-5.20477	0.53842	-0.38805	0.15860
2	-2.20665	-2.36140	-2.68898	0.40475	0.08329	6.19602	-2.78089	0.46835	-0.83047
3	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
4	-1.70281	-1.74391	-1.84035	0.07429	0.00310	-1.20685	-0.37930	-0.08454	-0.10497
5	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
6	-1.09459	-1.12136	-1.12865	0.03112	0.00369	-2.57276	0.26615	-0.17189	0.07025
7	-0.58301	-0.59708	-0.58770	0.00871	0.00310	-0.41320	-0.12986	-0.02700	-0.03352
8	0.52905	0.56711	0.55773	0.02397	0.08624	3.26275	-0.68072	0.21300	-0.17557
9	-0.37941	-0.38857	-0.38057	0.00369	0.00310	-0.26890	-0.08451	-0.01748	-0.02171
10	-0.18355	-0.19676	-0.19219	0.00289	0.08624	-1.13201	0.23617	-0.07340	0.06050
11	0.12701	0.13012	0.12703	0.00042	0.00369	0.29853	-0.03088	0.01935	-0.00791
12	0.33061	0.33869	0.33144	0.00284	0.00369	0.77708	-0.08039	0.05048	-0.02063
13	0.52905	0.56711	0.55773	0.02397	0.08624	3.26275	-0.68072	0.21300	-0.17557
14	0.53679	0.54975	0.54040	0.00738	0.00310	0.38045	0.11957	0.02482	0.03082
15	-0.38457	-0.39983	-0.39169	0.00647	0.03140	-1.58107	0.28090	-0.10281	0.07217

16	-0.18355	-0.19676	-0.19219	0.00289	0.08624	-1.13201	0.23617	-0.07340	0.06050
17	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
18	0.44015	0.47102	0.46212	0.01610	0.08329	-1.23590	0.55470	-0.08049	0.14272
19	0.54195	0.57996	0.57057	0.02441	0.08329	-1.52174	0.68299	-0.09938	0.17621
20	0.84477	0.87746	0.87246	0.03037	0.02963	-0.80942	0.59827	-0.05342	0.15600
21	0.83703	0.87025	0.86501	0.03065	0.03140	3.44124	-0.61139	0.22706	-0.15937
22	0.84735	0.90678	0.90277	0.05968	0.08329	-2.37927	1.06786	-0.15724	0.27881
23	0.84219	0.86252	0.85705	0.01817	0.00310	0.59690	0.18760	0.03937	0.04889
24	0.84735	0.90678	0.90277	0.05968	0.08329	-2.37927	1.06786	-0.15724	0.27881
25	0.84477	0.87746	0.87246	0.03037	0.02963	-0.80942	0.59827	-0.05342	0.15600
26	0.83445	0.89448	0.89004	0.05963	0.08624	5.14622	-1.07367	0.33991	-0.28018

Item 9

Case	ZRE_9	SRE_9	SDR_9	COO_9	LEV_9	DFB0_9	DFB1_9	SDB0_9	SDB1_9
1	-2.19344	-2.25354	-2.52574	0.14107	0.00915	-0.93933	-0.93933	-0.09000	-0.24827
2	-2.41872	-2.47535	-2.87050	0.14514	0.00175	-4.43228	0.44965	-0.43941	0.12296
3	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
4	-1.20234	-1.32850	-1.35466	0.19492	0.13744	3.34991	-2.30772	0.29203	-0.55492
5	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
6	-0.77898	-0.82014	-0.81351	0.03648	0.05438	0.81011	-0.85390	0.06870	-0.19974
7	-0.23844	-0.25104	-0.24536	0.00342	0.05438	0.24797	-0.26137	0.02072	-0.06024
8	1.17602	1.29943	1.32239	0.18648	0.13744	-3.27659	2.25721	-0.28507	0.54170
9	-0.69807	-0.72608	-0.71765	0.02158	0.03218	-2.33625	0.57449	-0.19741	0.13390
10	-0.48186	-0.50119	-0.49206	0.01028	0.03218	-1.61264	0.39655	-0.13536	0.09181
11	0.29303	0.30106	0.29444	0.00252	0.00915	0.12549	0.12549	0.01049	0.02894
12	0.28396	0.29061	0.28418	0.00200	0.00175	0.52035	-0.05279	0.04350	-0.01217
13	0.27489	0.28592	0.27957	0.00335	0.03218	0.91998	-0.22622	0.07690	-0.05216
14	0.27489	0.28592	0.27957	0.00335	0.03218	0.91998	-0.22622	0.07690	-0.05216

15	-0.24751	-0.25429	-0.24855	0.00180	0.00915	-0.10599	-0.10599	-0.00886	-0.02443
16	-0.48186	-0.50119	-0.49206	0.01028	0.03218	-1.61264	0.39655	-0.13536	0.09181
17	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
18	0.61735	0.63427	0.62499	0.01117	0.00915	0.26438	0.26438	0.02227	0.06143
19	0.72546	0.74533	0.73719	0.01543	0.00915	0.31067	0.31067	0.02627	0.07246
20	0.37393	0.40414	0.39594	0.01373	0.10044	1.93821	-0.58700	0.16234	-0.13562
21	1.27506	1.34244	1.37020	0.09775	0.05438	-1.32602	1.39770	-0.11571	0.33642
22	1.27506	1.34244	1.37020	0.09775	0.05438	-1.32602	1.39770	-0.11571	0.33642
23	0.59921	0.62325	0.61394	0.01590	0.03218	2.00539	-0.49313	0.16888	-0.11455
24	0.37393	0.40414	0.39594	0.01373	0.10044	1.93821	-0.58700	0.16234	-0.13562
25	0.59921	0.62325	0.61394	0.01590	0.03218	2.00539	-0.49313	0.16888	-0.11455
26	0.59921	0.62325	0.61394	0.01590	0.03218	2.00539	-0.49313	0.16888	-0.11455

Item 10

Case	ZRE_10	SRE_10	SDR_10	COO_10	LEV_10	DFB0_10	DFB1_10	SDB0_10	SDB1_10
1	-2.14669	-2.23442	-2.53293	0.20822	0.02937	1.10691	-1.75804	0.08975	-0.45182
2	-2.03420	-2.24436	-2.54825	0.54729	0.13089	-14.62773	3.95157	-1.18788	1.01718
3	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
4	-1.67116	-1.80252	-1.92692	0.26543	0.09282	4.02788	-2.61268	0.30797	-0.63321
5	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
6	-0.98241	-1.01150	-1.01215	0.03074	0.00906	-2.82821	0.43735	-0.20241	0.09922
7	-0.42252	-0.46617	-0.45636	0.02361	0.13089	-3.03830	0.82077	-0.21273	0.18216
8	0.57302	0.59644	0.58604	0.01484	0.02937	-0.29547	0.46928	-0.02076	0.10454
9	-0.24918	-0.26264	-0.25610	0.00382	0.05221	-1.19349	0.27900	-0.08324	0.06168
10	-0.16021	-0.17281	-0.16833	0.00244	0.09282	0.38615	-0.25048	0.02690	-0.05532
11	0.19822	0.20327	0.19807	0.00107	0.00145	0.23343	0.03502	0.01627	0.00774
12	0.39968	0.40986	0.40071	0.00433	0.00145	0.47068	0.07060	0.03291	0.01565
13	0.62926	0.64789	0.63770	0.01261	0.00906	1.81155	-0.28014	0.12753	-0.06251

14	0.57302	0.59644	0.58604	0.01484	0.02937	-0.29547	0.46928	-0.02076	0.10454
15	-0.33355	-0.34718	-0.33900	0.00503	0.02937	0.17199	-0.27316	0.01201	-0.06047
16	-0.07585	-0.07809	-0.07602	0.00018	0.00906	-0.21835	0.03377	-0.01520	0.00745
17	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
18	0.50041	0.51316	0.50297	0.00679	0.00145	0.58931	0.08840	0.04131	0.01964
19	0.60114	0.61646	0.60611	0.00980	0.00145	0.70793	0.10619	0.04978	0.02367
20	0.81896	0.93906	0.93599	0.13880	0.19181	-3.94908	2.08005	-0.28153	0.47004
21	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
22	0.98770	1.08974	1.09546	0.12903	0.13089	7.10245	-1.91867	0.51066	-0.43727
23	0.93145	0.95903	0.95690	0.02763	0.00906	2.68150	-0.41467	0.19136	-0.09380
24	0.93145	0.95903	0.95690	0.02763	0.00906	2.68150	-0.41467	0.19136	-0.09380
25	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
26	0.93145	0.95903	0.95690	0.02763	0.00906	2.68150	-0.41467	0.19136	-0.09380

Item 11

Case	ZRE_11	SRE_11	SDR_11	COO_11	LEV_11	DFB0_11	DFB1_11	SDB0_11	SDB1_11
1	-2.09960	-2.15150	-2.40787	0.11584	0.00004	-3.24058	-0.06895	-0.18211	-0.01646
2	-2.02568	-2.17164	-2.43781	0.35206	0.08229	8.66425	-3.13078	0.48837	-0.74969
3	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
4	-1.71241	-1.93730	-2.10495	0.52526	0.17107	-20.28881	4.24968	-1.10691	0.98497
5	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
6	-1.00386	-1.02867	-1.03034	0.02648	0.00004	-1.54938	-0.03297	-0.07792	-0.00704
7	-0.43187	-0.46299	-0.45321	0.01600	0.08229	1.84721	-0.66748	0.09079	-0.13937
8	0.66387	0.71170	0.70214	0.03781	0.08229	-2.83951	1.02604	-0.14066	0.21593
9	-0.26961	-0.27944	-0.27255	0.00290	0.02154	0.32609	-0.19928	0.01597	-0.04146
10	-0.14430	-0.14926	-0.14537	0.00078	0.01780	-0.62773	0.09657	-0.03070	0.02006
11	0.11758	0.12551	0.12222	0.00110	0.07481	0.89251	-0.17180	0.04364	-0.03568
12	0.42768	0.44329	0.43371	0.00730	0.02154	-0.51728	0.31612	-0.02541	0.06598

13	0.58995	0.60453	0.59415	0.00915	0.00004	0.91055	0.01937	0.04494	0.00406
14	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
15	-0.34352	-0.35534	-0.34702	0.00442	0.01780	-1.49439	0.22991	-0.07328	0.04789
16	-0.10734	-0.10999	-0.10709	0.00030	0.00004	-0.16567	-0.00352	-0.00810	-0.00073
17	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
18	0.52730	0.54653	0.53619	0.01110	0.02154	-0.63777	0.38975	-0.03142	0.08156
19	0.66387	0.71170	0.70214	0.03781	0.08229	-2.83951	1.02604	-0.14066	0.21593
20	0.85183	0.88114	0.87572	0.02717	0.01780	3.70561	-0.57009	0.18492	-0.12086
21	0.92575	0.95952	0.95742	0.03420	0.02154	-1.11969	0.68426	-0.05610	0.14564
22	0.81487	0.86986	0.86404	0.05278	0.07481	6.18537	-1.19061	0.30850	-0.25227
23	0.92575	0.95952	0.95742	0.03420	0.02154	-1.11969	0.68426	-0.05610	0.14564
24	0.77791	0.88007	0.87461	0.10840	0.17107	9.21677	-1.93054	0.45992	-0.40926
25	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
26	0.85183	0.88114	0.87572	0.02717	0.01780	3.70561	-0.57009	0.18492	-0.12086

Item 12

Case	ZRE_12	SRE_12	SDR_12	COO_12	LEV_12	DFB0_12	DFB1_12	SDB0_12	SDB1_12
1	-2.14417	-2.20497	-2.48796	0.13981	0.00677	1.85767	-1.19422	0.06950	-0.21047
2	-2.22832	-2.37920	-2.76375	0.39624	0.07519	16.35205	-4.45965	0.62982	-0.80914
3	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
4	-1.47620	-1.59053	-1.66275	0.20352	0.09098	-17.85067	3.30939	-0.61875	0.54037
5	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
6	-0.96076	-0.99076	-0.99025	0.03113	0.01203	-4.90268	0.71747	-0.16247	0.11200
7	-0.62940	-0.67202	-0.66201	0.03161	0.07519	4.61871	-1.25965	0.15086	-0.19382
8	0.72232	0.77826	0.76988	0.04873	0.09098	8.73453	-1.61932	0.28649	-0.25020
9	-0.09292	-0.11037	-0.10746	0.00250	0.24361	-2.10208	0.41428	-0.06786	0.06300
10	-0.06136	-0.06328	-0.06160	0.00013	0.01203	-0.31313	0.04582	-0.01011	0.00697
11	0.32259	0.34757	0.33938	0.00972	0.09098	3.90086	-0.72319	0.12629	-0.11029

12	0.35415	0.36419	0.35572	0.00381	0.00677	-0.30683	0.19725	-0.00994	0.03009
13	0.63817	0.65810	0.64797	0.01374	0.01203	3.25652	-0.47656	0.10631	-0.07329
14	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
15	-0.26123	-0.26939	-0.26270	0.00230	0.01203	-1.33303	0.19508	-0.04310	0.02971
16	-0.14552	-0.14964	-0.14574	0.00064	0.00677	0.12607	-0.08105	0.00407	-0.01233
17	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
18	0.45408	0.46696	0.45713	0.00627	0.00677	-0.39341	0.25290	-0.01277	0.03867
19	0.46986	0.50167	0.49156	0.01762	0.07519	-3.44795	0.94035	-0.11202	0.14391
20	0.85381	0.87802	0.87249	0.02217	0.00677	-0.73973	0.47554	-0.02437	0.07381
21	0.85381	0.87802	0.87249	0.02217	0.00677	-0.73973	0.47554	-0.02437	0.07381
22	0.76966	0.82177	0.81446	0.04727	0.07519	-5.64795	1.54035	-0.18560	0.23845
23	0.76966	0.82177	0.81446	0.04727	0.07519	-5.64795	1.54035	-0.18560	0.23845
24	0.93796	0.96726	0.96553	0.02967	0.01203	4.78638	-0.70045	0.15842	-0.10921
25	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
26	0.85381	0.87802	0.87249	0.02217	0.00677	-0.73973	0.47554	-0.02437	0.07381

Item 13

Case	ZRE_13	SRE_13	SDR_13	COO_13	LEV_13	DFB0_13	DFB1_13	SDB0_13	SDB1_13
1	-2.22013	-2.28072	-2.60492	0.14388	0.00480	-11.73427	1.54398	-0.26629	0.18540
2	-1.93105	-2.03187	-2.23540	0.22117	0.04916	20.28802	-4.50845	0.44348	-0.52148
3	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
4	-1.42115	-1.49535	-1.54949	0.11979	0.04916	14.93088	-3.31797	0.30740	-0.36147
5	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
6	-0.80927	-0.85152	-0.84509	0.03884	0.04916	8.50230	-1.88940	0.16766	-0.19715
7	-0.29936	-0.31499	-0.30739	0.00532	0.04916	3.14516	-0.69892	0.06098	-0.07171
8	0.53334	0.54790	0.53755	0.00830	0.00480	2.81892	-0.37091	0.05495	-0.03826
9	-0.67357	-0.74266	-0.73358	0.05948	0.12980	-15.97249	2.80598	-0.31348	0.29140
10	-0.18052	-0.18545	-0.18067	0.00095	0.00480	-0.95413	0.12554	-0.01847	0.01286

11	-0.16366	-0.18045	-0.17579	0.00351	0.12980	-3.88098	0.68179	-0.07512	0.06983
12	0.61846	0.65075	0.64057	0.02269	0.04916	-6.49770	1.44393	-0.12708	0.14944
13	0.53334	0.54790	0.53755	0.00830	0.00480	2.81892	-0.37091	0.05495	-0.03826
14	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
15	-0.38448	-0.39497	-0.38603	0.00432	0.00480	-2.03214	0.26739	-0.03946	0.02748
16	-0.18052	-0.18545	-0.18067	0.00095	0.00480	-0.95413	0.12554	-0.01847	0.01286
17	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
18	0.72044	0.75806	0.74926	0.03078	0.04916	-7.56912	1.68203	-0.14864	0.17479
19	0.53334	0.54790	0.53755	0.00830	0.00480	2.81892	-0.37091	0.05495	-0.03826
20	0.55020	0.60664	0.59627	0.03969	0.12980	13.04712	-2.29206	0.25480	-0.23686
21	0.55020	0.60664	0.59627	0.03969	0.12980	13.04712	-2.29206	0.25480	-0.23686
22	1.12837	1.18728	1.20102	0.07552	0.04916	-11.85484	2.63441	-0.23827	0.28018
23	0.83928	0.86219	0.85610	0.02056	0.00480	4.43594	-0.58368	0.08752	-0.06093
24	1.12837	1.18728	1.20102	0.07552	0.04916	-11.85484	2.63441	-0.23827	0.28018
25	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
26	1.12837	1.18728	1.20102	0.07552	0.04916	-11.85484	2.63441	-0.23827	0.28018

Item 14

Case	ZRE_14	SRE_14	SDR_14	COO_14	LEV_14	DFB0_14	DFB1_14	SDB0_14	SDB1_14
1	-2.09924	-2.15112	-2.40731	0.11576	0.00003	-3.71421	0.04952	-0.23528	0.01395
2	-2.15511	-2.27338	-2.59341	0.29142	0.05372	5.11845	-2.20901	0.33051	-0.63410
3	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
4	-1.48963	-1.75374	-1.86454	0.59367	0.23090	-19.25051	3.94287	-1.15849	1.05481
5	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
6	-1.05978	-1.11794	-1.12578	0.07047	0.05372	2.51700	-1.08629	0.14347	-0.27526
7	-0.56190	-0.59274	-0.58234	0.01981	0.05372	1.33453	-0.57595	0.07421	-0.14238
8	0.56137	0.57913	0.56873	0.01078	0.01278	-0.13423	0.26846	-0.00746	0.06634
9	-0.27895	-0.28818	-0.28111	0.00280	0.01547	-1.07024	0.14716	-0.05909	0.03612

10	-0.10773	-0.11039	-0.10748	0.00030	0.00003	-0.19061	0.00254	-0.01050	0.00062
11	0.21893	0.22618	0.22045	0.00172	0.01547	0.83998	-0.11550	0.04634	-0.02833
12	0.44602	0.47191	0.46204	0.01330	0.05909	2.74832	-0.48236	0.15231	-0.11884
13	0.53343	0.56271	0.55232	0.01785	0.05372	-1.26691	0.54677	-0.07039	0.13504
14	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
15	-0.25101	-0.26558	-0.25898	0.00421	0.05909	-1.54670	0.27146	-0.08537	0.06661
16	-0.13566	-0.13996	-0.13629	0.00063	0.01278	0.03244	-0.06488	0.00179	-0.01590
17	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
18	0.48973	0.50183	0.49171	0.00630	0.00003	0.86648	-0.01155	0.04806	-0.00285
19	0.61724	0.63768	0.62742	0.01369	0.01547	2.36816	-0.32562	0.13189	-0.08062
20	0.99977	1.17703	1.18984	0.26741	0.23090	12.92004	-2.64627	0.73928	-0.67312
21	0.86009	0.88731	0.88211	0.02531	0.01278	-0.20566	0.41131	-0.01157	0.10289
22	0.83216	0.87783	0.87229	0.04345	0.05372	-1.97640	0.85297	-0.11117	0.21328
23	0.88803	0.90997	0.90566	0.02072	0.00003	1.57120	-0.02095	0.08851	-0.00525
24	0.86009	0.88731	0.88211	0.02531	0.01278	-0.20566	0.41131	-0.01157	0.10289
25	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
26	0.83216	0.87783	0.87229	0.04345	0.05372	-1.97640	0.85297	-0.11117	0.21328

Item 15

Case	ZRE_15	SRE_15	SDR_15	COO_15	LEV_15	DFB0_15	DFB1_15	SDB0_15	SDB1_15
1	-1.95330	-2.03810	-2.24417	0.18424	0.03386	-5.59200	1.01673	-0.66841	0.43089
2	-2.54549	-2.74016	-3.42944	0.59617	0.08942	0.70513	-2.29169	0.09580	-1.10393
3	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
4	-1.43686	-1.49924	-1.55407	0.09970	0.03386	-4.11350	0.74791	-0.46287	0.29839
5	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
6	-0.81713	-0.85260	-0.84621	0.03224	0.03386	-2.33931	0.42533	-0.25204	0.16248
7	-0.30068	-0.31374	-0.30616	0.00437	0.03386	-0.86081	0.15651	-0.09119	0.05879
8	0.83549	0.87176	0.86601	0.03371	0.03386	2.39188	-0.43489	0.25793	-0.16628

9	-0.09411	-0.09819	-0.09560	0.00043	0.03386	-0.26941	0.04898	-0.02847	0.01836
10	-0.08493	-0.08705	-0.08474	0.00019	0.00053	-0.14930	0.00533	-0.01578	0.00200
11	-0.16985	-0.18284	-0.17812	0.00265	0.08942	0.04705	-0.15292	0.00498	-0.05734
12	0.62891	0.65622	0.64608	0.01910	0.03386	1.80048	-0.32736	0.19243	-0.12405
13	0.83549	0.87176	0.86601	0.03371	0.03386	2.39188	-0.43489	0.25793	-0.16628
14	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
15	-0.09411	-0.09819	-0.09560	0.00043	0.03386	-0.26941	0.04898	-0.02847	0.01836
16	-0.08493	-0.08705	-0.08474	0.00019	0.00053	-0.14930	0.00533	-0.01578	0.00200
17	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
18	0.73220	0.76399	0.75530	0.02589	0.03386	2.09618	-0.38112	0.22496	-0.14502
19	0.24330	0.26191	0.25538	0.00545	0.08942	-0.06740	0.21904	-0.00713	0.08221
20	0.55317	0.59547	0.58508	0.02815	0.08942	-0.15323	0.49801	-0.01634	0.18833
21	0.55317	0.59547	0.58508	0.02815	0.08942	-0.15323	0.49801	-0.01634	0.18833
22	0.55317	0.59547	0.58508	0.02815	0.08942	-0.15323	0.49801	-0.01634	0.18833
23	1.14536	1.19508	1.20955	0.06335	0.03386	3.27897	-0.59618	0.36026	-0.23224
24	0.55317	0.59547	0.58508	0.02815	0.08942	-0.15323	0.49801	-0.01634	0.18833
25	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
26	0.94796	0.97164	0.97014	0.02388	0.00053	1.66652	-0.05952	0.18063	-0.02287

Item 16

Case	ZRE_16	SRE_16	SDR_16	COO_16	LEV_16	DFB0_16	DFB1_16	SDB0_16	SDB1_16
1	-2.06191	-2.12169	-2.36406	0.13240	0.00794	0.00000	-0.66267	0.00000	-0.21671
2	-2.06191	-2.12169	-2.36406	0.13240	0.00794	0.00000	-0.66267	0.00000	-0.21671
3	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
4	-1.55350	-1.59853	-1.67242	0.07516	0.00794	0.00000	-0.49927	0.00000	-0.15331
5	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
6	-0.94340	-0.97075	-0.96920	0.02772	0.00794	0.00000	-0.30320	0.00000	-0.08885
7	-0.43498	-0.44759	-0.43797	0.00589	0.00794	0.00000	-0.13980	0.00000	-0.04015

8	0.68354	0.70336	0.69369	0.01455	0.00794	0.00000	0.21968	0.00000	0.06359
9	-0.23161	-0.23833	-0.23232	0.00167	0.00794	0.00000	-0.07444	0.00000	-0.02130
10	-0.02825	-0.02906	-0.02829	0.00002	0.00794	0.00000	-0.00908	0.00000	-0.00259
11	0.27680	0.28483	0.27783	0.00239	0.00794	0.00000	0.08896	0.00000	0.02547
12	0.48017	0.49409	0.48403	0.00718	0.00794	0.00000	0.15432	0.00000	0.04437
13	0.68354	0.70336	0.69369	0.01455	0.00794	0.00000	0.21968	0.00000	0.06359
14	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
15	-0.81347	-0.99629	-0.99608	0.24815	0.28571	-13.33333	2.22222	-0.70434	0.65209
16	-0.02825	-0.02906	-0.02829	0.00002	0.00794	0.00000	-0.00908	0.00000	-0.00259
17	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
18	0.58185	0.59872	0.58833	0.01054	0.00794	0.00000	0.18700	0.00000	0.05393
19	0.68354	0.70336	0.69369	0.01455	0.00794	0.00000	0.21968	0.00000	0.06359
20	0.40673	0.49814	0.48806	0.06204	0.28571	6.66667	-1.11111	0.34511	-0.31951
21	0.98859	1.01725	1.01823	0.03044	0.00794	0.00000	0.31772	0.00000	0.09334
22	0.98859	1.01725	1.01823	0.03044	0.00794	0.00000	0.31772	0.00000	0.09334
23	0.40673	0.49814	0.48806	0.06204	0.28571	6.66667	-1.11111	0.34511	-0.31951
24	0.98859	1.01725	1.01823	0.03044	0.00794	0.00000	0.31772	0.00000	0.09334
25	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
26	0.98859	1.01725	1.01823	0.03044	0.00794	0.00000	0.31772	0.00000	0.09334

Item 17

Case	ZRE_17	SRE_17	SDR_17	COO_17	LEV_17	DFB0_17	DFB1_17	SDB0_17	SDB1_17
1	-2.09627	-2.15248	-2.40933	0.12590	0.00393	-5.34700	0.50924	-0.39818	0.15504
2	-2.10294	-2.23990	-2.54137	0.33741	0.07094	4.53498	-2.33620	0.34232	-0.72096
3	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
4	-1.59911	-1.64199	-1.72529	0.07326	0.00393	-4.07889	0.38847	-0.28513	0.11102
5	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
6	-1.00252	-1.02940	-1.03111	0.02880	0.00393	-2.55715	0.24354	-0.17041	0.06635

7	-0.50536	-0.51891	-0.50869	0.00732	0.00393	-1.28903	0.12277	-0.08407	0.03273
8	0.58839	0.60417	0.59379	0.00992	0.00393	1.50082	-0.14294	0.09813	-0.03821
9	-0.29983	-0.33544	-0.32746	0.01416	0.15341	-2.52910	0.54041	-0.16426	0.14349
10	-0.11430	-0.12174	-0.11854	0.00100	0.07094	0.24648	-0.12697	0.01597	-0.03363
11	0.18400	0.19598	0.19095	0.00258	0.07094	-0.39680	0.20441	-0.02572	0.05417
12	0.38953	0.39997	0.39095	0.00435	0.00393	0.99358	-0.09463	0.06461	-0.02516
13	0.58173	0.61962	0.60928	0.02582	0.07094	-1.25450	0.64626	-0.08207	0.17284
14	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
15	-0.30650	-0.31472	-0.30712	0.00269	0.00393	-0.78179	0.07446	-0.05076	0.01976
16	-0.10763	-0.11052	-0.10761	0.00033	0.00393	-0.27454	0.02615	-0.01778	0.00692
17	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
18	0.48896	0.50207	0.49195	0.00685	0.00393	1.24720	-0.11878	0.08130	-0.03166
19	0.59505	0.66572	0.65566	0.05576	0.15341	5.01929	-1.07250	0.32888	-0.28730
20	0.88669	0.91046	0.90617	0.02253	0.00393	2.26169	-0.21540	0.14976	-0.05831
21	0.88002	0.93734	0.93420	0.05909	0.07094	-1.89777	0.97764	-0.12583	0.26502
22	0.89335	0.99944	0.99941	0.12567	0.15341	7.53542	-1.61013	0.50131	-0.43793
23	0.88002	0.93734	0.93420	0.05909	0.07094	-1.89777	0.97764	-0.12583	0.26502
24	0.88002	0.93734	0.93420	0.05909	0.07094	-1.89777	0.97764	-0.12583	0.26502
25	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
26	0.88669	0.91046	0.90617	0.02253	0.00393	2.26169	-0.21540	0.14976	-0.05831

Item 18

Case	ZRE_18	SRE_18	SDR_18	COO_18	LEV_18	DFB0_18	DFB1_18	SDB0_18	SDB1_18
1	-2.08382	-2.14424	-2.39714	0.13523	0.00794	0.00000	-0.64815	0.00000	-0.21975
2	-2.08382	-2.14424	-2.39714	0.13523	0.00794	0.00000	-0.64815	0.00000	-0.21975
3	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
4	-1.55849	-1.60367	-1.67864	0.07564	0.00794	0.00000	-0.48475	0.00000	-0.15388
5	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!

6	-0.92809	-0.95500	-0.95267	0.02682	0.00794	0.00000	-0.28867	0.00000	-0.08733
7	-0.40276	-0.41443	-0.40521	0.00505	0.00794	0.00000	-0.12527	0.00000	-0.03715
8	0.75298	0.77481	0.76635	0.01766	0.00794	0.00000	0.23420	0.00000	0.07025
9	-0.19262	-0.19821	-0.19312	0.00116	0.00794	0.00000	-0.05991	0.00000	-0.01770
10	0.01751	0.01802	0.01754	0.00001	0.00794	0.00000	0.00545	0.00000	0.00161
11	0.33271	0.34236	0.33426	0.00345	0.00794	0.00000	0.10349	0.00000	0.03064
12	0.54284	0.55858	0.54820	0.00918	0.00794	0.00000	0.16885	0.00000	0.05025
13	0.75298	0.77481	0.76635	0.01766	0.00794	0.00000	0.23420	0.00000	0.07025
14	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
15	-0.19262	-0.19821	-0.19312	0.00116	0.00794	0.00000	-0.05991	0.00000	-0.01770
16	0.01751	0.01802	0.01754	0.00001	0.00794	0.00000	0.00545	0.00000	0.00161
17	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
18	-0.28018	-0.34315	-0.33503	0.02944	0.28571	-4.44444	0.74074	-0.23690	0.21933
19	0.75298	0.77481	0.76635	0.01766	0.00794	0.00000	0.23420	0.00000	0.07025
20	1.06818	1.09915	1.10556	0.03553	0.00794	0.00000	0.33224	0.00000	0.10135
21	1.06818	1.09915	1.10556	0.03553	0.00794	0.00000	0.33224	0.00000	0.10135
22	0.14009	0.17157	0.16713	0.00736	0.28571	2.22222	-0.37037	0.11818	-0.10941
23	1.06818	1.09915	1.10556	0.03553	0.00794	0.00000	0.33224	0.00000	0.10135
24	1.06818	1.09915	1.10556	0.03553	0.00794	0.00000	0.33224	0.00000	0.10135
25	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
26	0.14009	0.17157	0.16713	0.00736	0.28571	2.22222	-0.37037	0.11818	-0.10941

Item 19

Case	ZRE_19	SRE_19	SDR_19	COO_19	LEV_19	DFB0_19	DFB1_19	SDB0_19	SDB1_19
1	-2.07507	-2.14790	-2.40256	0.16477	0.01905	0.00000	-0.71693	0.00000	-0.34322
2	-2.07507	-2.14790	-2.40256	0.16477	0.01905	0.00000	-0.71693	0.00000	-0.34322
3	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
4	-1.50079	-1.55347	-1.61829	0.08619	0.01905	0.00000	-0.51852	0.00000	-0.23118

5	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
6	-0.81165	-0.84014	-0.83336	0.02521	0.01905	0.00000	-0.28042	0.00000	-0.11905
7	-0.23737	-0.24570	-0.23953	0.00216	0.01905	0.00000	-0.08201	0.00000	-0.03422
8	1.02605	1.06206	1.06586	0.04028	0.01905	0.00000	0.35450	0.00000	0.15227
9	-0.00766	-0.00793	-0.00771	0.00000	0.01905	0.00000	-0.00265	0.00000	-0.00110
10	0.22206	0.22985	0.22403	0.00189	0.01905	0.00000	0.07672	0.00000	0.03200
11	0.56663	0.58651	0.57611	0.01229	0.01905	0.00000	0.19577	0.00000	0.08230
12	-0.42114	-0.46134	-0.45157	0.02128	0.11905	-2.44444	0.40741	-0.20195	0.17068
13	-0.19143	-0.20970	-0.20434	0.00440	0.11905	-1.11111	0.18519	-0.09138	0.07723
14	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
15	-0.00766	-0.00793	-0.00771	0.00000	0.01905	0.00000	-0.00265	0.00000	-0.00110
16	0.22206	0.22985	0.22403	0.00189	0.01905	0.00000	0.07672	0.00000	0.03200
17	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
18	0.91119	0.94318	0.94030	0.03177	0.01905	0.00000	0.31481	0.00000	0.13433
19	1.02605	1.06206	1.06586	0.04028	0.01905	0.00000	0.35450	0.00000	0.15227
20	1.37062	1.41873	1.46041	0.07189	0.01905	0.00000	0.47354	0.00000	0.20863
21	1.37062	1.41873	1.46041	0.07189	0.01905	0.00000	0.47354	0.00000	0.20863
22	0.15314	0.16776	0.16341	0.00281	0.11905	0.88889	-0.14815	0.07308	-0.06176
23	0.15314	0.16776	0.16341	0.00281	0.11905	0.88889	-0.14815	0.07308	-0.06176
24	0.15314	0.16776	0.16341	0.00281	0.11905	0.88889	-0.14815	0.07308	-0.06176
25	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
26	0.15314	0.16776	0.16341	0.00281	0.11905	0.88889	-0.14815	0.07308	-0.06176

Item 20

Case	ZRE_20	SRE_20	SDR_20	COO_20	LEV_20	DFB0_20	DFB1_20	SDB0_20	SDB1_20
1	-2.00009	-2.07309	-2.29383	0.15971	0.02156	0.42424	-0.84849	0.03501	-0.34913
2	-2.00009	-2.07309	-2.29383	0.15971	0.02156	0.42424	-0.84849	0.03501	-0.34913
3	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!

4	-1.46918	-1.52280	-1.58186	0.08618	0.02156	0.31163	-0.62326	0.02415	-0.24077
5	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
6	-0.83209	-0.86246	-0.85639	0.02764	0.02156	0.17650	-0.35299	0.01307	-0.13035
7	-0.30118	-0.31217	-0.30463	0.00362	0.02156	0.06388	-0.12777	0.00465	-0.04637
8	0.86682	0.89845	0.89368	0.03000	0.02156	-0.18386	0.36773	-0.01364	0.13602
9	-0.08882	-0.09206	-0.08962	0.00031	0.02156	0.01884	-0.03768	0.00137	-0.01364
10	0.12354	0.12805	0.12469	0.00061	0.02156	-0.02621	0.05241	-0.00190	0.01898
11	0.44209	0.45823	0.44849	0.00780	0.02156	-0.09377	0.18755	-0.00685	0.06826
12	0.65445	0.67834	0.66839	0.01710	0.02156	-0.13882	0.27764	-0.01020	0.10173
13	0.44710	0.46109	0.45132	0.00675	0.01213	1.31437	-0.14083	0.09596	-0.05126
14	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
15	-0.92826	-1.02659	-1.02813	0.11755	0.13477	-6.50056	1.12079	-0.48559	0.41742
16	-0.71589	-0.79173	-0.78364	0.06992	0.13477	-5.01338	0.86438	-0.37012	0.31816
17	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
18	0.76064	0.78840	0.78024	0.02310	0.02156	-0.16134	0.32268	-0.01191	0.11876
19	0.86682	0.89845	0.89368	0.03000	0.02156	-0.18386	0.36773	-0.01364	0.13602
20	0.34593	0.38257	0.37381	0.01632	0.13477	2.42251	-0.41767	0.17655	-0.15177
21	1.18536	1.22863	1.24639	0.05610	0.02156	-0.25143	0.50286	-0.01903	0.18971
22	0.76564	0.78960	0.78147	0.01981	0.01213	2.25083	-0.24116	0.16616	-0.08876
23	1.18536	1.22863	1.24639	0.05610	0.02156	-0.25143	0.50286	-0.01903	0.18971
24	0.34593	0.38257	0.37381	0.01632	0.13477	2.42251	-0.41767	0.17655	-0.15177
25	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
26	0.34593	0.38257	0.37381	0.01632	0.13477	2.42251	-0.41767	0.17655	-0.15177

Item 21

Case	ZRE_21	SRE_21	SDR_21	COO_21	LEV_21	DFB0_21	DFB1_21	SDB0_21	SDB1_21
1	-2.11379	-2.18312	-2.45499	0.15887	0.01488	-4.72222	0.78704	-0.63388	0.30930
2	-2.11379	-2.18312	-2.45499	0.15887	0.01488	-4.72222	0.78704	-0.63388	0.30930

3	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
4	-1.55177	-1.73493	-1.84075	0.37625	0.15238	0.00000	-2.16667	0.00000	-0.80337
5	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
6	-1.01959	-1.05303	-1.05623	0.03696	0.01488	-2.27778	0.37963	-0.27272	0.13307
7	-0.52223	-0.53936	-0.52904	0.00970	0.01488	-1.16667	0.19444	-0.13660	0.06665
8	0.57197	0.59073	0.58032	0.01163	0.01488	1.27778	-0.21296	0.14984	-0.07311
9	-0.25863	-0.28916	-0.28206	0.01045	0.15238	0.00000	-0.36111	0.00000	-0.12310
10	-0.12434	-0.12842	-0.12505	0.00055	0.01488	-0.27778	0.04630	-0.03229	0.01575
11	0.23873	0.26691	0.26028	0.00891	0.15238	0.00000	0.33333	0.00000	0.11360
12	0.37302	0.38526	0.37645	0.00495	0.01488	0.83333	-0.13889	0.09720	-0.04743
13	0.57197	0.59073	0.58032	0.01163	0.01488	1.27778	-0.21296	0.14984	-0.07311
14	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
15	-0.32329	-0.33389	-0.32594	0.00372	0.01488	-0.72222	0.12037	-0.08416	0.04106
16	-0.12434	-0.12842	-0.12505	0.00055	0.01488	-0.27778	0.04630	-0.03229	0.01575
17	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
18	0.47249	0.48799	0.47798	0.00794	0.01488	1.05556	-0.17593	0.12341	-0.06022
19	0.63662	0.71177	0.70221	0.06333	0.15238	0.00000	0.88889	0.00000	0.30647
20	0.87039	0.89893	0.89418	0.02694	0.01488	1.94444	-0.32407	0.23088	-0.11266
21	0.87039	0.89893	0.89418	0.02694	0.01488	1.94444	-0.32407	0.23088	-0.11266
22	0.93504	1.04541	1.04812	0.13661	0.15238	0.00000	1.30556	0.00000	0.45744
23	0.87039	0.89893	0.89418	0.02694	0.01488	1.94444	-0.32407	0.23088	-0.11266
24	0.87039	0.89893	0.89418	0.02694	0.01488	1.94444	-0.32407	0.23088	-0.11266
25	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
26	0.87039	0.89893	0.89418	0.02694	0.01488	1.94444	-0.32407	0.23088	-0.11266

Item 22

Case	ZRE_22	SRE_22	SDR_22	COO_22	LEV_22	DFB0_22	DFB1_22	SDB0_22	SDB1_22
1	-2.38926	-2.45473	-2.89133	0.16738	0.00501	0.00000	-0.68713	0.00000	-0.21031

2	-1.07319	-1.51772	-1.57585	1.15174	0.45238	-33.33333	5.55556	-1.57585	1.49893
3	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
4	-1.85266	-1.90343	-2.05939	0.10064	0.00501	0.00000	-0.53281	0.00000	-0.14980
5	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
6	-1.20875	-1.24187	-1.26101	0.04284	0.00501	0.00000	-0.34763	0.00000	-0.09173
7	-0.67216	-0.69057	-0.68075	0.01325	0.00501	0.00000	-0.19331	0.00000	-0.04952
8	0.50835	0.52228	0.51204	0.00758	0.00501	0.00000	0.14620	0.00000	0.03725
9	-0.45752	-0.47005	-0.46020	0.00614	0.00501	0.00000	-0.13158	0.00000	-0.03347
10	-0.24288	-0.24954	-0.24328	0.00173	0.00501	0.00000	-0.06985	0.00000	-0.01770
11	0.07908	0.08124	0.07909	0.00018	0.00501	0.00000	0.02274	0.00000	0.00575
12	0.29372	0.30176	0.29442	0.00253	0.00501	0.00000	0.08447	0.00000	0.02142
13	0.50835	0.52228	0.51204	0.00758	0.00501	0.00000	0.14620	0.00000	0.03725
14	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
15	-0.45752	-0.47005	-0.46020	0.00614	0.00501	0.00000	-0.13158	0.00000	-0.03347
16	1.07319	1.51772	1.57585	1.15174	0.45238	33.33333	-5.55556	1.57585	-1.49893
17	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
18	0.40103	0.41202	0.40284	0.00472	0.00501	0.00000	0.11533	0.00000	0.02930
19	0.50835	0.52228	0.51204	0.00758	0.00501	0.00000	0.14620	0.00000	0.03725
20	0.83031	0.85306	0.84668	0.02021	0.00501	0.00000	0.23879	0.00000	0.06159
21	0.83031	0.85306	0.84668	0.02021	0.00501	0.00000	0.23879	0.00000	0.06159
22	0.83031	0.85306	0.84668	0.02021	0.00501	0.00000	0.23879	0.00000	0.06159
23	0.83031	0.85306	0.84668	0.02021	0.00501	0.00000	0.23879	0.00000	0.06159
24	0.83031	0.85306	0.84668	0.02021	0.00501	0.00000	0.23879	0.00000	0.06159
25	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
26	0.83031	0.85306	0.84668	0.02021	0.00501	0.00000	0.23879	0.00000	0.06159

Item 23 (MajorGPA)

Case	ZRE_23	SRE_23	SDR_23	COO_23	LEV_23	DFB0_23	DFB1_23	SDB0_23	SDB1_23

1	-2.94961	-3.13565	-4.39372	0.63970	0.06752	56.29297	-16.92914	1.11501	-1.21371
2	-1.16931	-1.42487	-1.46749	0.49223	0.27893	-67.05846	17.92244	-0.97627	0.94443
3	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
4	-1.35113	-1.41446	-1.45550	0.09598	0.03992	-22.94117	5.78269	-0.33370	0.30446
5	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
6	-0.30827	-0.34045	-0.33238	0.01273	0.13248	-10.17314	2.67466	-0.14040	0.13361
7	-0.11920	-0.12479	-0.12151	0.00075	0.03992	-2.02393	0.51016	-0.02786	0.02542
8	0.81601	0.83823	0.83139	0.01939	0.00469	5.37410	-1.15244	0.07535	-0.05848
9	-0.80020	-0.83788	-0.83103	0.03384	0.04030	11.16345	-3.44227	0.15651	-0.17468
10	-0.59105	-0.61979	-0.60945	0.01914	0.04298	8.57056	-2.63345	0.11913	-0.13249
11	0.36804	0.37806	0.36937	0.00394	0.00469	2.42383	-0.51977	0.03347	-0.02598
12	0.59203	0.60814	0.59777	0.01021	0.00469	3.89896	-0.83611	0.05417	-0.04205
13	0.66765	0.68414	0.67425	0.01170	0.00001	1.13258	-0.03856	0.01578	-0.00194
14	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
15	-0.59250	-0.61094	-0.60057	0.01180	0.01184	3.93610	-1.33978	0.05470	-0.06739
16	0.55131	0.59333	0.58293	0.02785	0.08899	14.32342	-3.72290	0.19892	-0.18714
17	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
18	-0.03777	-0.04016	-0.03909	0.00010	0.06752	0.72091	-0.21680	0.00992	-0.01080
19	0.83085	0.85389	0.84754	0.02051	0.00563	5.88320	-1.28719	0.08254	-0.06537
20	1.00363	1.02842	1.03007	0.02645	0.00001	1.70252	-0.05796	0.02410	-0.00297
21	0.78110	0.80426	0.79649	0.01947	0.00916	-4.40810	1.54866	-0.06171	0.07847
22	0.78110	0.80426	0.79649	0.01947	0.00916	-4.40810	1.54866	-0.06171	0.07847
23	0.41020	0.43607	0.42658	0.01237	0.06752	-7.82864	2.35433	-0.10826	0.11784
24	0.70692	0.73074	0.72146	0.01830	0.01652	-5.76792	1.89733	-0.08050	0.09584
25	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
26	0.41020	0.43607	0.42658	0.01237	0.06752	-7.82864	2.35433	-0.10826	0.11784

Class B

Item 1

Case	ZRE_1	SRE_1	SDR_1	COO_1	LEV_1	DFB0_1	DFB1_1	SDB0_1	SDB1_1
1.0	-1.61959	-1.65554	-1.72520	0.06152	0.00296	-0.20596	-0.25745	-0.01590	-0.09599
2.0	-1.29859	-1.35116	-1.37725	0.07540	0.03630	2.28848	-0.74857	0.17283	-0.27301
3.0	-1.17687	-1.22451	-1.23864	0.06192	0.03630	2.07396	-0.67840	0.15544	-0.24553
4.0	-0.08133	-0.08462	-0.08278	0.00030	0.03630	0.14333	-0.04688	0.01039	-0.01641
5.0	-1.28777	-1.34803	-1.37379	0.08702	0.04741	-5.10930	0.85871	-0.38580	0.31312
6.0	-1.01096	-1.03340	-1.03500	0.02397	0.00296	-0.12856	-0.16070	-0.00954	-0.05759
7.0	-0.96678	-0.99016	-0.98971	0.02400	0.00667	-1.89762	0.23142	-0.14054	0.08276
8.0	-0.20306	-0.21128	-0.20683	0.00184	0.03630	0.35784	-0.11705	0.02596	-0.04100
9.0	0.08458	0.08645	0.08457	0.00017	0.00296	0.01076	0.01344	0.00078	0.00471
10.0	-0.02633	-0.02882	-0.02818	0.00008	0.12519	-0.16937	0.03119	-0.01227	0.01091
11.0	-0.63496	-0.69495	-0.68692	0.04778	0.12519	-4.08463	0.75213	-0.29915	0.26600
12.0	0.38303	0.45141	0.44345	0.03962	0.24000	3.78765	-0.72840	0.27569	-0.25603
13.0	0.61566	0.63055	0.62209	0.00973	0.00667	1.20844	-0.14737	0.08834	-0.05202
14.0	0.61566	0.63055	0.62209	0.00973	0.00667	1.20844	-0.14737	0.08834	-0.05202
15.0	0.89248	0.92860	0.92571	0.03561	0.03630	-1.57279	0.51446	-0.11617	0.18350
16.0	0.93666	0.95745	0.95565	0.02058	0.00296	0.11911	0.14889	0.00881	0.05317
17.0	-0.93341	-0.97120	-0.96995	0.03895	0.03630	1.64493	-0.53806	0.12172	-0.19227
18.0	-0.67914	-0.71092	-0.70306	0.02420	0.04741	-2.69453	0.45286	-0.19744	0.16024
19.0	-0.03715	-0.03797	-0.03714	0.00003	0.00296	-0.00472	-0.00591	-0.00034	-0.00207
20.0	0.16212	0.16868	0.16508	0.00118	0.03630	-0.28570	0.09345	-0.02072	0.03272
21.0	1.54529	1.57959	1.63617	0.05600	0.00296	0.19651	0.24564	0.01508	0.09104
22.0	1.87711	1.96495	2.10670	0.18490	0.04741	7.44752	-1.25168	0.59162	-0.48016
23.0	1.62283	1.68853	1.76439	0.11775	0.03630	-2.85988	0.93547	-0.22142	0.34975
24.0	0.57148	0.58417	0.57561	0.00766	0.00296	0.07268	0.09084	0.00531	0.03203

25.0	0.64903	0.67530	0.66710	0.01883	0.03630	-1.14376	0.37413	-0.08372	0.13224

Item 2

Case	ZRE_2	SRE_2	SDR_2	COO_2	LEV_2	DFB0_2	DFB1_2	SDB0_2	SDB1_2
1.0	-1.69844	-1.73641	-1.82185	0.06817	0.00326	0.06592	-0.29662	0.00491	-0.10634
2.0	-1.04261	-1.09087	-1.09561	0.05635	0.04652	2.50041	-0.72046	0.17846	-0.24724
3.0	-0.90714	-0.94913	-0.94700	0.04266	0.04652	2.17552	-0.62684	0.15425	-0.21370
4.0	0.31210	0.32655	0.32011	0.00505	0.04652	-0.74849	0.21567	-0.05214	0.07224
5.0	-1.15655	-1.18241	-1.19325	0.03161	0.00326	0.04489	-0.20198	0.00322	-0.06965
6.0	-0.63620	-0.66564	-0.65738	0.02098	0.04652	1.52574	-0.43962	0.10708	-0.14835
7.0	-1.27049	-1.30370	-1.32494	0.04501	0.01030	-2.83136	0.39738	-0.20448	0.13799
8.0	-0.20825	-0.21291	-0.20843	0.00102	0.00326	0.00808	-0.03637	0.00056	-0.01217
9.0	0.58304	0.61003	0.60151	0.01762	0.04652	-1.39827	0.40289	-0.09798	0.13574
10.0	0.33364	0.34110	0.33444	0.00263	0.00326	-0.01295	0.05827	-0.00090	0.01952
11.0	-0.34372	-0.35141	-0.34461	0.00279	0.00326	0.01334	-0.06003	0.00093	-0.02011
12.0	-0.66400	-0.83872	-0.83313	0.20946	0.33324	-9.08688	1.78984	-0.64142	0.60749
13.0	0.49064	0.50347	0.49514	0.00671	0.01030	1.09342	-0.15346	0.07642	-0.05157
14.0	0.10576	0.11196	0.10953	0.00076	0.06765	0.50608	-0.09021	0.03518	-0.03016
15.0	0.62611	0.64248	0.63407	0.01093	0.01030	1.39533	-0.19584	0.09786	-0.06604
16.0	0.37670	0.39878	0.39137	0.00959	0.06765	1.80259	-0.32133	0.12571	-0.10775
17.0	-0.63620	-0.66564	-0.65738	0.02098	0.04652	1.52574	-0.43962	0.10708	-0.14835
18.0	-0.47919	-0.48991	-0.48166	0.00543	0.00326	0.01860	-0.08369	0.00130	-0.02811
19.0	-0.32219	-0.33061	-0.32411	0.00289	0.01030	-0.71802	0.10077	-0.05002	0.03376
20.0	0.19816	0.20259	0.19832	0.00093	0.00326	-0.00769	0.03461	-0.00053	0.01158
21.0	1.05406	1.11583	1.12209	0.07510	0.06765	5.04385	-0.89912	0.36044	-0.30895
22.0	2.36571	2.41860	2.73929	0.13225	0.00326	-0.09181	0.41316	-0.00739	0.15989
23.0	2.20870	2.31093	2.57934	0.25290	0.04652	-5.29695	1.52624	-0.42013	0.58207
24.0	-0.02971	-0.03145	-0.03076	0.00006	0.06765	-0.14217	0.02534	-0.00988	0.00847

25.0	0.74005	0.75660	0.74935	0.01294	0.00326	-0.02872	0.12925	-0.00202	0.04374

Item 3

Case	ZRE_3	SRE_3	SDR_3	COO_3	LEV_3	DFB0_3	DFB1_3	SDB0_3	SDB1_3
1.0	-1.72087	-1.77076	-1.86351	0.09222	0.01556	3.11887	-1.03962	0.15839	-0.23916
2.0	-1.22581	-1.32403	-1.34728	0.14609	0.10286	-10.49107	2.09821	-0.51515	0.46671
3.0	-1.10410	-1.19256	-1.20417	0.11852	0.10286	-9.44940	1.88988	-0.46043	0.41714
4.0	-0.26033	-0.26787	-0.26240	0.00211	0.01556	0.47181	-0.15727	0.02230	-0.03368
5.0	-1.23402	-1.26980	-1.28785	0.04742	0.01556	2.23652	-0.74551	0.10946	-0.16528
6.0	-0.86067	-0.92963	-0.92678	0.07202	0.10286	-7.36607	1.47321	-0.35436	0.32105
7.0	-0.99060	-1.01932	-1.02022	0.03056	0.01556	1.79534	-0.59845	0.08671	-0.13093
8.0	-0.38204	-0.39311	-0.38577	0.00455	0.01556	0.69240	-0.23080	0.03279	-0.04951
9.0	-0.01690	-0.01739	-0.01701	0.00001	0.01556	0.03064	-0.01021	0.00145	-0.00218
10.0	0.35644	0.38500	0.37776	0.01235	0.10286	3.05060	-0.61012	0.14444	-0.13086
11.0	-0.50375	-0.51836	-0.50995	0.00790	0.01556	0.91299	-0.30433	0.04334	-0.06545
12.0	0.71747	0.73596	0.72841	0.01413	0.00960	2.12288	-0.33843	0.10139	-0.07322
13.0	0.59165	0.60881	0.60028	0.01090	0.01556	-1.07230	0.35743	-0.05102	0.07704
14.0	0.71747	0.73596	0.72841	0.01413	0.00960	2.12288	-0.33843	0.10139	-0.07322
15.0	0.83918	0.86080	0.85578	0.01934	0.00960	2.48301	-0.39584	0.11912	-0.08602
16.0	0.96089	0.98565	0.98501	0.02535	0.00960	2.84313	-0.45325	0.13711	-0.09901
17.0	-1.23813	-1.35148	-1.37760	0.17488	0.12071	9.19864	-2.34475	0.45247	-0.52246
18.0	-0.49965	-0.51252	-0.50414	0.00685	0.00960	-1.47837	0.23568	-0.07017	0.05068
19.0	-0.13862	-0.14263	-0.13956	0.00060	0.01556	0.25123	-0.08374	0.01186	-0.01791
20.0	0.10891	0.11172	0.10929	0.00033	0.00960	0.32225	-0.05137	0.01521	-0.01099
21.0	1.56945	1.60989	1.67149	0.06763	0.00960	4.64376	-0.74031	0.23266	-0.16802
22.0	1.80466	1.96989	2.11307	0.37153	0.12071	-13.40774	3.41766	-0.69403	0.80138
23.0	1.56945	1.60989	1.67149	0.06763	0.00960	4.64376	-0.74031	0.23266	-0.16802
24.0	0.59576	0.61111	0.60259	0.00975	0.00960	1.76276	-0.28102	0.08388	-0.06057

25.0	0.34412	0.37563	0.36851	0.01351	0.12071	-2.55667	0.65170	-0.12103	0.13976

Item 4

Case	ZRE_4	SRE_4	SDR_4	COO_4	LEV_4	DFB0_4	DFB1_4	SDB0_4	SDB1_4
1.0	-1.65502	-1.69208	-1.76863	0.06484	0.00333	-2.62975	0.27035	-0.21616	0.10433
2.0	-1.34987	-1.40875	-1.44137	0.08845	0.04184	2.40194	-0.81457	0.19327	-0.30770
3.0	-1.22884	-1.28244	-1.30165	0.07330	0.04184	2.18659	-0.74154	0.17453	-0.27787
4.0	-0.20268	-0.20722	-0.20286	0.00097	0.00333	-0.32206	0.03311	-0.02479	0.01197
5.0	-1.13936	-1.16613	-1.17579	0.03233	0.00539	0.06782	-0.23739	0.00538	-0.08837
6.0	-1.11297	-1.20180	-1.21413	0.11988	0.10237	-6.06553	1.12461	-0.48189	0.41946
7.0	-0.86576	-0.90352	-0.89977	0.03638	0.04184	1.54052	-0.52244	0.12065	-0.19208
8.0	-0.35526	-0.36951	-0.36247	0.00559	0.03565	-1.19030	0.19656	-0.09182	0.07119
9.0	0.10247	0.10694	0.10461	0.00051	0.04184	-0.18233	0.06183	-0.01403	0.02233
10.0	0.03421	0.04341	0.04246	0.00057	0.33895	0.43120	-0.08687	0.03317	-0.03137
11.0	-0.41319	-0.42290	-0.41522	0.00425	0.00539	0.02460	-0.08609	0.00190	-0.03121
12.0	0.58142	0.62782	0.61935	0.03271	0.10237	3.16863	-0.58750	0.24582	-0.21398
13.0	0.64451	0.65894	0.65063	0.00983	0.00333	1.02410	-0.10528	0.07952	-0.03838
14.0	0.70760	0.73847	0.73095	0.02431	0.04184	-1.25911	0.42700	-0.09801	0.15604
15.0	0.79709	0.81582	0.80969	0.01582	0.00539	-0.04745	0.16607	-0.00370	0.06085
16.0	0.91811	0.93969	0.93720	0.02099	0.00539	-0.05465	0.19129	-0.00429	0.07044
17.0	-1.04988	-1.07339	-1.07712	0.02609	0.00333	-1.66821	0.17150	-0.13165	0.06354
18.0	-0.53422	-0.54677	-0.53827	0.00711	0.00539	0.03180	-0.11130	0.00246	-0.04045
19.0	-0.05011	-0.05129	-0.05016	0.00006	0.00539	0.00298	-0.01044	0.00023	-0.00377
20.0	0.00782	0.00814	0.00796	0.00000	0.03565	0.02622	-0.00433	0.00202	-0.00156
21.0	1.52325	1.55905	1.61235	0.05779	0.00539	-0.09068	0.31737	-0.00737	0.12118
22.0	1.94427	2.02227	2.18122	0.16736	0.03565	6.51431	-1.07576	0.55256	-0.42838
23.0	1.55480	1.62262	1.68641	0.11735	0.04184	-2.76660	0.93824	-0.22612	0.36001
24.0	0.58658	0.61216	0.60364	0.01670	0.04184	-1.04375	0.35397	-0.08094	0.12887

25.0	0.55503	0.56807	0.55953	0.00767	0.00539	-0.03304	0.11564	-0.00256	0.04205

Item 5

Case	ZRE_5	SRE_5	SDR_5	COO_5	LEV_5	DFB0_5	DFB1_5	SDB0_5	SDB1_5
1.0	-1.67928	-1.71956	-1.80575	0.07177	0.00463	0.00000	-0.32138	0.00000	-0.12581
2.0	-1.24361	-1.29891	-1.32069	0.07669	0.04167	2.22854	-0.74285	0.17808	-0.28157
3.0	-1.11678	-1.16644	-1.17658	0.06184	0.04167	2.00126	-0.66709	0.15865	-0.25085
4.0	-0.33938	-0.34752	-0.34046	0.00293	0.00463	-0.58455	0.06495	-0.04501	0.02372
5.0	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
6.0	-1.40919	-1.47185	-1.51451	0.09847	0.04167	-5.05051	0.84175	-0.40843	0.32289
7.0	-0.91832	-0.94034	-0.93776	0.02146	0.00463	0.00000	-0.17575	0.00000	-0.06534
8.0	-0.10217	-0.10671	-0.10428	0.00052	0.04167	0.18308	-0.06103	0.01406	-0.02223
9.0	0.27831	0.29069	0.28455	0.00384	0.04167	-0.49874	0.16625	-0.03837	0.06067
10.0	-0.68698	-0.89947	-0.89540	0.28894	0.37500	-9.67262	1.93452	-0.75675	0.71792
11.0	-0.41101	-0.42087	-0.41286	0.00430	0.00463	0.00000	-0.07866	0.00000	-0.02877
12.0	0.18437	0.20085	0.19642	0.00377	0.11574	1.07830	-0.19968	0.08287	-0.07280
13.0	0.54841	0.56156	0.55263	0.00765	0.00463	0.94458	-0.10495	0.07305	-0.03850
14.0	0.73043	0.74795	0.74022	0.01358	0.00463	0.00000	0.13979	0.00000	0.05157
15.0	0.67524	0.69143	0.68299	0.01160	0.00463	1.16303	-0.12923	0.09029	-0.04759
16.0	0.98408	1.00768	1.00805	0.02465	0.00463	0.00000	0.18833	0.00000	0.07023
17.0	-1.22717	-1.25660	-1.27429	0.03833	0.00463	-2.11367	0.23485	-0.16846	0.08878
18.0	-0.35582	-0.37164	-0.36424	0.00628	0.04167	0.63763	-0.21254	0.04911	-0.07766
19.0	-0.03053	-0.03126	-0.03055	0.00002	0.00463	0.00000	-0.00584	0.00000	-0.00213
20.0	0.27831	0.29069	0.28455	0.00384	0.04167	-0.49874	0.16625	-0.03837	0.06067
21.0	1.61822	1.65703	1.73052	0.06664	0.00463	0.00000	0.30969	0.00000	0.12057
22.0	1.57946	1.72068	1.80711	0.27655	0.11574	9.23764	-1.71067	0.76247	-0.66976
23.0	1.80024	1.88028	2.00523	0.16070	0.04167	-3.22601	1.07534	-0.27039	0.42752
24.0	0.42158	0.43169	0.42357	0.00452	0.00463	0.72613	-0.08068	0.05599	-0.02951

25.0	0.42158	0.43169	0.42357	0.00452	0.00463	0.72613	-0.08068	0.05599	-0.02951

Item 6

Case	ZRE_6	SRE_6	SDR_6	COO_6	LEV_6	DFB0_6	DFB1_6	SDB0_6	SDB1_6
1.0	-1.78841	-1.82538	-1.93056	0.06959	0.00009	-1.85205	0.08418	-0.08245	0.01914
2.0	-1.05378	-1.10731	-1.11304	0.06386	0.05434	5.46777	-1.26179	0.23134	-0.27264
3.0	-0.92329	-0.97019	-0.96889	0.04902	0.05434	4.79068	-1.10554	0.20138	-0.23733
4.0	-0.22251	-0.22711	-0.22237	0.00108	0.00009	-0.23043	0.01047	-0.00950	0.00220
5.0	-0.79280	-0.83307	-0.82733	0.03615	0.05434	4.11360	-0.94929	0.17196	-0.20265
6.0	-0.66231	-0.69595	-0.68793	0.02523	0.05434	3.43652	-0.79304	0.14298	-0.16851
7.0	-1.47911	-1.56240	-1.61623	0.14133	0.06377	-11.03662	1.93887	-0.48056	0.43114
8.0	-0.35300	-0.36030	-0.35338	0.00271	0.00009	-0.36557	0.01662	-0.01509	0.00350
9.0	-0.43518	-0.45968	-0.45166	0.01223	0.06377	-3.24714	0.57044	-0.13429	0.12048
10.0	0.16896	0.17245	0.16877	0.00062	0.00009	0.17497	-0.00795	0.00721	-0.00167
11.0	-0.48350	-0.49349	-0.48522	0.00509	0.00009	-0.50070	0.02276	-0.02072	0.00481
12.0	0.21728	0.22952	0.22473	0.00305	0.06377	1.62128	-0.28482	0.06682	-0.05995
13.0	-0.25637	-0.30327	-0.29719	0.01836	0.24538	-4.44147	0.82670	-0.18321	0.17415
14.0	1.16457	1.22373	1.23780	0.07800	0.05434	-6.04265	1.39446	-0.25727	0.30320
15.0	0.82142	0.83840	0.83279	0.01468	0.00009	0.85065	-0.03867	0.03557	-0.00826
16.0	0.95191	0.97159	0.97035	0.01971	0.00009	0.98579	-0.04481	0.04144	-0.00962
17.0	-0.66231	-0.69595	-0.68793	0.02523	0.05434	3.43652	-0.79304	0.14298	-0.16851
18.0	-0.14034	-0.14747	-0.14429	0.00113	0.05434	0.72818	-0.16804	0.02999	-0.03534
19.0	-0.09202	-0.09392	-0.09188	0.00018	0.00009	-0.09530	0.00433	-0.00392	0.00091
20.0	0.03847	0.03927	0.03840	0.00003	0.00009	0.03984	-0.00181	0.00164	-0.00038
21.0	1.13072	1.19439	1.20614	0.08259	0.06377	8.43707	-1.48219	0.35863	-0.32174
22.0	2.12633	2.17029	2.38025	0.09837	0.00009	2.20200	-0.10009	0.10165	-0.02360
23.0	2.07802	2.18356	2.39861	0.24833	0.05434	-10.78223	2.48821	-0.49854	0.58754
24.0	0.56044	0.57202	0.56347	0.00683	0.00009	0.58038	-0.02638	0.02406	-0.00559

25.0	0.08679	0.09168	0.08968	0.00049	0.06377	0.64759	-0.11377	0.02666	-0.02392

Item 7

Case	ZRE_7	SRE_7	SDR_7	COO_7	LEV_7	DFB0_7	DFB1_7	SDB0_7	SDB1_7
1.0	-1.64235	-1.67633	-1.74986	0.05875	0.00013	-1.53637	0.03906	-0.21555	0.02056
2.0	-1.34805	-1.43405	-1.46978	0.13539	0.07635	1.34661	-0.83582	0.18550	-0.43202
3.0	-1.22709	-1.30537	-1.32677	0.11218	0.07635	1.22577	-0.76082	0.16745	-0.38999
4.0	-0.20826	-0.21384	-0.20935	0.00124	0.01155	-0.32749	0.04678	-0.04309	0.02310
5.0	-1.21088	-1.29790	-1.31857	0.12541	0.08960	-3.72634	0.82572	-0.50881	0.42306
6.0	-1.02008	-1.04500	-1.04719	0.02701	0.00713	-0.32585	-0.17922	-0.04389	-0.09057
7.0	-0.93403	-0.95908	-0.95734	0.02500	0.01155	-1.46879	0.20983	-0.19705	0.10563
8.0	-0.31176	-0.31821	-0.31190	0.00212	0.00013	-0.29164	0.00741	-0.03842	0.00367
9.0	0.10350	0.11011	0.10772	0.00080	0.07635	-0.10339	0.06418	-0.01359	0.03166
10.0	0.11972	0.12832	0.12554	0.00123	0.08960	0.36841	-0.08164	0.04844	-0.04028
11.0	-0.39781	-0.41307	-0.40550	0.00667	0.03253	0.12403	-0.15340	0.01636	-0.07595
12.0	0.62103	0.64795	0.63957	0.01859	0.04137	1.40954	-0.27265	0.18700	-0.13572
13.0	0.62103	0.64795	0.63957	0.01859	0.04137	1.40954	-0.27265	0.18700	-0.13572
14.0	0.70832	0.75351	0.74621	0.03738	0.07635	-0.70756	0.43918	-0.09418	0.21934
15.0	0.74199	0.77415	0.76720	0.02654	0.04137	1.68409	-0.32575	0.22431	-0.16281
16.0	0.88041	0.90402	0.90029	0.02221	0.01155	1.38447	-0.19778	0.18531	-0.09933
17.0	-1.07245	-1.11894	-1.12541	0.05545	0.04137	-2.43415	0.47084	-0.32904	0.23883
18.0	-0.55369	-0.56514	-0.55660	0.00668	0.00013	-0.51796	0.01317	-0.06856	0.00654
19.0	-0.03492	-0.03626	-0.03546	0.00005	0.03253	0.01089	-0.01346	0.00143	-0.00664
20.0	-0.00125	-0.00134	-0.00131	0.00000	0.08960	-0.00384	0.00085	-0.00050	0.00042
21.0	1.48522	1.52505	1.57319	0.06320	0.01155	2.33556	-0.33365	0.32381	-0.17358
22.0	1.98653	2.02764	2.18827	0.08595	0.00013	1.85834	-0.04725	0.26955	-0.02571
23.0	1.55506	1.65427	1.72370	0.18016	0.07635	-1.55339	0.96418	-0.21754	0.50666
24.0	0.56990	0.59176	0.58321	0.01369	0.03253	-0.17768	0.21976	-0.02354	0.10923

25.0	0.56990	0.59176	0.58321	0.01369	0.03253	-0.17768	0.21976	-0.02354	0.10923

Item 8

Case	ZRE_8	SRE_8	SDR_8	COO_8	LEV_8	DFB0_8	DFB1_8	SDB0_8	SDB1_8
1.0	-1.63023	-1.67116	-1.74372	0.07100	0.00839	-0.57135	-0.28568	-0.08775	-0.16370
2.0	-1.37073	-1.45433	-1.49265	0.13293	0.07166	0.95007	-0.75214	0.14353	-0.42395
3.0	-1.30293	-1.37950	-1.40872	0.11513	0.06794	-3.25998	0.69321	-0.49003	0.38877
4.0	-0.17055	-0.17707	-0.17330	0.00122	0.03227	0.02594	-0.06013	0.00374	-0.03232
5.0	-1.18202	-1.25149	-1.26792	0.09476	0.06794	-2.95748	0.62889	-0.44105	0.34991
6.0	-1.04342	-1.06892	-1.07240	0.02827	0.00715	-1.40467	0.16856	-0.20744	0.09287
7.0	-0.91367	-0.93251	-0.92976	0.01812	0.00001	-0.76914	-0.00610	-0.11288	-0.00334
8.0	-0.29146	-0.30260	-0.29653	0.00357	0.03227	0.04433	-0.10276	0.00639	-0.05531
9.0	0.02700	0.02859	0.02796	0.00005	0.06794	0.06756	-0.01437	0.00973	-0.00772
10.0	0.20100	0.21326	0.20878	0.00286	0.07166	-0.13932	0.11029	-0.02008	0.05930
11.0	-0.41236	-0.42812	-0.42039	0.00714	0.03227	0.06272	-0.14539	0.00907	-0.07840
12.0	0.63151	0.66863	0.66038	0.02705	0.06794	1.58007	-0.33599	0.22972	-0.18225
13.0	0.64036	0.66395	0.65567	0.01654	0.02979	1.20978	-0.21635	0.17586	-0.11733
14.0	0.64921	0.66508	0.65681	0.01094	0.00715	0.87398	-0.10488	0.12705	-0.05688
15.0	0.80552	0.85464	0.84945	0.04591	0.07166	-0.55831	0.44200	-0.08168	0.24127
16.0	0.90872	0.93153	0.92875	0.02206	0.00839	0.31848	0.15924	0.04674	0.08719
17.0	-1.00802	-1.06950	-1.07301	0.07189	0.07166	0.69867	-0.55311	0.10318	-0.30476
18.0	-0.56866	-0.58961	-0.58106	0.01304	0.02979	-1.07432	0.19212	-0.15584	0.10398
19.0	-0.08505	-0.08818	-0.08626	0.00029	0.02979	-0.16068	0.02873	-0.02314	0.01544
20.0	0.02700	0.02859	0.02796	0.00005	0.06794	0.06756	-0.01437	0.00973	-0.00772
21.0	1.51323	1.55122	1.60331	0.06118	0.00839	0.53034	0.26517	0.08069	0.15052
22.0	1.99684	2.04698	2.21376	0.10653	0.00839	0.69984	0.34992	0.11141	0.20783
23.0	1.47783	1.56469	1.61888	0.14812	0.06794	3.69760	-0.78627	0.56313	-0.44677
24.0	0.53716	0.54824	0.53973	0.00626	0.00001	0.45219	0.00359	0.06553	0.00194

25.0	0.56371	0.59809	0.58955	0.02248	0.07166	-0.39071	0.30932	-0.05669	0.16745

Item 9

Case	ZRE_9	SRE_9	SDR_9	COO_9	LEV_9	DFB0_9	DFB1_9	SDB0_9	SDB1_9
1.0	-1.81087	-1.91978	-2.04891	0.22833	0.07024	-5.82716	1.22248	-0.71234	0.57569
2.0	-1.23595	-1.31936	-1.34214	0.12143	0.08244	1.95980	-0.91645	0.22836	-0.41136
3.0	-1.11413	-1.18932	-1.20068	0.09868	0.08244	1.76664	-0.82613	0.20429	-0.36801
4.0	-0.28280	-0.29229	-0.28640	0.00292	0.02390	-0.60789	0.10585	-0.06822	0.04576
5.0	-1.38986	-1.53575	-1.58549	0.26058	0.14098	-6.30262	1.44400	-0.74529	0.65779
6.0	-0.93675	-0.97200	-0.97079	0.03622	0.03122	0.54523	-0.40387	0.06237	-0.17798
7.0	-0.81493	-0.84560	-0.84018	0.02741	0.03122	0.47433	-0.35135	0.05398	-0.15404
8.0	-0.40461	-0.41820	-0.41057	0.00597	0.02390	-0.86974	0.15145	-0.09780	0.06561
9.0	0.22587	0.24111	0.23611	0.00406	0.08244	-0.35815	0.16748	-0.04017	0.07237
10.0	0.14892	0.15214	0.14887	0.00051	0.00195	0.18050	-0.01556	0.02023	-0.00672
11.0	-0.39392	-0.40296	-0.39550	0.00377	0.00439	-0.12793	-0.06190	-0.01438	-0.02681
12.0	0.83496	0.89131	0.88717	0.05542	0.08244	-1.32397	0.61912	-0.15095	0.27192
13.0	0.56993	0.58906	0.58051	0.01184	0.02390	1.22510	-0.21333	0.13829	-0.09276
14.0	0.70244	0.71857	0.71080	0.01199	0.00439	0.22812	0.11038	0.02585	0.04818
15.0	0.89052	0.92403	0.92098	0.03274	0.03122	-0.51832	0.38394	-0.05917	0.16885
16.0	0.74731	0.79225	0.78563	0.03889	0.07024	2.40475	-0.50449	0.27314	-0.22074
17.0	-0.93675	-0.97200	-0.97079	0.03622	0.03122	0.54523	-0.40387	0.06237	-0.17798
18.0	-0.71451	-0.75748	-0.75025	0.03555	0.07024	-2.29920	0.48235	-0.26084	0.21080
19.0	0.03779	0.03922	0.03835	0.00006	0.03122	-0.02200	0.01629	-0.00246	0.00703
20.0	-0.03916	-0.04047	-0.03959	0.00006	0.02390	-0.08418	0.01466	-0.00943	0.00633
21.0	1.55517	1.59088	1.64930	0.05878	0.00439	0.50505	0.24438	0.05997	0.11179
22.0	1.90993	1.97404	2.11844	0.13301	0.02390	4.10551	-0.71489	0.50465	-0.33851
23.0	1.48891	1.52116	1.56873	0.05066	0.00195	1.80474	-0.15558	0.21318	-0.07080
24.0	0.51437	0.52551	0.51707	0.00605	0.00195	0.62348	-0.05375	0.07027	-0.02334

25.0	0.44811	0.46315	0.45510	0.00732	0.02390	0.96324	-0.16773	0.10841	-0.07272

Item 10

Case	ZRE_10	SRE_10	SDR_10	COO_10	LEV_10	DFB0_10	DFB1_10	SDB0_10	SDB1_10
1.0	-1.74640	-1.78750	-1.88895	0.07607	0.00379	-0.72754	-0.24251	-0.09092	-0.11899
2.0	-1.21334	-1.33312	-1.35849	0.18409	0.12995	-5.13113	1.13717	-0.61833	0.53805
3.0	-1.09087	-1.19856	-1.21121	0.14880	0.12995	-4.61321	1.02239	-0.55129	0.47972
4.0	-0.27675	-0.28326	-0.27726	0.00191	0.00379	-0.11529	-0.03843	-0.01334	-0.01747
5.0	-1.25652	-1.28609	-1.30659	0.03938	0.00379	-0.52346	-0.17449	-0.06289	-0.08231
6.0	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
7.0	-1.08360	-1.12339	-1.13046	0.04718	0.02791	0.44107	-0.41902	0.05249	-0.19578
8.0	-0.47125	-0.48855	-0.47993	0.00892	0.02791	0.19182	-0.18223	0.02228	-0.08312
9.0	0.25630	0.28160	0.27562	0.00821	0.12995	1.08388	-0.24021	0.12545	-0.10917
10.0	0.01863	0.01932	0.01887	0.00001	0.02791	-0.00758	0.00720	-0.00088	0.00327
11.0	-0.52169	-0.53397	-0.52511	0.00679	0.00379	-0.21733	-0.07244	-0.02527	-0.03308
12.0	0.43649	0.46423	0.45579	0.01413	0.07429	-0.57032	0.28983	-0.06622	0.13213
13.0	0.72460	0.74896	0.74126	0.01918	0.02234	1.50991	-0.24921	0.17672	-0.11452
14.0	0.65257	0.66728	0.65864	0.01015	0.00193	0.80107	-0.06460	0.09350	-0.02961
15.0	0.63098	0.65415	0.64542	0.01600	0.02791	-0.25684	0.24399	-0.02997	0.11178
16.0	0.82548	0.84491	0.83921	0.01700	0.00379	0.34389	0.11463	0.04039	0.05287
17.0	-1.20607	-1.25035	-1.26747	0.05845	0.02791	0.49092	-0.46637	0.05885	-0.21951
18.0	-0.71619	-0.74249	-0.73468	0.02061	0.02791	0.29152	-0.27694	0.03411	-0.12724
19.0	-0.08225	-0.08411	-0.08219	0.00016	0.00193	-0.10097	0.00814	-0.01167	0.00369
20.0	0.25630	0.28160	0.27562	0.00821	0.12995	1.08388	-0.24021	0.12545	-0.10917
21.0	1.43784	1.47167	1.51431	0.05157	0.00379	0.59899	0.19966	0.07289	0.09539
22.0	2.07177	2.14144	2.35160	0.15680	0.02234	4.31715	-0.71254	0.56062	-0.36331
23.0	1.29378	1.37602	1.40625	0.12417	0.07429	-1.69046	0.85909	-0.20430	0.40765
24.0	0.38604	0.40022	0.39245	0.00599	0.02791	-0.15714	0.14928	-0.01822	0.06797

25.0	0.67416	0.71327	0.70508	0.03038	0.06501	2.05781	-0.41442	0.24055	-0.19021

Item 11

Case	ZRE_11	SRE_11	SDR_11	COO_11	LEV_11	DFB0_11	DFB1_11	SDB0_11	SDB1_11
1.0	-1.43965	-1.49955	-1.54622	0.09550	0.03662	2.36593	-0.77303	0.19442	-0.30821
2.0	-1.17057	-1.21927	-1.23365	0.06314	0.03662	1.92372	-0.62854	0.15512	-0.24591
3.0	-1.03603	-1.07914	-1.08339	0.04946	0.03662	1.70262	-0.55630	0.13622	-0.21595
4.0	-0.13986	-0.14307	-0.13985	0.00048	0.00272	-0.02195	-0.01975	-0.00171	-0.00747
5.0	-0.90149	-0.93900	-0.93637	0.03745	0.03662	1.48152	-0.48406	0.11774	-0.18665
6.0	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
7.0	-1.26179	-1.29404	-1.31534	0.04336	0.00757	-2.40832	0.29855	-0.19509	0.11734
8.0	-0.27440	-0.28070	-0.27474	0.00183	0.00272	-0.04306	-0.03876	-0.00336	-0.01467
9.0	0.44391	0.46237	0.45395	0.00908	0.03662	-0.72952	0.23836	-0.05708	0.09049
10.0	-0.05093	-0.05223	-0.05103	0.00007	0.00757	-0.09720	0.01205	-0.00757	0.00455
11.0	-0.72363	-0.74213	-0.73431	0.01426	0.00757	-1.38116	0.17122	-0.10891	0.06551
12.0	-0.77151	-1.04604	-1.04840	0.45863	0.41435	-12.01770	2.36100	-0.95989	0.91498
13.0	0.17255	0.18116	0.17712	0.00168	0.05115	0.66178	-0.11125	0.05157	-0.04206
14.0	1.11661	1.16306	1.17295	0.05745	0.03662	-1.83503	0.59957	-0.14748	0.23381
15.0	1.25115	1.30320	1.32542	0.07213	0.03662	-2.05614	0.67181	-0.16666	0.26420
16.0	1.07100	1.09559	1.10086	0.02788	0.00272	0.16808	0.15128	0.01346	0.05877
17.0	-1.08164	-1.10648	-1.11244	0.02844	0.00272	-0.16975	-0.15278	-0.01360	-0.05939
18.0	-0.54348	-0.55596	-0.54703	0.00718	0.00272	-0.08529	-0.07677	-0.00669	-0.02921
19.0	-0.00532	-0.00544	-0.00532	0.00000	0.00272	-0.00084	-0.00075	-0.00007	-0.00028
20.0	0.12922	0.13219	0.12920	0.00041	0.00272	0.02028	0.01825	0.00158	0.00690
21.0	1.42901	1.46554	1.50732	0.05561	0.00757	2.72750	-0.33812	0.22356	-0.13447
22.0	1.33780	1.47299	1.51582	0.23035	0.13347	8.34301	-1.53239	0.68421	-0.60976
23.0	2.05839	2.14402	2.35519	0.19522	0.03662	-3.38276	1.10526	-0.29613	0.46946
24.0	0.35269	0.36171	0.35445	0.00339	0.00757	0.67317	-0.08345	0.05257	-0.03162

25.0	0.03801	0.03990	0.03899	0.00008	0.05115	0.14577	-0.02450	0.01135	-0.00926

Item 12

Case	ZRE_12	SRE_12	SDR_12	COO_12	LEV_12	DFB0_12	DFB1_12	SDB0_12	SDB1_12
1.0	-1.17019	-1.24766	-1.26375	0.10647	0.08033	3.81826	-1.13516	0.29075	-0.38190
2.0	-0.90275	-0.96252	-0.96091	0.06336	0.08033	2.94562	-0.87572	0.22107	-0.29038
3.0	-0.76903	-0.81994	-0.81390	0.04598	0.08033	2.50930	-0.74601	0.18725	-0.24596
4.0	-0.29629	-0.30264	-0.29658	0.00198	0.00149	-0.38368	0.03597	-0.02827	0.01171
5.0	-1.00068	-1.02938	-1.03078	0.03082	0.01498	0.86252	-0.39019	0.06493	-0.12977
6.0	-0.86696	-0.89182	-0.88770	0.02314	0.01498	0.74726	-0.33805	0.05592	-0.11176
7.0	-0.73324	-0.75427	-0.74699	0.01655	0.01498	0.63201	-0.28591	0.04705	-0.09405
8.0	-0.79538	-0.82919	-0.82336	0.02984	0.03988	-2.85001	0.51971	-0.21275	0.17140
9.0	-0.39422	-0.41098	-0.40343	0.00733	0.03988	-1.41258	0.25759	-0.10424	0.08398
10.0	0.10487	0.10711	0.10479	0.00025	0.00149	0.13580	-0.01273	0.00999	-0.00414
11.0	-1.29448	-1.42098	-1.45508	0.20697	0.13012	-8.34943	1.69409	-0.64275	0.57618
12.0	-0.45637	-0.55030	-0.54178	0.06874	0.27224	-4.91596	1.04239	-0.36385	0.34086
13.0	1.00512	1.03394	1.03557	0.03110	0.01498	-0.86635	0.39192	-0.06523	0.13038
14.0	1.00512	1.03394	1.03557	0.03110	0.01498	-0.86635	0.39192	-0.06523	0.13038
15.0	0.77347	0.79003	0.78337	0.01351	0.00149	1.00160	-0.09390	0.07466	-0.03093
16.0	0.90719	0.92662	0.92365	0.01858	0.00149	1.17476	-0.11013	0.08803	-0.03646
17.0	-0.86696	-0.89182	-0.88770	0.02314	0.01498	0.74726	-0.33805	0.05592	-0.11176
18.0	-0.69745	-0.71239	-0.70455	0.01098	0.00149	-0.90316	0.08467	-0.06715	0.02781
19.0	-0.16257	-0.16605	-0.16250	0.00060	0.00149	-0.21052	0.01974	-0.01549	0.00642
20.0	0.70189	0.74836	0.74099	0.03830	0.08033	-2.29023	0.68088	-0.17048	0.22392
21.0	1.94116	1.99683	2.14798	0.11599	0.01498	-1.67315	0.75690	-0.13530	0.27043
22.0	2.11067	2.15587	2.36042	0.10060	0.00149	2.73320	-0.25624	0.22497	-0.09318
23.0	1.21042	1.26186	1.27920	0.06911	0.03988	4.33714	-0.79089	0.33053	-0.26630
24.0	0.14066	0.14663	0.14348	0.00093	0.03988	0.50400	-0.09190	0.03707	-0.02987

25.0	0.50603	0.51686	0.50847	0.00578	0.00149	0.65528	-0.06143	0.04846	-0.02007

Item 13

Case	ZRE_13	SRE_13	SDR_13	COO_13	LEV_13	DFB0_13	DFB1_13	SDB0_13	SDB1_13
1.0	-1.63851	-1.67251	-1.74532	0.05865	0.00025	-0.87147	-0.10893	-0.04465	-0.02804
2.0	-1.31667	-1.37657	-1.40545	0.08817	0.04514	4.91299	-1.23973	0.24626	-0.31219
3.0	-1.19536	-1.24975	-1.26602	0.07268	0.04514	4.46037	-1.12551	0.22183	-0.28122
4.0	-0.34137	-0.37760	-0.37045	0.01593	0.14266	-3.49115	0.63960	-0.16815	0.15477
5.0	-1.07406	-1.12293	-1.12965	0.05867	0.04514	4.00774	-1.01130	0.19793	-0.25092
6.0	-1.03200	-1.05342	-1.05605	0.02327	0.00025	-0.54889	-0.06861	-0.02701	-0.01696
7.0	-0.91070	-0.92960	-0.92674	0.01812	0.00025	-0.48437	-0.06055	-0.02371	-0.01489
8.0	-0.38343	-0.39819	-0.39079	0.00622	0.03276	-1.83380	0.30343	-0.08835	0.07345
9.0	0.13895	0.14527	0.14215	0.00098	0.04514	-0.51848	0.13083	-0.02491	0.03157
10.0	0.18101	0.18477	0.18084	0.00072	0.00025	0.09627	0.01203	0.00463	0.00291
11.0	-0.42549	-0.43432	-0.42653	0.00396	0.00025	-0.22631	-0.02829	-0.01091	-0.00685
12.0	0.42850	0.53984	0.53135	0.08557	0.32997	8.35390	-1.58399	0.40368	-0.38454
13.0	0.50774	0.56162	0.55308	0.03524	0.14266	5.19256	-0.95131	0.25105	-0.23107
14.0	0.66622	0.68004	0.67189	0.00970	0.00025	0.35434	0.04429	0.01719	0.01079
15.0	0.86676	0.90620	0.90253	0.03821	0.04514	-3.23422	0.81611	-0.15814	0.20048
16.0	0.90882	0.92768	0.92476	0.01804	0.00025	0.48337	0.06042	0.02366	0.01486
17.0	-1.03200	-1.05342	-1.05605	0.02327	0.00025	-0.54889	-0.06861	-0.02701	-0.01696
18.0	-0.54680	-0.55814	-0.54961	0.00653	0.00025	-0.29082	-0.03635	-0.01406	-0.00883
19.0	-0.14083	-0.14625	-0.14310	0.00084	0.03276	-0.67353	0.11145	-0.03235	0.02690
20.0	0.05971	0.06095	0.05962	0.00008	0.00025	0.03176	0.00397	0.00153	0.00096
21.0	1.51533	1.54678	1.59818	0.05017	0.00025	0.80595	0.10074	0.04088	0.02567
22.0	2.07978	2.17440	2.38593	0.22000	0.04514	-7.76045	1.95824	-0.41805	0.52998
23.0	1.59457	1.66712	1.73892	0.12932	0.04514	-5.94996	1.50139	-0.30469	0.38626
24.0	0.54492	0.55623	0.54770	0.00649	0.00025	0.28982	0.03623	0.01401	0.00880

25.0	0.54492	0.55623	0.54770	0.00649	0.00025	0.28982	0.03623	0.01401	0.00880

Item 14

Case	ZRE_14	SRE_14	SDR_14	COO_14	LEV_14	DFB0_14	DFB1_14	SDB0_14	SDB1_14
1.0	-2.17117	-2.25140	-2.49379	0.19076	0.03000	-6.38468	1.10081	-0.58738	0.44790
2.0	-0.97159	-1.02844	-1.02980	0.06370	0.06750	2.41254	-0.76996	0.20064	-0.28320
3.0	-0.83904	-0.88814	-0.88391	0.04750	0.06750	2.08340	-0.66492	0.17222	-0.24308
4.0	-0.58057	-0.60202	-0.59349	0.01364	0.03000	-1.70726	0.29435	-0.13979	0.10659
5.0	-0.70649	-0.74783	-0.74045	0.03368	0.06750	1.75427	-0.55987	0.14427	-0.20363
6.0	-1.19693	-1.22214	-1.23609	0.03179	0.00083	-1.35332	0.09807	-0.11369	0.03643
7.0	-0.75289	-0.77380	-0.76684	0.01687	0.01333	0.45000	-0.25000	0.03704	-0.09101
8.0	-0.40163	-0.41009	-0.40255	0.00358	0.00083	-0.45411	0.03291	-0.03702	0.01187
9.0	0.61901	0.65523	0.64689	0.02586	0.06750	-1.53704	0.49055	-0.12604	0.17790
10.0	0.44007	0.45229	0.44433	0.00576	0.01333	-0.26303	0.14613	-0.02146	0.05273
11.0	-0.22268	-0.22887	-0.22410	0.00148	0.01333	0.13310	-0.07394	0.01082	-0.02660
12.0	-0.58720	-0.76285	-0.75571	0.20012	0.36750	-7.61698	1.63555	-0.62672	0.59516
13.0	0.65878	0.67265	0.66443	0.00963	0.00083	0.74485	-0.05397	0.06111	-0.01958
14.0	0.97027	0.99723	0.99710	0.02801	0.01333	-0.57993	0.32218	-0.04816	0.11833
15.0	0.79133	0.80799	0.80169	0.01390	0.00083	0.89472	-0.06483	0.07373	-0.02363
16.0	0.30089	0.32461	0.31821	0.00864	0.10083	1.53572	-0.30274	0.12504	-0.10901
17.0	-0.88544	-0.91004	-0.90650	0.02333	0.01333	0.52923	-0.29401	0.04379	-0.10758
18.0	-0.35523	-0.36510	-0.35812	0.00375	0.01333	0.21232	-0.11796	0.01730	-0.04250
19.0	-0.44802	-0.46458	-0.45651	0.00812	0.03000	-1.31747	0.22715	-0.10753	0.08199
20.0	0.30752	0.31606	0.30979	0.00281	0.01333	-0.18380	0.10211	-0.01496	0.03676
21.0	1.58663	1.62005	1.68339	0.05587	0.00083	1.79394	-0.13000	0.15483	-0.04962
22.0	2.11683	2.16142	2.36804	0.09944	0.00083	2.39342	-0.17344	0.21779	-0.06980
23.0	1.27513	1.32225	1.34533	0.06580	0.03000	3.74973	-0.64651	0.31688	-0.24163
24.0	0.21473	0.22267	0.21801	0.00187	0.03000	0.63145	-0.10887	0.05135	-0.03916

25.0	0.83772	0.86099	0.85597	0.02088	0.01333	-0.50070	0.27817	-0.04134	0.10159

Item 15

Case	ZRE_15	SRE_15	SDR_15	COO_15	LEV_15	DFB0_15	DFB1_15	SDB0_15	SDB1_15
1.0	-1.64895	-1.68359	-1.75850	0.06017	0.00072	-1.57250	0.07863	-0.29079	0.04831
2.0	-1.22762	-1.27853	-1.29738	0.06920	0.03805	-2.10124	0.44157	-0.37750	0.26358
3.0	-1.10396	-1.14975	-1.15825	0.05596	0.03805	-1.88958	0.39709	-0.33701	0.23532
4.0	-0.16506	-0.16853	-0.16493	0.00060	0.00072	-0.15741	0.00787	-0.02727	0.00453
5.0	-1.32834	-1.37004	-1.39820	0.05986	0.01995	-0.35548	-0.33933	-0.06423	-0.20371
6.0	-0.85665	-0.89218	-0.88807	0.03369	0.03805	-1.46627	0.30813	-0.25840	0.18042
7.0	-0.73299	-0.76339	-0.75625	0.02467	0.03805	-1.25462	0.26365	-0.22005	0.15364
8.0	-0.11470	-0.11946	-0.11687	0.00060	0.03805	-0.19633	0.04126	-0.03401	0.02374
9.0	0.25627	0.26690	0.26143	0.00302	0.03805	0.43864	-0.09218	0.07607	-0.05311
10.0	0.03189	0.03289	0.03217	0.00003	0.01995	0.00854	0.00815	0.00148	0.00469
11.0	-0.41238	-0.42104	-0.41338	0.00376	0.00072	-0.39326	0.01966	-0.06836	0.01136
12.0	0.35251	0.37918	0.37201	0.01129	0.09575	-0.16791	0.21455	-0.02916	0.12382
13.0	0.70054	0.71525	0.70744	0.01086	0.00072	0.66806	-0.03340	0.11698	-0.01944
14.0	0.70054	0.71525	0.70744	0.01086	0.00072	0.66806	-0.03340	0.11698	-0.01944
15.0	0.99821	1.03961	1.04152	0.04575	0.03805	1.70858	-0.35905	0.30305	-0.21160
16.0	0.94785	0.96776	0.96637	0.01988	0.00072	0.90391	-0.04520	0.15980	-0.02655
17.0	-1.37870	-1.48302	-1.52518	0.17272	0.09575	0.65670	-0.83912	0.11957	-0.50765
18.0	-0.88407	-0.95097	-0.94890	0.07102	0.09575	0.42110	-0.53807	0.07439	-0.31584
19.0	-0.38944	-0.41891	-0.41127	0.01378	0.09575	0.18550	-0.23702	0.03224	-0.13689
20.0	0.25627	0.26690	0.26143	0.00302	0.03805	0.43864	-0.09218	0.07607	-0.05311
21.0	1.21811	1.31029	1.33217	0.13483	0.09575	-0.58021	0.74138	-0.10444	0.44340
22.0	2.06077	2.10406	2.28997	0.09397	0.00072	1.96523	-0.09826	0.37868	-0.06291
23.0	1.21811	1.31029	1.33217	0.13483	0.09575	-0.58021	0.74138	-0.10444	0.44340
24.0	0.75090	0.78204	0.77522	0.02589	0.03805	1.28526	-0.27009	0.22557	-0.15750

25.0	0.75090	0.78204	0.77522	0.02589	0.03805	1.28526	-0.27009	0.22557	-0.15750

Item 16

Case	ZRE_16	SRE_16	SDR_16	COO_16	LEV_16	DFB0_16	DFB1_16	SDB0_16	SDB1_16
1.0	-1.54800	-1.59042	-1.64876	0.07026	0.01263	0.00000	-0.27900	0.00000	-0.19038
2.0	-1.29113	-1.32651	-1.35002	0.04888	0.01263	0.00000	-0.23270	0.00000	-0.15589
3.0	-1.16269	-1.19455	-1.20631	0.03964	0.01263	0.00000	-0.20955	0.00000	-0.13929
4.0	-0.81343	-0.89107	-0.88693	0.07940	0.12667	-3.16667	0.52778	-0.39665	0.34579
5.0	-1.03425	-1.06259	-1.06573	0.03136	0.01263	0.00000	-0.18640	0.00000	-0.12306
6.0	-0.90582	-0.93064	-0.92782	0.02406	0.01263	0.00000	-0.16326	0.00000	-0.10714
7.0	-0.77738	-0.79868	-0.79219	0.01772	0.01263	0.00000	-0.14011	0.00000	-0.09147
8.0	-0.13520	-0.13890	-0.13590	0.00054	0.01263	0.00000	-0.02437	0.00000	-0.01569
9.0	0.25011	0.25697	0.25168	0.00183	0.01263	0.00000	0.04508	0.00000	0.02906
10.0	0.37855	0.38892	0.38163	0.00420	0.01263	0.00000	0.06823	0.00000	0.04407
11.0	-0.26363	-0.27086	-0.26533	0.00204	0.01263	0.00000	-0.04751	0.00000	-0.03064
12.0	0.08562	0.09380	0.09175	0.00088	0.12667	0.33333	-0.05556	0.04103	-0.03577
13.0	0.08562	0.09380	0.09175	0.00088	0.12667	0.33333	-0.05556	0.04103	-0.03577
14.0	0.89230	0.91675	0.91344	0.02335	0.01263	0.00000	0.16082	0.00000	0.10548
15.0	0.21406	0.23449	0.22961	0.00550	0.12667	0.83333	-0.13889	0.10269	-0.08952
16.0	1.14917	1.18066	1.19137	0.03872	0.01263	0.00000	0.20712	0.00000	0.13757
17.0	-0.90582	-0.93064	-0.92782	0.02406	0.01263	0.00000	-0.16326	0.00000	-0.10714
18.0	-0.39207	-0.40281	-0.39536	0.00451	0.01263	0.00000	-0.07066	0.00000	-0.04565
19.0	0.12168	0.12501	0.12230	0.00043	0.01263	0.00000	0.02193	0.00000	0.01412
20.0	-0.55656	-0.60968	-0.60116	0.03717	0.12667	-2.16667	0.36111	-0.26885	0.23437
21.0	0.98468	1.07866	1.08269	0.11635	0.12667	3.83333	-0.63889	0.48420	-0.42211
22.0	2.30510	2.36826	2.66364	0.15580	0.01263	0.00000	0.41545	0.00000	0.30757
23.0	1.79135	1.84044	1.94923	0.09409	0.01263	0.00000	0.32286	0.00000	0.22508
24.0	0.76386	0.78479	0.77803	0.01711	0.01263	0.00000	0.13767	0.00000	0.08984

25.0	0.76386	0.78479	0.77803	0.01711	0.01263	0.00000	0.13767	0.00000	0.08984

Item 17

Case	ZRE_17	SRE_17	SDR_17	COO_17	LEV_17	DFB0_17	DFB1_17	SDB0_17	SDB1_17
1.0	-1.06175	-1.16014	-1.16937	0.13050	0.12242	-3.91075	0.79237	-0.51494	0.44706
2.0	-1.96464	-2.05498	-2.22435	0.19864	0.04599	1.43026	-0.82349	0.20224	-0.49894
3.0	-1.24996	-1.27879	-1.29767	0.03816	0.00459	-1.58280	0.15828	-0.20982	0.08990
4.0	-0.64845	-0.67827	-0.67010	0.02164	0.04599	0.47208	-0.27180	0.06093	-0.15031
5.0	-1.11834	-1.14414	-1.15226	0.03054	0.00459	-1.41614	0.14161	-0.18631	0.07983
6.0	-0.40366	-0.44106	-0.43320	0.01886	0.12242	-1.48679	0.30125	-0.19077	0.16562
7.0	-0.27204	-0.29725	-0.29127	0.00857	0.12242	-1.00200	0.20302	-0.12827	0.11136
8.0	-0.78007	-0.81594	-0.80981	0.03132	0.04599	0.56789	-0.32697	0.07363	-0.18165
9.0	0.19785	0.20241	0.19814	0.00096	0.00459	0.25053	-0.02505	0.03204	-0.01373
10.0	-0.25360	-0.26526	-0.25982	0.00331	0.04599	0.18462	-0.10630	0.02362	-0.05828
11.0	-0.32863	-0.33621	-0.32963	0.00264	0.00459	-0.41614	0.04161	-0.05330	0.02284
12.0	0.85594	0.87568	0.87108	0.01789	0.00459	1.08386	-0.10839	0.14085	-0.06035
13.0	0.85594	0.87568	0.87108	0.01789	0.00459	1.08386	-0.10839	0.14085	-0.06035
14.0	0.27288	0.28543	0.27965	0.00383	0.04599	-0.19866	0.11438	-0.02543	0.06273
15.0	0.40450	0.42310	0.41542	0.00842	0.04599	-0.29448	0.16955	-0.03777	0.09318
16.0	1.11918	1.14499	1.15317	0.03059	0.00459	1.41720	-0.14172	0.18646	-0.07989
17.0	-1.56978	-1.64196	-1.70917	0.12682	0.04599	1.14281	-0.65798	0.15540	-0.38338
18.0	-0.46025	-0.47086	-0.46275	0.00517	0.00459	-0.58280	0.05828	-0.07482	0.03206
19.0	0.06623	0.06776	0.06627	0.00011	0.00459	0.08386	-0.00839	0.01072	-0.00459
20.0	0.19785	0.20241	0.19814	0.00096	0.00459	0.25053	-0.02505	0.03204	-0.01373
21.0	1.19421	1.24912	1.26534	0.07339	0.04599	-0.86939	0.50056	-0.11505	0.28382
22.0	1.72068	1.79980	1.89904	0.15237	0.04599	-1.25266	0.72123	-0.17266	0.42597
23.0	1.19421	1.24912	1.26534	0.07339	0.04599	-0.86939	0.50056	-0.11505	0.28382
24.0	1.30738	1.42853	1.46357	0.19786	0.12242	4.81549	-0.97569	0.64450	-0.55953

25.0	0.72432	0.74103	0.73355	0.01281	0.00459	0.91720	-0.09172	0.11861	-0.05082

Item 18

Case	ZRE_18	SRE_18	SDR_18	COO_18	LEV_18	DFB0_18	DFB1_18	SDB0_18	SDB1_18
1.0	-1.69136	-1.72937	-1.81336	0.06797	0.00348	0.00000	-0.26268	0.00000	-0.10935
2.0	-1.44747	-1.48000	-1.52174	0.04978	0.00348	0.00000	-0.22480	0.00000	-0.09176
3.0	-1.32552	-1.35531	-1.38185	0.04175	0.00348	0.00000	-0.20586	0.00000	-0.08333
4.0	-0.22799	-0.23311	-0.22826	0.00124	0.00348	0.00000	-0.03541	0.00000	-0.01376
5.0	-1.20357	-1.23062	-1.24527	0.03442	0.00348	0.00000	-0.18692	0.00000	-0.07509
6.0	-0.60974	-0.86230	-0.85732	0.37178	0.46000	-12.50000	2.08333	-0.85732	0.82231
7.0	-0.95968	-0.98124	-0.98042	0.02188	0.00348	0.00000	-0.14904	0.00000	-0.05912
8.0	-0.34994	-0.35780	-0.35091	0.00291	0.00348	0.00000	-0.05435	0.00000	-0.02116
9.0	0.01591	0.01626	0.01591	0.00001	0.00348	0.00000	0.00247	0.00000	0.00096
10.0	0.60974	0.86230	0.85732	0.37178	0.46000	12.50000	-2.08333	0.85732	-0.82231
11.0	-0.47188	-0.48249	-0.47429	0.00529	0.00348	0.00000	-0.07329	0.00000	-0.02860
12.0	0.62564	0.63971	0.63129	0.00930	0.00348	0.00000	0.09717	0.00000	0.03807
13.0	0.62564	0.63971	0.63129	0.00930	0.00348	0.00000	0.09717	0.00000	0.03807
14.0	0.62564	0.63971	0.63129	0.00930	0.00348	0.00000	0.09717	0.00000	0.03807
15.0	0.74759	0.76439	0.75727	0.01328	0.00348	0.00000	0.11611	0.00000	0.04567
16.0	0.86954	0.88908	0.88488	0.01797	0.00348	0.00000	0.13505	0.00000	0.05336
17.0	-1.08162	-1.10593	-1.11158	0.02780	0.00348	0.00000	-0.16798	0.00000	-0.06703
18.0	-0.59383	-0.60718	-0.59865	0.00838	0.00348	0.00000	-0.09223	0.00000	-0.03610
19.0	-0.10604	-0.10842	-0.10607	0.00027	0.00348	0.00000	-0.01647	0.00000	-0.00640
20.0	0.01591	0.01626	0.01591	0.00001	0.00348	0.00000	0.00247	0.00000	0.00096
21.0	1.47928	1.51253	1.55884	0.05199	0.00348	0.00000	0.22974	0.00000	0.09400
22.0	1.96707	2.01128	2.16683	0.09194	0.00348	0.00000	0.30550	0.00000	0.13066
23.0	1.47928	1.51253	1.55884	0.05199	0.00348	0.00000	0.22974	0.00000	0.09400
24.0	0.50370	0.51502	0.50663	0.00603	0.00348	0.00000	0.07823	0.00000	0.03055

25.0	0.50370	0.51502	0.50663	0.00603	0.00348	0.00000	0.07823	0.00000	0.03055

Item 19

Case	ZRE_19	SRE_19	SDR_19	COO_19	LEV_19	DFB0_19	DFB1_19	SDB0_19	SDB1_19
1.0	-1.59096	-1.64680	-1.71487	0.09685	0.02667	0.00000	-0.39087	0.00000	-0.28987
2.0	-1.34868	-1.39601	-1.42713	0.06960	0.02667	0.00000	-0.33135	0.00000	-0.24123
3.0	-1.22754	-1.27062	-1.28875	0.05766	0.02667	0.00000	-0.30159	0.00000	-0.21784
4.0	-0.26651	-0.28092	-0.27522	0.00438	0.06000	-0.61111	0.10185	-0.09174	0.07106
5.0	-1.23562	-1.30245	-1.32357	0.09424	0.06000	-2.83333	0.47222	-0.44119	0.34174
6.0	-0.98526	-1.01984	-1.02077	0.03715	0.02667	0.00000	-0.24206	0.00000	-0.17254
7.0	-0.86412	-0.89445	-0.89042	0.02857	0.02667	0.00000	-0.21230	0.00000	-0.15051
8.0	-0.25843	-0.26750	-0.26203	0.00256	0.02667	0.00000	-0.06349	0.00000	-0.04429
9.0	-0.02423	-0.02554	-0.02498	0.00004	0.06000	-0.05556	0.00926	-0.00833	0.00645
10.0	0.09691	0.10215	0.09993	0.00058	0.06000	0.22222	-0.03704	0.03331	-0.02580
11.0	-0.37957	-0.39289	-0.38555	0.00551	0.02667	0.00000	-0.09325	0.00000	-0.06517
12.0	0.71068	0.73562	0.72807	0.01933	0.02667	0.00000	0.17460	0.00000	0.12307
13.0	0.58147	0.61292	0.60440	0.02087	0.06000	1.33333	-0.22222	0.20147	-0.15606
14.0	0.71068	0.73562	0.72807	0.01933	0.02667	0.00000	0.17460	0.00000	0.12307
15.0	0.70260	0.74061	0.73313	0.03047	0.06000	1.61111	-0.26852	0.24438	-0.18929
16.0	0.95296	0.98641	0.98580	0.03475	0.02667	0.00000	0.23413	0.00000	0.16663
17.0	-0.98526	-1.01984	-1.02077	0.03715	0.02667	0.00000	-0.24206	0.00000	-0.17254
18.0	-0.62992	-0.66400	-0.65572	0.02449	0.06000	-1.44444	0.24074	-0.21857	0.16931
19.0	-0.14537	-0.15323	-0.14994	0.00130	0.06000	-0.33333	0.05556	-0.04998	0.03871
20.0	0.10499	0.10867	0.10631	0.00042	0.02667	0.00000	0.02579	0.00000	0.01797
21.0	1.55865	1.61336	1.67555	0.09296	0.02667	0.00000	0.38294	0.00000	0.28322
22.0	2.04321	2.11492	2.30463	0.15975	0.02667	0.00000	0.50198	0.00000	0.38955
23.0	1.55865	1.61336	1.67555	0.09296	0.02667	0.00000	0.38294	0.00000	0.28322
24.0	0.46033	0.48523	0.47701	0.01308	0.06000	1.05556	-0.17593	0.15900	-0.12316

25.0	0.46033	0.48523	0.47701	0.01308	0.06000	1.05556	-0.17593	0.15900	-0.12316

Item 20

Case	ZRE_20	SRE_20	SDR_20	COO_20	LEV_20	DFB0_20	DFB1_20	SDB0_20	SDB1_20
1.0	-1.74100	-1.81070	-1.91245	0.13388	0.03550	0.06501	-0.49837	0.01119	-0.37478
2.0	-1.49797	-1.55794	-1.61107	0.09911	0.03550	0.05593	-0.42880	0.00943	-0.31572
3.0	-1.37645	-1.43155	-1.46697	0.08368	0.03550	0.05139	-0.39402	0.00858	-0.28748
4.0	-0.08013	-0.08395	-0.08211	0.00034	0.04893	-0.16090	0.02732	-0.02565	0.01903
5.0	-1.05227	-1.10243	-1.10786	0.05931	0.04893	-2.11302	0.35881	-0.34612	0.25673
6.0	-0.93075	-0.97512	-0.97403	0.04640	0.04893	-1.86901	0.31738	-0.30431	0.22572
7.0	-0.80923	-0.84781	-0.84244	0.03508	0.04893	-1.62499	0.27594	-0.26319	0.19522
8.0	-0.40431	-0.42050	-0.41284	0.00722	0.03550	0.01510	-0.11574	0.00242	-0.08090
9.0	0.16291	0.17067	0.16703	0.00142	0.04893	0.32713	-0.05555	0.05218	-0.03871
10.0	0.28442	0.29798	0.29200	0.00433	0.04893	0.57114	-0.09699	0.09123	-0.06767
11.0	-0.32316	-0.33857	-0.33195	0.00559	0.04893	-0.64893	0.11020	-0.10371	0.07693
12.0	0.56783	0.59056	0.58201	0.01424	0.03550	-0.02120	0.16255	-0.00341	0.11405
13.0	0.56783	0.59056	0.58201	0.01424	0.03550	-0.02120	0.16255	-0.00341	0.11405
14.0	0.56783	0.59056	0.58201	0.01424	0.03550	-0.02120	0.16255	-0.00341	0.11405
15.0	0.89201	0.93453	0.93185	0.04262	0.04893	1.79122	-0.30417	0.29113	-0.21594
16.0	0.81086	0.84333	0.83784	0.02904	0.03550	-0.03028	0.23212	-0.00490	0.16419
17.0	-0.93075	-0.97512	-0.97403	0.04640	0.04893	-1.86901	0.31738	-0.30431	0.22572
18.0	-0.64735	-0.67326	-0.66505	0.01851	0.03550	0.02417	-0.18531	0.00389	-0.13033
19.0	-0.16128	-0.16773	-0.16415	0.00115	0.03550	0.00602	-0.04617	0.00096	-0.03217
20.0	0.16291	0.17067	0.16703	0.00142	0.04893	0.32713	-0.05555	0.05218	-0.03871
21.0	1.62112	1.69839	1.77617	0.14077	0.04893	3.25530	-0.55279	0.55491	-0.41160
22.0	2.00585	2.04750	2.21446	0.08795	0.00027	1.87576	-0.04810	0.33068	-0.03704
23.0	1.41845	1.47524	1.51633	0.08887	0.03550	-0.05296	0.40604	-0.00887	0.29715
24.0	0.44631	0.46418	0.45612	0.00880	0.03550	-0.01666	0.12776	-0.00267	0.08938

25.0	0.44631	0.46418	0.45612	0.00880	0.03550	-0.01666	0.12776	-0.00267	0.08938

Item 21

Case	ZRE_21	SRE_21	SDR_21	COO_21	LEV_21	DFB0_21	DFB1_21	SDB0_21	SDB1_21
1.0	-1.62736	-1.66236	-1.73328	0.06008	0.00167	-1.45380	0.24230	-0.36141	0.07228
2.0	-1.38402	-1.41379	-1.44702	0.04345	0.00167	-1.23641	0.20607	-0.30172	0.06034
3.0	-1.26235	-1.28950	-1.30937	0.03615	0.00167	-1.12772	0.18795	-0.27302	0.05460
4.0	-0.16730	-0.17090	-0.16725	0.00063	0.00167	-0.14946	0.02491	-0.03487	0.00697
5.0	-1.14068	-1.16521	-1.17480	0.02952	0.00167	-1.01902	0.16984	-0.24496	0.04899
6.0	-1.01900	-1.04092	-1.04290	0.02355	0.00167	-0.91033	0.15172	-0.21746	0.04349
7.0	-0.89733	-0.91663	-0.91332	0.01827	0.00167	-0.80163	0.13361	-0.19044	0.03809
8.0	-0.28897	-0.29519	-0.28925	0.00189	0.00167	-0.25815	0.04303	-0.06031	0.01206
9.0	0.07605	0.07768	0.07598	0.00013	0.00167	0.06793	-0.01132	0.01584	-0.00317
10.0	0.19772	0.20197	0.19771	0.00089	0.00167	0.17663	-0.02944	0.04122	-0.00824
11.0	-0.41064	-0.41948	-0.41183	0.00383	0.00167	-0.36685	0.06114	-0.08587	0.01717
12.0	0.68441	0.69913	0.69114	0.01063	0.00167	0.61141	-0.10190	0.14411	-0.02882
13.0	0.68441	0.69913	0.69114	0.01063	0.00167	0.61141	-0.10190	0.14411	-0.02882
14.0	0.68441	0.69913	0.69114	0.01063	0.00167	0.61141	-0.10190	0.14411	-0.02882
15.0	0.80608	0.82341	0.81745	0.01474	0.00167	0.72011	-0.12002	0.17045	-0.03409
16.0	0.92775	0.94770	0.94552	0.01952	0.00167	0.82880	-0.13813	0.19715	-0.03943
17.0	-1.01900	-1.04092	-1.04290	0.02355	0.00167	-0.91033	0.15172	-0.21746	0.04349
18.0	-0.53232	-0.54376	-0.53526	0.00643	0.00167	-0.47554	0.07926	-0.11161	0.02232
19.0	-0.04563	-0.04661	-0.04559	0.00005	0.00167	-0.04076	0.00679	-0.00951	0.00190
20.0	0.07605	0.07768	0.07598	0.00013	0.00167	0.06793	-0.01132	0.01584	-0.00317
21.0	1.53611	1.56915	1.62405	0.05353	0.00167	1.37228	-0.22871	0.33864	-0.06773
22.0	2.02280	2.06630	2.23940	0.09282	0.00167	1.80707	-0.30118	0.46695	-0.09339
23.0	1.53611	1.56915	1.62405	0.05353	0.00167	1.37228	-0.22871	0.33864	-0.06773
24.0	0.00000	#NULL!	#NULL!	#NULL!	0.96000	#NULL!	#NULL!	#NULL!	#NULL!

25.0	0.56273	0.57484	0.56628	0.00718	0.00167	0.50272	-0.08379	0.11808	-0.02362

Item 22

Case	ZRE_22	SRE_22	SDR_22	COO_22	LEV_22	DFB0_22	DFB1_22	SDB0_22	SDB1_22
1.0	-1.60378	-1.65638	-1.72619	0.09145	0.02250	0.00000	-0.36806	0.00000	-0.26742
2.0	-1.36170	-1.40636	-1.43870	0.06593	0.02250	0.00000	-0.31250	0.00000	-0.22288
3.0	-1.24066	-1.28135	-1.30046	0.05473	0.02250	0.00000	-0.28472	0.00000	-0.20147
4.0	-0.15130	-0.15626	-0.15291	0.00081	0.02250	0.00000	-0.03472	0.00000	-0.02369
5.0	-1.22385	-1.29809	-1.31878	0.10531	0.07111	-3.15972	0.52662	-0.46626	0.37301
6.0	-0.99858	-1.03133	-1.03283	0.03545	0.02250	0.00000	-0.22917	0.00000	-0.16000
7.0	-0.87754	-0.90632	-0.90266	0.02738	0.02250	0.00000	-0.20139	0.00000	-0.13984
8.0	-0.27234	-0.28127	-0.27556	0.00264	0.02250	0.00000	-0.06250	0.00000	-0.04269
9.0	0.09078	0.09376	0.09171	0.00029	0.02250	0.00000	0.02083	0.00000	0.01421
10.0	0.10759	0.11412	0.11164	0.00081	0.07111	0.27778	-0.04630	0.03947	-0.03158
11.0	-0.49761	-0.52779	-0.51935	0.01741	0.07111	-1.28472	0.21412	-0.18362	0.14689
12.0	0.69598	0.71881	0.71104	0.01722	0.02250	0.00000	0.15972	0.00000	0.11015
13.0	0.69598	0.71881	0.71104	0.01722	0.02250	0.00000	0.15972	0.00000	0.11015
14.0	0.69598	0.71881	0.71104	0.01722	0.02250	0.00000	0.15972	0.00000	0.11015
15.0	0.81702	0.84382	0.83835	0.02373	0.02250	0.00000	0.18750	0.00000	0.12988
16.0	0.93806	0.96883	0.96748	0.03129	0.02250	0.00000	0.21528	0.00000	0.14988
17.0	-1.10281	-1.16971	-1.17962	0.08551	0.07111	-2.84722	0.47454	-0.41706	0.33365
18.0	-0.61865	-0.65618	-0.64785	0.02691	0.07111	-1.59722	0.26620	-0.22905	0.18324
19.0	-0.03026	-0.03125	-0.03057	0.00003	0.02250	0.00000	-0.00694	0.00000	-0.00474
20.0	-0.01345	-0.01426	-0.01395	0.00001	0.07111	-0.03472	0.00579	-0.00493	0.00395
21.0	1.43903	1.52632	1.57465	0.14560	0.07111	3.71528	-0.61921	0.55672	-0.44538
22.0	2.02742	2.09391	2.27631	0.14615	0.02250	0.00000	0.46528	0.00000	0.35265
23.0	1.43903	1.52632	1.57465	0.14560	0.07111	3.71528	-0.61921	0.55672	-0.44538
24.0	0.57494	0.59380	0.58525	0.01175	0.02250	0.00000	0.13194	0.00000	0.09067

25.0	0.47071	0.49927	0.49096	0.01558	0.07111	1.21528	-0.20255	0.17358	-0.13886

Item 23 (MajorGPA)

Case	ZRE_23	SRE_23	SDR_23	COO_23	LEV_23	DFB0_23	DFB1_23	SDB0_23	SDB1_23
1.0	-2.16912	-2.21603	-2.45655	0.10737	0.00023	-0.25257	-0.34947	-0.00771	-0.03797
2.0	-1.14429	-1.18463	-1.19618	0.05035	0.02529	-7.86436	1.98959	-0.21861	0.19693
3.0	-0.72374	-0.75937	-0.75183	0.02908	0.04996	-6.96855	1.81684	-0.18994	0.17632
4.0	-0.79729	-0.82341	-0.81717	0.02258	0.02077	3.87423	-1.25041	0.10585	-0.12164
5.0	-0.56568	-0.59352	-0.58457	0.01777	0.04996	-5.44662	1.42004	-0.14768	0.13710
6.0	-0.67009	-0.69372	-0.68530	0.01727	0.02529	-4.60534	1.16509	-0.12525	0.11282
7.0	-0.24954	-0.26183	-0.25621	0.00346	0.04996	-2.40274	0.62644	-0.06473	0.06009
8.0	-0.68500	-0.70195	-0.69362	0.01234	0.00604	1.54805	-0.57016	0.04211	-0.05523
9.0	2.06490	2.42266	2.76424	1.10499	0.23187	51.39367	-13.96304	1.61434	-1.56168
10.0	0.12313	0.12585	0.12300	0.00035	0.00119	-0.07571	0.04525	-0.00204	0.00434
11.0	0.17273	0.17923	0.17524	0.00123	0.02956	1.27941	-0.32619	0.03444	-0.03126
12.0	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
13.0	0.49291	0.50610	0.49737	0.00695	0.00980	-1.51855	0.52474	-0.04108	0.05055
14.0	-0.13705	-0.14495	-0.14168	0.00125	0.06441	1.30665	-0.39692	0.03516	-0.03803
15.0	0.38849	0.40250	0.39470	0.00595	0.02673	-2.19180	0.69550	-0.05917	0.06685
16.0	0.28408	0.29839	0.29212	0.00460	0.05198	-2.37882	0.72898	-0.06411	0.06996
17.0	-0.09263	-0.09944	-0.09718	0.00075	0.09056	-1.23260	0.32771	-0.03316	0.03139
18.0	-0.03783	-0.03916	-0.03826	0.00006	0.02529	-0.25998	0.06577	-0.00699	0.00630
19.0	0.09572	0.09785	0.09562	0.00022	0.00133	0.19790	-0.03721	0.00532	-0.00356
20.0	-0.95362	-1.01049	-1.01100	0.06271	0.06772	9.37602	-2.84267	0.25825	-0.27879
21.0	0.81193	0.86909	0.86407	0.05505	0.08555	-9.23140	2.77579	-0.25267	0.27052
22.0	2.31038	2.36791	2.68007	0.14138	0.00634	-5.39287	1.97156	-0.16804	0.21874
23.0	1.33689	1.38509	1.41641	0.07042	0.02673	-7.54247	2.39336	-0.21234	0.23991
24.0	0.07236	0.07497	0.07326	0.00021	0.02673	-0.40825	0.12955	-0.01098	0.01241

25.0	0.07236	0.07497	0.07326	0.00021	0.02673	-0.40825	0.12955	-0.01098	0.01241

Class A Total Score and Major GPA

Case	Score %	Total Score	Major GPA	ZRE_1	SRE_1	SDR_1	COO_1	LEV_1	DFB0_1	DFB1_1	DFB2_1
1	0.00%	90	4.00	-2.83701	-3.03505	-4.22118	0.44364	0.07862	82.09879	-0.21734	-18.71539
2	0.00%	104	2.80	-1.03068	-1.28084	-1.30567	0.29767	0.30485	-42.08780	-0.16279	15.05402
3	0.00%	35	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
4	16.67%	94	3.30	-1.29836	-1.36107	-1.39654	0.06109	0.04240	-16.78371	-0.04512	5.20094
5	33.33%	13	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
6	36.67%	94	3.05	-0.30540	-0.33727	-0.32881	0.00833	0.13248	-10.18783	0.00006	2.67709
7	53.33%	103	3.30	0.07116	0.07696	0.07480	0.00034	0.09750	-0.25679	0.01269	-0.20815
8	90.00%	90	3.50	0.81201	0.83413	0.82677	0.01281	0.00472	5.04827	0.00288	-1.13116
9	60.00%	86	3.91	-0.78996	-0.82716	-0.81958	0.02199	0.04031	11.32366	-0.00156	-3.44736
10	66.67%	87	3.92	-0.56466	-0.59234	-0.58135	0.01175	0.04365	9.53658	-0.01025	-2.64030
11	76.67%	95	3.50	0.45181	0.46716	0.45677	0.00503	0.01700	-1.13868	0.03404	-0.33055
12	83.33%	80	3.50	0.42369	0.44531	0.43516	0.00692	0.04713	10.47909	-0.06125	-1.21300
13	90.00%	75	3.60	0.43105	0.46285	0.45251	0.01092	0.08507	12.12825	-0.09208	-0.89988
14	90.00%	39	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
15	60.00%	76	3.77	-0.77301	-0.82188	-0.81414	0.02937	0.06777	-10.62010	0.13128	-0.63364
16	66.67%	76	3.15	0.26152	0.30538	0.29755	0.01130	0.21902	18.11985	-0.08169	-2.87394
17	66.67%	22	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
18	86.67%	91	4.00	0.06233	0.06687	0.06499	0.00022	0.08352	-1.93226	0.00576	0.42262
19	90.00%	110	3.49	1.15828	1.32397	1.35430	0.17913	0.18701	-40.07545	0.40945	1.63649

20	100.00%	67	3.60	0.63040	0.73276	0.72298	0.06284	0.21225	32.02678	-0.24927	-2.40864
21	100.00%	104	3.75	1.05011	1.15971	1.17166	0.09846	0.13246	-42.00090	0.28570	5.12578
22	100.00%	92	3.75	0.85021	0.87988	0.87409	0.01832	0.01868	-11.83427	0.05645	2.25486
23	100.00%	89	4.00	0.47250	0.50433	0.49362	0.01181	0.07462	-12.72302	0.02881	3.03437
24	100.00%	82	3.80	0.61808	0.64262	0.63180	0.01114	0.02727	0.25654	-0.04402	1.27819
25	100.00%	33	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
26	100.00%	79	4.00	0.30592	0.32823	0.31994	0.00543	0.08367	-2.51345	-0.02843	1.53727

Case	SDB0_1	SDB1_1	SDB2_1
1	1.07882	-0.47583	-1.26119
2	-0.40536	-0.26123	0.74354
3	#NULL!	#NULL!	#NULL!
4	-0.16271	-0.07287	0.25856
5	#NULL!	#NULL!	#NULL!
6	-0.09384	0.00010	0.12646
7	-0.00236	0.01941	-0.00980
8	0.04728	0.00449	-0.05432
9	0.10601	-0.00243	-0.16550
10	0.08843	-0.01583	-0.12555
11	-0.01052	0.05239	-0.01566
12	0.09675	-0.09423	-0.05743
13	0.11203	-0.14171	-0.04263
14	#NULL!	#NULL!	#NULL!
15	-0.09940	0.20471	-0.03041
16	0.16681	-	-0.13568

		0.12529	
17	#NULL!	#NULL!	#NULL!
18	-0.01774	0.00882	0.01990
19	-0.38731	0.65929	0.08111
		-	
20	0.29855	0.38715	-0.11515
21	-0.40092	0.45437	0.25091
22	-0.11108	0.08828	0.10853
23	-0.11766	0.04438	0.14390
		-	
24	0.00238	0.06812	0.06089
25	#NULL!	#NULL!	#NULL!
		-	
26	-0.02315	0.04362	0.07260

Class A Subscales and Major GPA

Case	Score %	Spec Subscale	Test Subscale	Trb Subscale	Major GPA	ZRE_1	SRE_1	SDR_1	COO_1	LEV_1	DFB0_1
1	0.00%	24.0	48.0	18	4.00	-2.80579	-3.03087	-4.49694	0.30660	0.09539	81.39680
2	0.00%	27.0	47.0	30	2.80	-1.69990	-2.32724	-2.77053	0.94703	0.41884	-49.81137
3	0.00%	17.0	18.0	0	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
4	16.67%	25.0	59.0	10	3.30	0.04062	0.05921	0.05733	0.00079	0.48159	1.67112
5	33.33%	13.0	0.0	0	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
6	36.67%	24.0	50.0	20	3.05	-0.08581	-0.09557	-0.09256	0.00044	0.14633	-2.90660
7	53.33%	25.0	54.0	24	3.30	0.00982	0.01064	0.01030	0.00000	0.09985	-0.05001
8	90.00%	24.0	47.0	19	3.50	1.10534	1.14173	1.15346	0.01745	0.01511	5.97942
9	60.00%	19.0	53.0	14	3.91	-0.42192	-0.47498	-0.46317	0.01206	0.16331	0.41547
10	66.67%	23.0	46.0	18	3.92	-0.43408	-0.45697	-0.44538	0.00452	0.05004	6.94752
11	76.67%	24.0	53.0	18	3.50	0.91857	0.96991	0.96799	0.02162	0.05543	0.26743
12	83.33%	23.0	39.0	18	3.50	0.58399	0.61527	0.60291	0.00833	0.05150	12.68421
13	90.00%	27.0	29.0	19	3.60	0.57745	0.66969	0.65770	0.03094	0.20886	7.85572
14	90.00%	12.0	27.0	0	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
15	60.00%	20.0	42.0	14	3.77	-0.49919	-0.54528	-0.53294	0.01149	0.11428	-10.34752
16	66.67%	24.0	31.0	21	3.15	0.08989	0.10735	0.10398	0.00098	0.25119	5.24529
17	66.67%	16.0	6.0	0	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
18	86.67%	24.0	47.0	20	4.00	0.11302	0.12180	0.11799	0.00048	0.09138	-3.66487
19	90.00%	18.0	66.0	26	3.49	0.67966	0.90653	0.90119	0.12804	0.39028	-14.38840
20	100.00%	11.0	38.0	18	3.60	-0.04052	-0.06752	-0.06539	0.00162	0.59218	-5.92051
21	100.00%	27.0	52.0	25	3.75	0.99964	1.13933	1.15082	0.07763	0.18256	-49.71242
22	100.00%	18.0	48.0	26	3.75	0.00169	0.00196	0.00190	0.00000	0.21367	-0.01649
23	100.00%	23.0	46.0	20	4.00	0.47237	0.50492	0.49283	0.00727	0.07715	-12.73355
24	100.00%	25.0	35.0	22	3.80	0.40757	0.44237	0.43097	0.00697	0.10356	-4.37924
25	100.00%	11.0	22.0	0	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
26	100.00%	25.0	32.0	22	4.00	-0.01243	-0.01430	-0.01385	0.00001	0.19749	0.29656

Case	DFB1_1	DFB2_1	DFB3_1	DFB4_1	SDB0_1	SDB1_1	SDB2_1	SDB3_1	SDB4_1
1	-0.76110	-0.23600	0.22522	-17.21381	1.15832	-0.66743	-0.51795	0.23507	-1.31701
2	-0.54959	0.05290	-1.55639	24.14183	-0.56875	-0.38670	0.09316	-1.30337	1.48201
3	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
4	0.02856	0.01789	-0.07153	-0.44170	0.01552	0.01634	0.02563	-0.04872	-0.02206
5	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
6	-0.00300	-0.00367	0.01606	0.74350	-0.02700	-0.00172	-0.00525	0.01094	0.03713
7	0.00193	0.00143	0.00219	-0.02461	-0.00046	0.00111	0.00205	0.00149	-0.00123
8	0.13403	0.02180	-0.13649	-1.59252	0.05794	0.08003	0.03258	-0.09700	-0.08296
9	0.12540	-0.06368	0.17843	-1.29216	0.00389	0.07227	-0.09185	0.12240	-0.06498
10	-0.04872	-0.01321	0.03765	-1.83705	0.06494	-0.02807	-0.01905	0.02581	-0.09233
11	0.16161	0.12013	-0.19333	-1.17247	0.00256	0.09533	0.17735	-0.13573	-0.06034
12	-0.01681	-0.07710	-0.11578	-1.54946	0.11921	-0.00974	-0.11175	-0.07981	-0.07829
13	0.26408	-0.19660	-0.09310	-0.55156	0.07400	0.15329	-0.28562	-0.06432	-0.02793
14	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
15	0.13325	0.03969	0.22419	0.05304	-0.09700	0.07697	0.05738	0.15414	0.00267
16	-0.00899	-0.03474	-0.00684	-0.87166	0.04873	-0.00515	-0.04977	-0.00466	-0.04354
17	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
18	0.02724	0.00729	0.01009	0.74333	-0.03405	0.01559	0.01045	0.00687	0.03713
19	-0.56218	0.35754	0.54206	0.43423	-0.13719	-0.33032	0.52577	0.37906	0.02226
20	0.14045	0.02217	0.00442	0.40418	-0.05499	0.08039	0.03176	0.00301	0.02018
21	0.57900	0.17710	0.45696	5.79848	-0.48161	0.34566	0.26461	0.32469	0.30202
22	-0.00118	0.00004	0.00117	0.00582	-0.00015	-0.00067	0.00006	0.00080	0.00029
23	0.05323	0.01798	0.04668	2.90452	-0.11921	0.03070	0.02596	0.03205	0.14619
24	0.08686	-0.07259	0.07942	1.32003	-0.04092	0.05002	-0.10460	0.05442	0.06631
25	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
26	-0.00337	0.00306	-0.00351	-0.08618	0.00275	-0.00193	0.00438	-0.00239	-0.00430

Class B Total Score and Major GPA

Case	Score Perc	Total Score	Major GPA	ZRE_1	SRE_1	SDR_1	COO_1	LEV_1	DFB0_1
1	2.50%	93	3.570	-2.09668	-2.15758	-2.38666	0.09144	0.01398	6.82359
2	7.50%	111	3.300	-1.03568	-1.17463	-1.18594	0.13169	0.18093	5.55011
3	10.00%	102	3.200	-0.65736	-0.71240	-0.70379	0.02952	0.10689	-1.89763
4	32.50%	78	3.770	-0.80425	-0.83659	-0.83038	0.01913	0.03414	1.31944
5	12.50%	70	3.200	-0.61456	-0.67681	-0.66783	0.03250	0.13385	-12.53308
6	15.00%	68	3.300	-0.72211	-0.79088	-0.78358	0.04161	0.12469	-13.10167
7	17.50%	86	3.200	-0.24947	-0.26184	-0.25595	0.00232	0.05061	-2.64830
8	30.00%	97	3.667	-0.62966	-0.65789	-0.64875	0.01323	0.04231	5.07048
9	37.50%	86	2.800	2.00794	2.36075	2.68798	0.71017	0.23489	55.45823
10	40.00%	63	3.600	0.04091	0.04528	0.04419	0.00015	0.14235	0.48175
11	27.50%	84	3.280	0.15780	0.16398	0.16014	0.00072	0.03233	1.44243
12	50.00%	63	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
13	50.00%	68	3.700	0.42160	0.45282	0.44408	0.01050	0.09149	2.32506
14	50.00%	102	3.940	-0.07201	-0.08011	-0.07819	0.00051	0.15030	1.48648
15	52.50%	83	3.800	0.37344	0.38710	0.37912	0.00372	0.02768	-1.81983
16	55.00%	89	3.900	0.29383	0.30961	0.30285	0.00352	0.05768	-3.20155
17	15.00%	99	3.080	-0.05246	-0.05740	-0.05602	0.00022	0.12304	-0.43378
18	25.00%	85	3.300	-0.04433	-0.04593	-0.04482	0.00005	0.02649	-0.35675
19	35.00%	92	3.490	0.11370	0.11678	0.11400	0.00025	0.01033	-0.06665
20	37.50%	67	3.950	-0.99278	-1.10308	-1.10911	0.09514	0.14833	1.51537
21	67.50%	82	4.000	0.78720	0.84313	0.83710	0.03487	0.08661	-8.36132
22	77.50%	86	3.670	2.26159	2.31801	2.62238	0.09048	0.00642	-5.98500
23	67.50%	103	3.800	1.37088	1.49394	1.54219	0.13956	0.11629	-21.99179
24	47.50%	88	3.800	0.08171	0.08478	0.08275	0.00018	0.02940	-0.59624
25	47.50%	82	3.800	0.06075	0.06302	0.06150	0.00010	0.02897	-0.26713

Case	DFB1_1	DFB2_1	SDB0_1	SDB1_1	SDB2_1
1	-0.06950	-0.66047	0.16401	-0.28802	-0.06959
2	-0.14029	1.58389	0.12176	-0.53063	0.15232
3	-0.04917	1.58068	-0.04073	-0.18197	0.14874
4	0.02685	-1.18850	0.02846	0.09985	-0.11237
5	0.05763	1.99493	-0.26871	0.21301	0.18750
6	0.07290	1.76198	-0.28205	0.27057	0.16628
7	0.00187	0.64912	-0.05625	0.00686	0.06044
8	-0.03494	-0.71296	0.10864	-0.12909	-0.06697
9	-0.04073	-14.12230	1.37206	-0.17374	-1.53165
10	-0.00503	-0.00440	0.01022	-0.01838	-0.00041
11	-0.00239	-0.31627	0.03061	-0.00876	-0.02942
12	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
13	-0.03711	0.33660	0.04954	-0.13633	0.03144
14	-0.00697	-0.26701	0.03153	-0.02549	-0.02482
15	-0.00330	0.66950	-0.03873	-0.01213	0.06246
16	0.00658	0.80517	-0.06804	0.02411	0.07502
17	-0.00302	0.18364	-0.00920	-0.01105	0.01707
18	0.00044	0.08088	-0.00757	0.00161	0.00752
19	0.00304	-0.03207	-0.00141	0.01111	-0.00298
20	0.09289	-2.91254	0.03311	0.34988	-0.27894
21	-0.00787	2.71992	-0.18038	-0.02926	0.25723
22	0.00577	1.99913	-0.14712	0.02444	0.21543
23	0.13006	3.35643	-0.49328	0.50297	0.33004
24	0.00121	0.15541	-0.01265	0.00444	0.01445
25	-0.00083	0.10778	-0.00567	-0.00302	0.01002

Class B Subscales and Major GPA

Case	Score Perc	Spec Subscale	Test Subscale	Trb Subscale	Major GPA	ZRE_1	SRE_1	SDR_1	COO_1	DFB0_1
1	2.50%	21	50	22	3.570	-1.83864	-1.93664	-2.10406	0.08210	1.17547
2	7.50%	27	60	24	3.300	-0.97382	-1.10650	-1.11346	0.07127	6.07541
3	10.00%	24	54	24	3.200	-0.47006	-0.51880	-0.50857	0.01174	-2.21411
4	32.50%	23	38	17	3.770	-1.00156	-1.07498	-1.07965	0.03512	2.05644
5	12.50%	22	21	27	3.200	-0.58052	-0.72470	-0.71533	0.05866	-5.06933
6	15.00%	20	34	14	3.300	-0.79981	-0.95336	-0.95096	0.07650	-27.13512
7	17.50%	19	48	19	3.200	0.03210	0.03632	0.03535	0.00007	0.81837
8	30.00%	28	53	16	3.667	-0.99236	-1.17163	-1.18395	0.10816	8.38480
9	37.50%	25	40	21	2.800	1.88504	2.23595	2.53528	0.40692	57.82115
10	40.00%	22	19	22	3.600	-0.15816	-0.18809	-0.18325	0.00293	0.04772
11	27.50%	21	45	18	3.280	0.23317	0.24974	0.24348	0.00184	4.24014
12	50.00%	9	45	9	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
13	50.00%	16	35	17	3.700	0.60722	0.67703	0.66707	0.02229	8.98917
14	50.00%	23	56	23	3.940	0.05711	0.06467	0.06296	0.00024	-1.34819
15	52.50%	20	43	20	3.800	0.47025	0.49039	0.48036	0.00421	-1.59480
16	55.00%	21	50	18	3.900	0.33692	0.35896	0.35058	0.00348	-2.18855
17	15.00%	30	43	26	3.080	-0.30081	-0.35773	-0.34937	0.01060	1.48439
18	25.00%	21	39	25	3.300	0.16543	0.17937	0.17474	0.00113	0.99167
19	35.00%	23	47	22	3.490	0.17231	0.17744	0.17285	0.00038	-0.13102
20	37.50%	18	28	21	3.950	-0.89513	-1.01775	-1.01876	0.06064	5.97396
21	67.50%	18	40	24	4.000	1.05183	1.23137	1.24941	0.11236	-18.12203
22	77.50%	26	42	18	3.670	1.88982	2.05337	2.26575	0.15227	-11.16857
23	67.50%	28	51	24	3.800	1.14670	1.31766	1.34546	0.11126	-34.16084
24	47.50%	18	55	15	3.800	0.30004	0.34875	0.34054	0.00854	2.63050
25	47.50%	26	39	17	3.800	-0.33708	-0.38455	-0.37575	0.00892	3.34396

Case	LEV_1	DFB1_1	DFB2_1	DFB3_1	DFB4_1	SDB0_1	SDB1_1	SDB2_1	SDB3_1	SDB4_1
1	0.05698	0.36582	-0.13945	-0.27902	0.25753	0.02263	0.36962	-0.43041	-0.29809	0.02434
2	0.18377	-0.09561	-0.13786	-0.19891	1.47147	0.10834	-0.08948	-0.39412	-0.19682	0.12881
3	0.13738	0.06001	-0.05247	-0.10056	1.35073	-0.03846	0.05471	-0.14612	-0.09694	0.11519
4	0.09026	-0.20144	0.06709	0.24983	-1.78819	0.03660	-0.18815	0.19141	0.24674	-0.15623
5	0.31666	0.02799	0.11798	-0.26919	1.21036	-0.08867	0.02569	0.33083	-0.26128	0.10393
6	0.25452	0.05040	0.06686	0.48838	3.46676	-0.47966	0.04675	0.18945	0.47903	0.30081
7	0.17717	-0.01336	0.00294	-0.00301	-0.15610	0.01412	-0.01210	0.00814	-0.00289	-0.01322
8	0.24095	-0.55462	-0.02008	0.45529	-1.51423	0.15015	-0.52122	-0.05766	0.45242	-0.13311
9	0.24759	0.12775	-0.04700	-0.32505	-14.14254	1.16185	0.13472	-0.15139	-0.36243	-1.39496
10	0.25131	-0.03182	0.03855	-0.00735	-0.27895	0.00082	-0.02883	0.10669	-0.00704	-0.02364
11	0.08663	-0.03488	0.00748	-0.04450	-0.75443	0.07326	-0.03162	0.02070	-0.04266	-0.06398
12	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!
13	0.15392	-0.22909	-0.01728	-0.09174	-0.19279	0.15696	-0.20992	-0.04835	-0.08889	-0.01652
14	0.17847	-0.00240	0.00652	0.01713	0.23129	-0.02326	-0.00218	0.01804	0.01640	0.01959
15	0.03880	-0.05996	0.00564	0.01946	0.74840	-0.02768	-0.05462	0.01570	0.01874	0.06377
16	0.07737	-0.01972	0.01778	-0.02636	0.75447	-0.03788	-0.01791	0.04932	-0.02531	0.06410
17	0.25126	-0.14718	0.01220	-0.06589	0.66709	0.02569	-0.13367	0.03386	-0.06328	0.05667
18	0.10775	-0.03737	0.00062	0.04969	-0.30057	0.01712	-0.03386	0.00172	0.04760	-0.02547
19	0.01531	-0.00571	0.00594	0.01551	-0.05313	-0.00226	-0.00517	0.01643	0.01486	-0.00450
20	0.18478	0.14493	0.10053	-0.12544	-3.31762	0.10597	0.13492	0.28587	-0.12347	-0.28889
21	0.22869	-0.37402	0.01475	0.48703	4.75817	-0.32585	-0.35294	0.04252	0.48594	0.41998
22	0.11129	0.70705	-0.10272	-0.45539	2.98377	-0.21839	0.72557	-0.32201	-0.49413	0.28641
23	0.20099	0.47370	0.02907	0.27562	4.97019	-0.61815	0.44984	0.08433	0.27675	0.44148
24	0.21819	-0.10994	0.04129	-0.08358	0.02015	0.04552	-0.09984	0.11454	-0.08025	0.00171
25	0.18997	-0.16747	0.03307	0.11322	-1.02314	0.05790	-0.15219	0.09181	0.10879	-0.08697

Appendix G: Institutional Review Board

From: mjm6ny@virginia.edu
Sent: Friday, February 27, 2015 12:03 PM
To: sdv2w@virginia.edu; sw2xe@virginia.edu
Cc: Monroe, Jeffrey (Jeff) (mjm6ny)
Subject: Pertaining to SBS Number 2015006200

In reply, please refer to: Project # 2015-0062-00

February 27, 2015

Sheila Warren and Stephanie van Hover
CISE (Curriculum, Instruction & Special Ed)
232 Wes Ashley Dr.
Meridianville, AL 35759

Dear Sheila Warren and Stephanie van Hover:

Thank you for submitting your project entitled: "Novice Alignment to Expert Decisions as a Predictor of Problem Solving Performance" for review by the Institutional Review Board for the Social & Behavioral Sciences. The Board reviewed your Protocol on February 27, 2015.

The first action that the Board takes with a new project is to decide whether the project is exempt from a more detailed review by the Board because the project may fall into one of the categories of research described as "exempt" in the Code of Federal Regulations. Since the Board, and not individual researchers, is authorized to classify a project as exempt, we requested that you submit the materials describing your project so that we could make this initial decision.

As a result of this request, we have reviewed your project and classified it as exempt from further review by the Board for a period of four years. This means that you may conduct the study as planned and you are not required to submit requests for continuation until the end of the fourth year.

This project # 2015-0062-00 has been exempted for the period February 27, 2015 to February 17, 2019. If the study continues beyond the approval period, you will need to submit a continuation request to the Board. If you make changes in the study, you will need to notify the Board of the changes.

Sincerely,

Tonya R. Moon, Ph.D.
Chair, Institutional Review Board for the Social and Behavioral Sciences

Institutional

Review Board

USU Assurance: FWA#00003308

Exemption #2

Certificate of Exemption

FROM:

Melanie Domenech Rodriguez, IRB Chair

Nicole Vouvalis, IRB Administrator

Nicole Vouvalis

To: David Feldon

Date: April 17, 2015

Protocol #: 6486

Title: Cta-Based Survey Assessment For Engineering

The Institutional Review Board has determined that the above-referenced study is exempt from review under federal guidelines 45 CFR Part 46.101(b) category #2:

Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures or observation of public behavior, unless: (a) information obtained is recorded in such a manner that human subjects can be identified, directly or through the identifiers linked to the subjects: and (b) any disclosure of human subjects' responses outside the research could reasonably place the subjects at risk of criminal or civil liability or be damaging to the subjects' financial standing, employability, or reputation.

This exemption is valid for three years from the date of this correspondence, after which the study will be closed. If the research will extend beyond three years, it is your responsibility as the Principal Investigator to notify the IRB before the study's expiration date and submit a new application to continue the research. Research activities that continue beyond the expiration date without new certification of exempt status will be in violation of those federal guidelines which permit the exempt status.

As part of the IRB's quality assurance procedures, this research may be randomly selected for continuing review during the three year period of exemption. If so, you will receive a request for completion of a Protocol Status Report during the month of the anniversary date of this certification.

In all cases, it is your responsibility to notify the IRB prior to making any changes to the study by submitting an Amendment/Modification request. This will document whether or not the study still meets the requirements for exempt status under federal regulations.

Upon receipt of this memo, you may begin your research. If you have questions, please call the IRB office at (435) 797-1821 or email to irb@usu.edu.

The IRB wishes you success with your research.

4460 Old Main Hill   Logan, UT 84322-4460   PH: (435) 797-1821   Fax: (435) 797-3769   WEB: irb.usu.edu   EMAIL: irb@usu.edu

Student Communications

Preliminary email contact:

Dear student:

In the next few days, you will be invited to participate in a research study conducted by me, Sheila Warren, a graduate student from the University of Virginia's Curry School of Education and David Feldon, the Director of Utah State University's STE2M Center for science, technology, engineering and math education. You have been selected because you are taking an engineering course in which you will solve problems that include an aspect of engineering design. This study is an independent research project that will be used for a student's dissertation. Your participation is voluntary. Whether you choose to participate or not, this study will **not** impact your class grades at all, and it is **not** a class assignment.

The purpose of the study is to learn more about engineering problem solving, and the goal is to make engineering education more efficient for future students. The study will be an online survey which should take less than twenty minutes of your time.

When you receive the invitation and link to the survey, more information will be included.

Regards,

Sheila Warren

First Invitation:

Dear Student:

You are invited to participate in a research study conducted by a student at University of Virginia's Curry School of Education because you are a taking an engineering course in which you will solve problems that include an aspect of engineering design. This study is an independent research project that will be used for a student's dissertation. Your participation is voluntary. Whether you choose to participate or not, this study will **not** impact your class grades at all, and it is **not** a class assignment.

You must be aged 18 or older to participate. Data collection will continue until [date].

[link redacted]

The main purpose of this survey project is to find out if the way students think about and approach engineering design predicts how well they will score on classroom problems. In other words, does your score on this survey predict your score on certain class problems?

This survey should take you less than 20 minutes to complete. Your answers will remain confidential, and your instructor will not know how you answered. The student who is the researcher will perform a statistical analysis to determine if there is a relationship between how students answer and how they score on certain types of problems.

You will not be paid for your participation. However, your participation will make you eligible for entry into a drawing where two students will receive a $20 Amazon gift card.

You will have the opportunity to help understand engineering education better. This study could help improve engineering education by making it more efficient for future students.

Thank you,
Sheila Warren

Second Invitation:
Dear student,
This is a reminder that you have been invited to participate in a research study conducted by a student at University of Virginia's Curry School of Education because you are a taking an engineering course in which you will solve problems that include an aspect of engineering design. This study is an independent research project that will be used for a student's dissertation. Your participation is voluntary. Whether you choose to participate or not, this study will **not** impact your class grades at all, and it is **not** a class assignment.

You must be aged 18 or older to participate. Data collection will continue until [date].

[link redacted]

The main purpose of this survey project is to find out if the way students think about and approach engineering design predicts how well they will score on classroom problems. In other words, does your score on this survey predict your score on certain class problems?

This survey should take you less than 20 minutes to complete. Your answers will remain confidential, and your instructor will not know how you answered. The student who is the researcher will perform a statistical analysis to determine if there is a relationship between how students answer and how they score on certain types of problems.

You will not be paid for your participation. However, your participation will make you eligible for entry into a drawing where two students will receive a $20 Amazon gift card.

You will have the opportunity to help understand engineering education better. This study could help improve engineering education by making it more efficient for future students.

Thank you,
Sheila Warren

Third Invitation:
Dear student,
This is a reminder that you have been invited to participate in a research study conducted by a student at University of Virginia's Curry School of Education because you are a taking an engineering course in which you will solve problems that include an aspect of engineering design. Data collection will continue until [date]. Your participation would be very helpful.

You must be aged 18 or older to participate.

[link redacted]

The purpose of the survey is to learn more about engineering education, and hopefully that knowledge will be used to make it more efficient for future students.

This survey should take you less than 20 minutes to complete. Your answers will remain confidential, and your instructor will not know how you answered. The student who is the researcher will perform a statistical analysis to determine if there is a relationship between how students answer and how they score on certain types of problems.

You will not be paid for your participation. However, your participation will make you eligible for entry into a drawing where two students will receive a $20 Amazon gift card.

Thank you,
Sheila Warren

Note of appreciation upon completion of the survey

Dear student,
Thank you for your participation in my survey. Your name will be included in a drawing of participants to receive a $20 Amazon gift card.

If you have any questions about the survey, change your mind about participation, or want to know the results of the survey please contact me at sw2xe@virginial.edu.

Again, thank you very much for your assistance,
Sheila Warren

UtahState University
STE²M Center
139 Old Main Hill
Logan UT 84322-1400
Telephone: (435) 797-1000

IRB Certificate of Exemption Date: 04/17/2015
Exemption Expires: 04/16/2018
USU Protocol #6486
IRB Password Protected per IRB Director

LETTER OF INFORMATION

Novice Alignment to Expert Decisions as a Predictor of Problem Solving Performance

Introduction/ Purpose

Dr. David Feldon, Director of the Science, Technology, Engineering, Education and Math (STE2M) Center at Utah State University and associate professor of Instructional Technology and Learning Sciences and Sheila Warren, a doctoral student at the University of Virginia, are conducting a research study to find out more about engineering education. You have been asked to take part because you are enrolled in an undergraduate engineering class that includes solving problems involving design. There will be approximately 130 total participants in this research.

Procedures

If you agree to be in this research study, you will be asked to complete an online survey with questions about how you approach certain aspects of design in engineering. The survey has been designed to take less than 30 minutes.

If you choose to participate, your professor will provide scores to problems you will have solved as a regular part of your class in order to understand how well responses to the survey questions might predict performance – no additional effort is required on your part. Your professor will provide the scores, identified only by your A-number to David Feldon. David Feldon will also receive copies of your survey responses (also identified by your A-number). He will link the scores to the survey responses and then remove the A-numbers from the data set, so that all data is completely anonymous before it is analyzed. He will destroy all data linked with A-numbers once the anonymous data set is created.

Risks

Participation in this research is minimal risk. There is small risk of loss of confidentiality, but we will take steps to reduce this risk, as described later in "Confidentiality." The data we are collecting is not sensitive and will have little to no meaning to anyone not involved in the study.

Benefits

You will receive no direct benefit from this research. However, the further understanding of engineering education may potentially benefit you (either directly or indirectly) in the future. You will also be entered into a drawing for a $20 gift card, and have a chance to win as a result of your participation.

Explanation & offer to answer questions

Through this Letter of Information, we have explained this research study to you and answered your questions. If you have other questions or research-related problems, you may reach (PI) Dr. Feldon at (435) 797- 0556, or at david.feldon@usu.edu

Payment/Compensation

If you participate, you will be added to the pool of participants, and two participants will be randomly selected to receive a $20 Amazon gift card as a token of appreciation for your participation in this study. You will be contacted via email using the email address to which the survey link was sent.

If you will receive payments, gift cards or similar items of value for participating in this research, the Internal Revenue Service (IRS) has determined that if the amount you get from this study, plus any prior amounts