UNIVERSITY OF CAPE COAST

REGRESSION ANALYSIS OF ACADEMIC PERFORMANCE OF POTSIN T. I. AHMADIYYA SECONDARY SCHOOL STUDENTS

BY

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Dissertation submitted to the Department of Mathematics & Statistics of School of Physical Sciences, University of Cape Coast in partial fulfillment of the requirements for the award of Master of Science Degree in Statistics.

DECEMBER, 2007

DECLARATION

Candidate's Declaration

I hereby declare that this dissertation is the result of my own original work and that no part of it has been presented for another degree in this university or elsewhere.

Candidate's signature:..... Date: 11-09-08

Candidate's name: MOHAMMED FLEMPING

Supervisor's Declaration

I hereby declare that the preparation and presentation of the dissertation were supervised in accordance with the guidelines on supervision of dissertation laid down by the University of Cape Coast.

Supervisor's signature:..... Date: 11/09/08

Supervisor's name: GISELLE K. NKANSAH

FOR (D. D. ACYEI)

ABSTRACT

This research is based on the results of Senior Secondary School Certificate Examination (SSSCE) released by the West African Examinations Council in elective and core subjects of study at Potsin T. I. Ahmadiyya Secondary School from 2000 to 2003. The elective programmes of study are General Arts, Business, Home Economics and Technical subjects. The data also includes the gender and religious affiliation of candidates.

The main objective of the study is to identify variables that significantly determine students' academic performance at SSSCE.

Preliminary analysis was carried on the data using frequency and percentage distribution, multiple bar and line graphs and correlation analysis. In order to establish concrete statistical evidence, multiple regression was performed on the data. The results revealed that sex and religious affiliation did not significantly explain students' academic performance. However, elective subjects and Business and Home Economics related subjects significantly determine academic performance. In addition, the study revealed that elective subjects accounts for most of the variation in academic performance than core subjects. Students' performance in elective subjects was better than performance in core subjects.

Finally, the developed regression model was found to explain 85% of variations in students' academic performance.

DEDICATION

I dedicate this research work to my mother, Helima Akua and my late father, Adam K. Antwi.

ACKNOWLEDGEMENTS

This dissertation could not have been written without substantial assistance from many individuals. My thanks goes to the following for their immense contributions: Professor B. K. Gordor, Dr. Mrs. N. G Mensah, Head of Department and Mr. B. K. Nkansah, all of Mathematics and Statistics Department of University of Cape Coast.

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CHAPTER ONE

INTRODUCTION

Background to the Study

Education may generally be considered as the teaching or the training of the mind and character. Education is a basic human right to which every individual should have access. To many, the key function lies in its ability to offer or hold the chance to rise in the economic hierarchy (Opolot and Enon, 1990). The very nature of education creates in the minds of those who receive it, attitudes, expectations, evaluations, and aspirations about what they study and their future world. Education is interpreted in a broad sense to cover both formal and informal aspects including nursery, primary, secondary, university and college education as well as culture in and out of school.

Merret and Tang (1994) reported that formal education (schooling) appears to overshadow informal education. They added that the nature of schooling and the way schools have been structured so that pupils are taught in groups of varying sizes presupposes that someone should be expert in the management of such groups in order to bring about good examination results. In line with this report, under a Free Compulsory Universal Basic Education (FCUBE, 1996), programme, teachers in basic education are to have a minimum qualification of diploma in Basic Education. Tutors for initial training colleges

will be B.Ed. degree holders and ultimately all tutors may obtain Master of Education or post- graduate degree with appropriate qualification in education.

Every country designs education that will be suitable for its citizens so as to achieve as a whole, the country's educational aims and objectives.

Change also, is a necessary element for development and progress. Therefore throughout the world, countries, including Ghana, have gone through several educational systems and reforms. In Ghana, some educational plans include:

1. The Remote Pre- colonial system (The castle school);
2. The Accelerated Development Plan (ADP, 1951);
3. The first fee-free and compulsory education (The Educational Act of 1961) ;
4. Improvement of content and structure of education (The Dzobo committee Report, 1973);
5. New Educational System (The Educational Reform, 1987); and
6. The Free Compulsory and Universal Basic Education (The FCUBE,1996).

The contribution of education in both developed and developing countries cannot be over emphasized. It is the key to the doors of every organisation and development of human resources for both public and private sectors of the economy. Prior to the coming of the Europeans to Africa, Africa practiced indigenous education where emphasis was placed on the vocational or skilled development of the individual, and for that matter, no one was regarded as a failure (Moumouni, 1991).

With the coming of the Europeans, a new system was introduced which was titled "training people for white collar jobs". This new system of education resulted in the selection of the best product; thus examination was established as a yardstick for this selection.

Ghana ran an educational programme that consisted of nine (9) years of Basic Education, and three (3) years of senior secondary education. The basic education programme is made up of six (6) years primary education and three (3) years junior secondary school (J.S.S) education. At the basic level pupils are taught subjects such as Mathematics, English Language, Social Studies, Religious and Moral Education, Agricultural Science, Ghanaian Language, French, Pre-Vocational Skills, General Science and Pre-Technical Skills. The Senior Secondary School of which there are a total of 503 schools (Ghana Education Service) in the country undertake elective programmes such as Science, Agricultural Science, Home Economics, General Arts, Visual Arts, Technical and Business Studies. Apart from these, every student is required to read core subjects such as Integrated Science, English Language, Core Mathematics and Social Studies. With this, students who excel in their final examination were made to pursue further studies and those who fail to perform creditably were made to acquire vocation and other handi-skills. But the number of students who fail to perform creditably continues to rise over the years bringing the number one school crises, being poor academic performance (1852 Education Ordinance, Sir Stephen Hill).

Academic performance is not a current issue or only a feature of the schools of developing countries, but also exists in developed countries too. In an address before the Medical Society of the State of New York, January 28, 1896 on "Education Reform", President Charles W. Elliot states that "1870 written examinations were not given at Howard University because students could not express themselves coherently. Many, infact could barely read and write".

Academic performance continues to be a subject of great concern to all Ghanaians. Various efforts continue to be made in terms of research to find out factors that significantly determine academic performance. This is because it is necessary to obtain adequate information that will enable us explain the factors that determines academic performance. To ensure that SSS programme runs successfully, we need to do an in-depth study and analysis and come up with real factors that determine academic performance. There is the fear that if care is not taken to ensure proper development of secondary education, institutions of higher learning will end up producing people who may not possess adequate knowledge to spear-head the nation in its quest to becoming a middle income country by 2020.

Objectives of Study

Academic performance plays a very important role in education. It helps in the selection and placement of students from one stage to another on the academic ladder. In most organizations and tertiary institutions such as Polytechnics, Universities and other research institutions, it is used as criteria for awarding qualification and promotion. On the job market, academic performance serves as

a guideline for which required applications are selected. For instance in Ghana, selecting applicants into tertiary institution is mostly based on six subjects comprising English, Mathematics and Science as Core Subjects and other three best elective subjects in a selected discipline. It is in this direction that the study seeks to identify the variables that significantly determine academic performance. The knowledge of these variables would eventually be the bases for predicting the academic output of the students.

The main objective of the research is to identify the factors that significantly determine academic performance of Potsin T. I. Ahmadiyya Secondary Students at SSSCE. The study would further analyze and address the following specific objectives:

1. To develop a model and determine its reliability in predicting the results of the students;
2. Predict the output of students based on the studying variables (core and elective subjects, religious affiliation, sex and programme);
3. Compare students' performance in core and elective subjects over the years;
4. Compare the performance of males to female students of P – AMASS at SSSCE for the period 2000 to 2003.
5. Compare the performance of Muslim to non-Muslim students at SSSCE.

Research Questions

In line with the above objectives, the study poses the following research questions:

1. Which variables significantly contribute to academic performance of P-AMASS at SSSCE?
2. Is academic performance of P – AMASS at SSSCE dependent on core and elective subjects, sex, programme of study and religious affiliation?
3. How reliable are the selected variables in predicting the results of the students?
4. Do males perform better than females at P-AMASS?
5. Do Muslims perform better than Non-Muslims at P-AMASS?
6. Which of the programmes of study performs better than the other?

Literature Review

A large body of the literature focuses on the nature of factors which contribute to academic performance in developing countries (Lockhead, 1991). A few researchers have examined specific problems thought to influence poor academic performance such as students' school environment perception (Fobih and Koomson, 1992) and the students' study habits (Abdulahi, 1996). The vast majority have, however, either explicitly or implicitly discussed academic performance as part of wide problem of population explosion and the effect of increase demand for school facilities. The review focuses on variables, which the research seeks to find how they determine academic performance. These are the

sex of candidate, programme of study, religious affiliation, core and elective subjects.

Sex

Studies show that education attainment is closely associated with sex. With regards to intelligence, which is related to academic performance, sex difference is noted in various findings. However, it tends to be conflicting and sometimes very inconsistent and inconclusive.

Terman (1954) contented that gifted boys perform better than girls at the high school level by two to one. Witthy (1934) discovered that 0.32% of boys as compared to 0.35% of girls tested 140 IQ among Negroes in grade III to VII. Girls with standard IQ's of 120 provide twice as numerous as boys.

Pressey (1918) conducted a study into sex differences regarding academic performance in examination of school children aged 8-16 years. The survey covered 2,544 school children of which 1,342 were girls and 1202 were boys. The examination consisted of ten tests each of which was made up of twenty items giving a total of 200 items. The duration of the examination was fifty minutes. The ten tests consisted of Analogies, Rate memory (for words), Logical Selection, Practical Arithmetic, Opposites, Logical Memory, Word Completion, Moral Classification, Dissected Sentences and Practical Information. In obtaining a rate of 'general intelligence' the results of the tests were combined by simple addition of number of correct responses to items on each of the ten tests, giving the number of items correct out of the total of 200 items. Results from the 2,544 school children showed that the girls averages were slightly higher in total sense

or general intelligence than boys. Analyses of the tests showed that the comparative standing of the two sexes vary according to the nature of the tests. On three tests, boys averaged above girls while on the remaining seven, girls excelled.

During the same year, Brook (1918) using the same sets of tests that had been used by Pressey Mental scale No. 1 schedules made a state-wide mental survey of the high school senior graduating from 314 schools involving a total of 5925 students, 2,422 boys and 3,503 girls. The results obtained in this study simply contrast with that of Pressy's finding. The boys scored higher totals on the tests as opposed to Pressey's in which the girls excelled more than the boys in seven of the ten tests. We find here contrasting results of the same test being used. This leads to the need for further probing into the mental abilities of the sexes.

A more elaborate research is that on sex differences in primary mental abilities, which Thurstone in co-operation with the Chicago Public School published in 1941. The research was an attempt 'to make an objective measure of clearly differentiating mental abilities at the level of Junior High School". It was basically the application of factorial analysis of the measurement of adult intelligence.

Also after extensive research into sex difference in academic performance a wide variety of verbal and motor tasks, Wade (1982) and his associates in sex passage structure and presentation rate also prove that "boys are quicker than girls at retrieving information from memory. However, girls require a greater degree

of certainty than boys before being satisfied that search is complete". There is a tendency for men to be more excellent than women, whatever is being tested. Again according to Watts (1953) , "When a group of comparable young men and women take a test, women tend to gain mean scores which are similar to those of men but the highest and the lowest scores are liable to men".

The question as to whether boys are variable in their intellectual performance than girls is an outstanding one. The question was raised initially in Tasman's Work when he identified more boys to be gifted. The excess of boys having intelligent quotient over one hundred and forty (140) was found on test where there were no sex differences in the means of large samples, including both high scorers and low scorers.

According to Crow and Crow (1953), gifted children come from all racial stocks. Both sexes are included in this group, with boys showing a slight superiority over girls. They represented all kinds of background and homes although the majority appears to have experienced favourable socioeconomic status. The gifted child's classroom attitudes usually are satisfactory and these are evidenced in his academic, physical and psychological outlook. He also transforms his extra energy into useful activities.

Programme

With programme of study at SSSCE as one of the studying variables, Ofori and Mensah (2004), conducted a research on "Factors influencing the performance of students at the SSSCE in Business Management: A case study of

selected schools in the Shama Ahanta East Metropolitan Assembly". They identified the major factors as the teacher, the role of the School Administrator, motivation on part of the students, inadequate text books and other facilities. Thus, the programme of study of the student was not a major factor in student performance.

A similar study was conducted by Adum-Kwaprong (1999) on "Causes of poor performance in Introduction to Business Management (I.B.M) in the Senior Secondary Schools' Certificate Examination (S.S.S.C.E): a case study of the Cape Coast District of the Central Region". The study revealed: inadequate trained teachers, lack of libraries, science and language laboratories, lack of motivation and students' attitude towards the subject as the cause of poor performance in Business Management.

The West Africa Examination Council's Chief Examiners' report (2001, pp 132 and 135), stated that the performance was commensurate with the level of the examination. However, students' performance was below expectation. The candidates' weaknesses were pointed out as follows:

1. Lack of understanding of basic accounting principles.
2. Illogical presentation of materials, suggesting lack of confidence of candidates in the materials they presented and ill preparation for the examination.
3. Poor application of the English Language.
4. Inadequate coverage of the syllabus.
5. Poor knowledge in the double entry.

Similar cross examination of the reports of General Subjects released by the West African Examination Council's Chief Examiners' report (2001, pp 65) stated that the standard of the various papers was similar to that of the previous years e.g. Christian Religious Studies 2 (pp 66), Economics 2 (pp 68), Geography IB (pp 71) and Government 2 (pp79). The performance of candidates was varied according to the Chief Examiners' Reports. Candidates' weaknesses were identified as:

1. Poor command of English Language.
2. Inability to read and understand the questions.
3. Sketchy answers to the questions.
4. Shallow grasp of syllabus topics.
5. Poor sketching of maps and diagrams.

Also the same observation as the above, were made by Chief Examiners in Technical and vocational subjects respectively (Chief Examiners Report 2001, pp14, and pp183). The Chief Examiners unanimously suggested the following as a panacea to increase student's academic performance:

1. Candidates should be encouraged to use correct English expression.
2. Teachers should help candidates to cover the examination syllabus.
3. Candidates should be adequately prepared to know how to answer the examination questions.

Religion

As a matter of fact, written documents on this topic have become a bone of contention. Written work especially on religious affiliation of people with regard to their academic performance is not available. However, Mohadeen (1994) in his research work; "The influence of the Ahmadiyya in Wa" dicusses Ahmadiyya which is a religious sect and formal education in Wa. In his work, he enumerated the development in the community in terms of infrastructure, education and others which are not on academic performance. It is in this light, that the researcher intends delving into the main subject of discussion, to see whether P-AMASS students' religious affiliation have some effect on their academic performance at SSSCE. The question of what accounts for this academic performance is still far from being explained. There is, therefore, the need for more research into the performance with regards to religion, sex and programme of study.

Data and Method of Data Collection

In all, five hundred and seventy (570) students' results were collected over the study period from 2000 to 2003. However, results of 561 students were studied. The remaining nine students' results that were not used were as a result of examination irregularities.

Convenience sampling was used during the study period. Convenience sampling because (2000 – 2003) SSSCE results were found to be most appropriate. This is due to its availability, low cost and less time consuming in extracting the data for the research.

Secondary data was mainly used. The source was the West African Examinations Council, (WAEC) release of the SSSCE results of Potsin T.I. Ahmadiyya Secondary School from 2000-2003. The original data from WAEC were regrouped and the best six subjects comprising English Language, Mathematics, Core science and other three best Elective Subjects were collated. The grade points corresponding to the following grades: A, B, C, D, E, and F are respectively 1, 2, 3, 4, 5 and 6. The grades obtained in English Language, Mathematics and Core Science were totalled and recorded under core subjects. Similarly, equivalent figures of grades of three best elective subjects were also summed and classified under Elective subjects. The overall aggregate results were then obtained by summing results of the three best core subjects and the three best elective subjects. By this representation, if the overall aggregate of a candidate is low, it means that the candidate performed well. On the other hand, if the aggregate score is high, it means that the candidate performed poorly.

The programmes offered in Potsin T.I. Ahmadiyya Secondary School are General Arts, Business Studies, Home Economics and Technical subjects. These are denoted as A, B, H and T. The students, like all other students all over the country are supposed to read four core subjects i.e. Mathematics, English, Science and Social Studies in addition to the subjects in their chosen programmes. With sex, all the male and female – bearing names were classified. This was then coded using the dummy variable, 1 for male, and 0 for female as shown in Appendix 1. Similarly, all Muslim-bearing names and Non-Muslim – bearing

names were collated. This data was further regrouped using dummy variables where 1 denotes Muslim and 0 for Non-Muslim as shown in Appendix 1.

The four programmes: General Arts, Business, Home Economics and Technical subjects were also represented using dummy variables. Under this the dummy variables were defined as follows:

P_1, = {1, General Arts, 0, otherwise}

P_2 = {1, Business, 0, otherwise}

P_3= {1, Home Economics, 0, otherwise}

Noting that the dummy variables are one less than the total number of variables. The results of all the variables were then combined in a single table as shown in Appendix 1. This was used to construct the regression model in Chapter Four.

Outline of Dissertation

The dissertation consists of a short declaration by the candidate and his supervisor on one page. This is followed by the abstract page which gives a short summary of what the report is about and what the main conclusions are. Preceding the abstract page, is the dedication and acknowledgements.

Next, is the content page. This page contains chapter numbers and corresponding titles as well as their respective page numbers. List of figures and list of tables show their respective headings and page numbers.

Chapter One deals with introduction to the study. This is made up of background, objectives, research questions, literature review, data and method of data collection. A brief out line concludes Chapter One.

Chapter Two deals with review of methods i.e. methods that could be used to analyse the data. The main method reviewed is multiple linear regression. This explains regression analyses, conditions required for regression analyses. Also the various regression methods and criteria for selecting variables to build the regression model are discussed.

Chapter Three deals with preliminary analysis. This consists of exploratory analysis by the use of frequency and percentage distributions, multiple bar chart and line graph.

Further analysis is embodied in Chapter Four. This employs the use of correlation analysis, correlation matrix, best regression subsets and multiple linear regression analyses.

Chapter Five reports on summary of preliminary and further analyses, discussions, conclusions and recommendations.

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CHAPTER TWO

REVIEW OF METHODS

This chapter deals with the theory of the various statistical techniques employed in the analysis of the data. The multivariate method used is multiple linear regression.

Regression Model and the Required Conditions

Regression is used to predict the value of one variable on the basis of other variables. The technique involves developing mathematical equation that describes the relationship between the variable to be forecast, which is called the dependent variable (Y), and the variables that the researcher believes are related to the dependent variable, called independent variables (X_1, X_2,..., X_k). To conduct regression analysis, we analyse a critical part, the error variable, ϵ, of the model. The probability distribution of error variables must satisfy the following conditions:

1. The probability distribution of the error variables are normal.
2. The mean of the distribution is zero.
3. The standard deviation, σ , of the error term, ϵ, is a constant.
4. The errors are independent.

The dependent variable, Y, is related to the independent variables $X_1, X_2, \cdots, X_k$ by $\left[Y = \beta_o + \beta_1 X_1 + \beta_2 X_2 + ... + \beta_k X_k + \varepsilon\right]$

where the coefficients $\beta_0, \beta_1, \beta_2 \cdots, \beta_k$ are to be determined and ε is the error term. In this equation, the dependent variable, Y, is said to be linearly related to the independent variables. If we are interested only in determining whether relationship exists between the variables, we employ correlation analysis or draw scatter diagrams. The total variation in the dependent variable, measured by $\left[\sum\left(Y-\hat{Y}\right)^2\right]$ is called the total sum of squares, SST. This can be decomposed into two parts; the explained variation measured by sum of squares of regression, SSR and unexplained variation measured by sum of squares errors, SSE. That is the total variation in the data, SST is

$$\text{SST} = \text{SSR} + \text{SSE} \qquad (2.1)$$

If SSR is large relative to SSE, the coefficient of determination, R^2 (which is the proportion of variation in the dependent variable that is explained by the independent variables) will be high signifying a good model given in Equation (2.1). However, if SSE is large, it means that most of the variation in the dependent variable will be unexplained, which indicates that the model provides a poor fit and consequently has little validity. If SSR is large enough relative to SSE it is inferred that at least one coefficient is not equal to zero. In order to determine the significance of SSR, we compute the ratio of the two mean squares: Mean sum of squares of regression (MSR) and Mean sum of squares error (MSE). Mean square is the sum of squares divided by its degrees of freedom. That is,

$MSR = \dfrac{SSR}{k}$ and $MSE = \dfrac{SSE}{n-k-1}$.

Also the ratio of two mean squares gives the value of the statistic that has an F distribution, as long as the underlying population is normal. The calculation of the test statistic is summarized in the ANOVA table below.

Table 1: Analysis of Variance Table for Regression Analysis

Source of variation	Degree of freedom	Sum of squares	Mean square	F – statistic
Regression	k-1	SSR	$MSR = \frac{SSR}{k}$	$F = \frac{MSR}{MSE}$
Residual	n-k-1	SSE	$MSE = \frac{SSE}{n-k-1}$	
Total	n-1	$\left[\sum\left(Y-\hat{Y}\right)^2\right]$		

A large value of F indicates that most of the variation in Y is explained by the regression model and that the model is useful. This leads to the rejection of the null hypothesis. A small value of F indicates that most of the variation in Y is unexplained, and this leads to the non-rejection of H_o. We reject H_o if $F > F_{\alpha,k,n-k-1}$ for a specified significance level, α.

As the main objective of the study, one of the research questions of Chapter One was transformed into the following hypotheses:

$H_o : \beta_i = 0$

$H_1 : \beta_i \neq 0$ (for some $i = 1, 2, \ldots, k$)

where the statement of H_o means that none of the variables; core and elective subjects, sex, programme and religious affiliation is related to Y, academic performance and H_1 means that at least one of the variables determines, Y, academic performance.

Estimating the coefficient and assessing the model

If the model fit is poor, we do not proceed to find the coefficients of that model. However, we check the model by performing the following:

1. The coefficients and the statistics used to assess the model is generated.
2. Diagnose the violation of required conditions.
3. Assume the model's fitness by considering the following statistics: standard error of estimate, coefficient of determination, and the F – test of ANOVA.

Having met the above conditions, we can now use the model to predict or estimate the expected value of the dependent variable. The standard error of estimate,

$$S_\varepsilon = \sqrt{\frac{SSE}{n-k-1}} \tag{2.2}$$

Coefficient of determination, is given by

$$R^2 = 1 - \frac{SSE}{\sum\left(Y-\hat{Y}\right)^2} \quad \text{or} \quad R^2 = 1 - \frac{SSE}{SST} \tag{2.3}$$

Testing the Validity of the Model

In multiple linear regression, we have more than one independent variable. For each of such variables, we can test to determine if there is enough evidence of a linear relationship between it and the dependent variable. We formulate the following hypotheses $H_o : \beta_i = 0$ and

$H_1 : \beta_i \neq 0$ (for some $i = 1, 2, 3, ..., k$).

In multiple regression model, we conduct a test to determine whether each of the variables $X_1, X_2, ..., X_k$ determine performance. The test statistic is

$$t = \frac{b_i - \beta_i}{S_{bi}} \qquad (2.4)$$

where b_i are the estimate of β_i, s_{bi} is the standard error of the estimate which is student t distributed with degrees of freedom, n-k-1, where k is the number of independent variables and n is the sample size.

Variable selection in multiple regression

One of the objectives of the regression analysis is to determine how each independent variable affects the dependent variable. It was therefore necessary to reduce the extent of *multicollinearity* i.e. a state of very high intercorrelations among independent variables by including independent variables that appear to be uncorrelated with each other. A correlation matrix is always produced to determine the correlation coefficients for each pair of variables. In many cases one cannot use the correlation matrix to identify whether multicollinearity is a serious problem. This is because there are many ways in which variables do relate. For instance, one variable may be a function of several other variables, but

a correlation matrix may not reveal this situation. Therefore we use stepwise regression, a procedure that eliminates correlated independent variables.

Stepwise regression is an iterative procedure that adds or deletes one variable at a time. The decision to add or delete a variable is made on the basis of whether or not that variable improves the model. The purpose of stepwise regression is to select, from a large number of predictor variables, a small subset that accounts for most of the variation in the dependent or criterion variable. The three methods for conducting stepwise regression are discussed in the following paragraphs.

Initially there are no predictor variables in the regression equation. Predictor variable are entered one at a time only if they meet certain criteria specified in terms of the F-ratio. The order in which the variable is included is based on the contribution to the explained variance.

Initially, all the predictor variables are included in the regression equation. Predictor variables are then removed at a time based on the F-ratio.

Forward inclusion is combined with the removal of predictors that no longer meet the specified criterion at each step. Stepwise regression is useful when the sample size is large in relation to the number of predictors.

Stepwise regression procedure

This is done by computing the simple regression model for each independent variable. The independent variable with the largest F – statistic (which in simple regression is the t – statistic squared) or equally with smallest p

– value is chosen as the first entering variable. The standard is usually set at $F = 4.0$ which is chosen because the significance level is about 5%. This standard is called F-to-enter. If no independent variable exceeds F-to-enter, we cease the procedure with regression model produced. If at least one of the variables exceeds the standard, we continue to improve the model by adding a second independent variable. We examine these models to determine which is best and whether the F-statistic of the second variable is greater than the F-to-enter. If the two independent variables are highly correlated, only one of them will enter the equation. Once we included the first variable, the added explanatory power of the second variable will be minimal and its F-statistic will not be large enough to enter the model. In this way we reduce multicollinearity. We continue the procedure by adding another independent variable and each step *p*-values are computed and compared to the F-to-enter. Variables with F-statistic below the standard are removed from the equation. The steps are repeated until no more variables are added or removed. Finally, the best set of variables used to build the regression model must possess all the following characteristics:

1. High coefficient of determination, R^2;
2. Low standard deviation of values of the response variable, *Y*, yielded from the model;
3. A very low Mallow's C. P.

Mallow's C.P. is a measure of the bias produced in the use of the regression model in predicting values of the response variable. Since bias measures the deviation of estimated mean value from the true value, it is required that Mallow's

C.P. be small for a regression model to be adjudged as good. This criterion aids in the selection of the best set of variables from a number of sets of variables that can be considered for constructing the model.

CHAPTER THREE

PRELIMINARY ANALYSIS

This chapter deals with preliminary analysis of the data. It highlights the exploratory aspects of the data and discusses the analysis of frequency distribution. This is done by employing the use of line graph, bar charts, cross tabulations and frequency distributions.

Analysis of 2000 Results

Table 2 shows the percentage distribution of students' aggregates by subjects. The table shows that in the year 2000, no student was able to score between aggregate three and nine in the three core subjects. The best aggregate score in the core subjects was aggregate ten; which was scored by four (4) students. It can be seen that nineteen students failed all the three core subjects (obtained aggregate eighteen) studied. This constitutes 17.27% of the total number of students presented for the examination in 2000.

Table 2: Percentage distribution of students' aggregate by subjects in 2000

	Core		Elective	
Aggregate	Number	%	Number	%
3	0	0.00	0	0.00
4	0	0.00	0	0.00
5	0	0.00	0	0.00
6	0	0.00	1	0.91
7	0	0.00	2	1.82
8	0	0.00	2	1.82
9	0	0.00	3	2.73
10	4	3.64	3	2.73
11	6	5.46	7	6.36
12	2	1.80	9	8.17
13	11	10.00	12	10.91
14	13	11.82	7	6.36
15	17	15.46	12	10.91
16	14	12.73	15	13.64
17	24	21.82	20	18.18
18	19	17.27	17	15.46
Total	110	100.0	110	100.0

Similarly, from the table we observe that unlike students of core subjects, students performed better in the elective subjects. The best aggregate in this case is aggregate six which was scored by one student. Other aggregates that were not scored in core subjects, but were scored in elective subjects are aggregates six, seven, eight and nine. The corresponding numbers of students are one, two, two and three. It can be seen that, no student scored between aggregate three and five in the elective subjects. Further, we observe that seventeen students failed (obtained aggregate eighteen) all the elective subjects which accounts for 15.46%. The modal aggregate in elective subjects is aggregate seventeen.

Figure 1 shows the percentage distribution of students' total aggregate by sex.

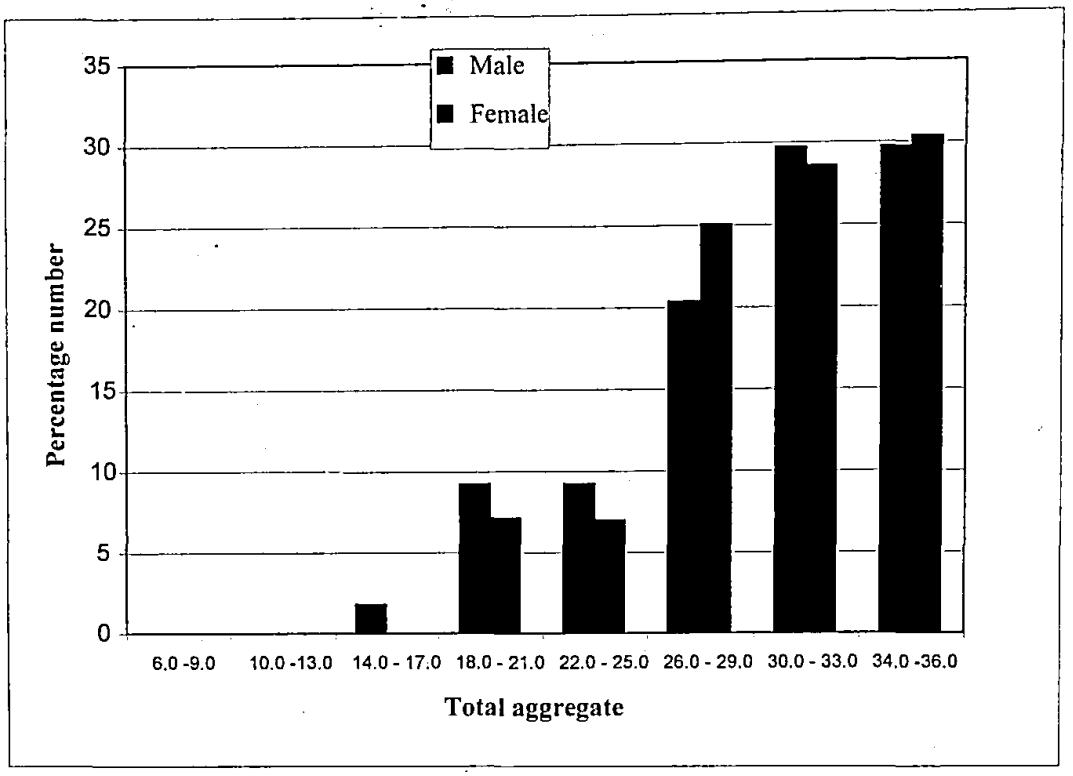

Figure1: Percentage distribution of total aggregate by sex (2000)

We observe that no student was able to score aggregate (6-9) and (10-13). The best aggregate (14-17) was obtained by a male student. This accounts for less than 5%. Also we can see that almost 10% of males scored aggregates (18-21) and (22-25) whilst the corresponding percentage of females of the same categories of aggregate is almost 7.5%. However, it is only two categories, aggregates (26-29) and (34-36), that the percentage of females are higher than the percentage of males.

Figure 2 below shows the percentage distribution of students' aggregate by programmes.

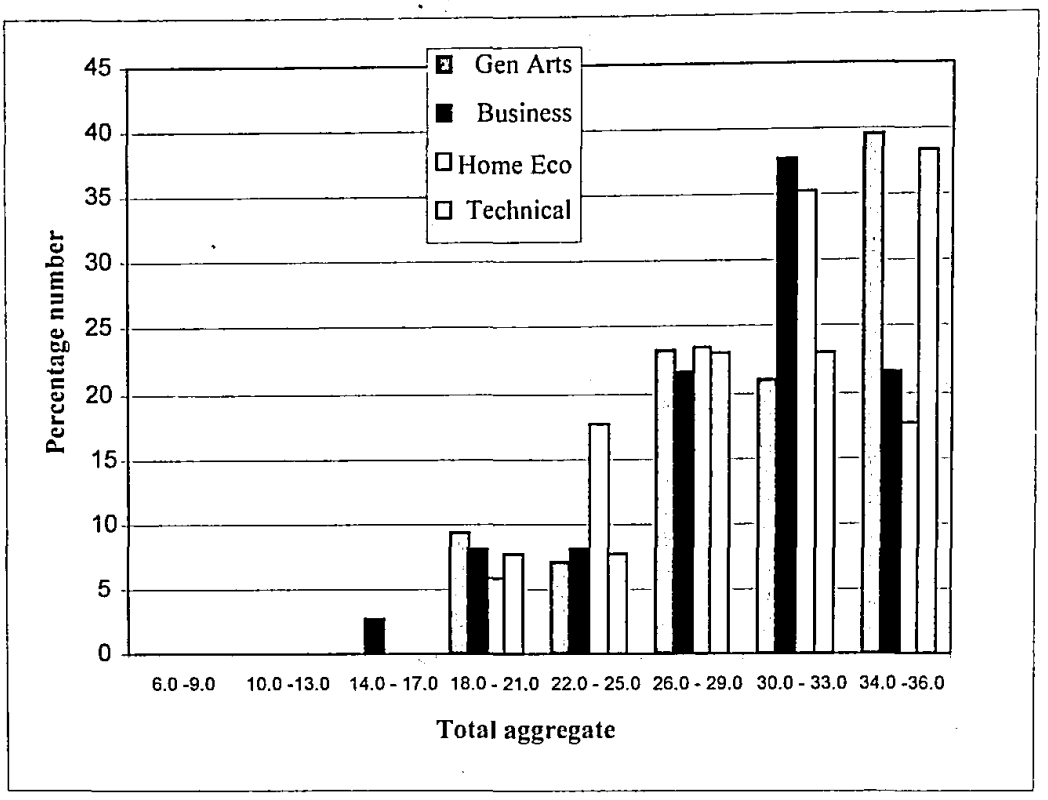

Figure2: Percentage distribution of total aggregate by programme (2000)

It can be seen that no student was able to score aggregate (6-9) and (10-13). The best aggregate (14-17) was obtained by a business student. This represents less than 5%. Performances of Business students were also dominant in aggregate (30-33). Performances of Home Economics students were also dominant in aggregate (22-25). Also General Arts and Technical students were the worse in that year with about the same percentage (37%) of students scoring between aggregate (34 -36). In the range aggregate (26-29), the performances of students from all programmes were almost the same (about 23%).

Figure 3 shows the percentage distribution of students' total aggregate by religion.

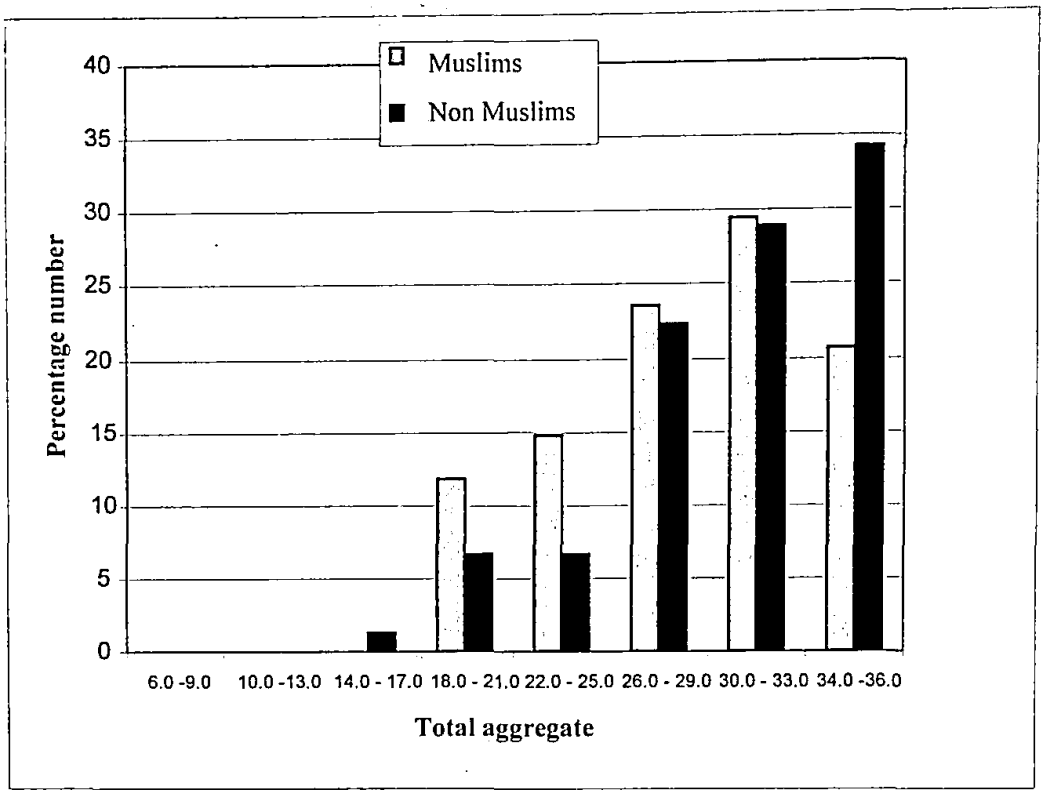

Figure 3: Percentage distribution of total aggregate by religion (2000)

We observe that no Muslim or Non-Muslim student was able to score aggregate (6-9) and (10-13). The best aggregate (14-17) was scored by a Non-Muslim. This constitutes less than 5%. We can see that exactly one half the proportion of Muslims who obtained aggregate (22-25) were Non-Muslims. Further, we can see that almost the same percentage of Muslims and Non-Muslims obtained aggregate (26-29) and also aggregate (30-33). The percentage of Muslims who scored aggregate (34-36) is almost 15% less than the corresponding score of Non-Muslims. Further, we observe that Non-Muslims

corresponding score of Non-Muslims. Further, we observe that Non-Muslims performed worse than Muslims. In addition, we observe that apart from aggregate (14-17), Muslims performed better than Non-Muslims.

Summary of Preliminary Analysis of 2000 Results

Nineteen (19) students representing 17.27% failed all the three core subjects while seventeen (17) students constituting 15.46% failed all the three elective subjects. The best student obtained aggregate (14-17). This student was a male Business student who was Non-Muslim. However, majority of students who had worse performance were Non-Muslims. Students performed better in elective subjects than core subjects. Also males performance were better than females. Students offering General Arts and Technical subjects formed the majority of students who had worse performance in the year.

Analysis of 2001 Results

Table 3 shows the percentage distribution of students' aggregates by subjects. The table shows that in 2001, no student was able score between aggregate three and five in the three core subjects. The best aggregate was aggregate six. Also we observe from Table 3 that fifty-two (52) students representing 38.81% failed all the three core subjects. The modal aggregate in this respect was aggregate eighteen.

Table 3: Percentage distribution of students' aggregate by subjects in 2001

	Core		Elective	
Aggregate	Number	%	Number	%
3	0	0.00	0	0.00
4	0	0.00	1	0.75
5	0	0.00	3	2.24
6	1	0.75	1	0.75
7	1	0.75	0	0.00
8	1	0.75	3	2.24
9	2	1.49	4	2.96
10	3	2.24	6	4.48
11	5	3.73	8	5.97
12	9	6.80	12	8.97
13	2	1.50	10	7.46
14	8	5.97	11	8.21
15	8	5.79	13	9.70
16	18	13.51	17	12.69
17	24	17.91	23	17.16
18	52	38.81	22	16.42
Total	134	100.0	134	100.0

Similarly, it can be observed that the elective students are widely distributed between aggregate four and aggregate eighteen. The best aggregate in this respect is aggregate four. Other aggregates that were not scored in core subjects but were scored in elective subjects are aggregates four and five. The corresponding numbers of students are one and three. Also we can see that twenty two students constituting 16.42% (obtained aggregate eighteen) failed all the three elective subjects. It can be observed from Table 3 that between aggregates seven and nine; the number of students with regard to core and elective subjects differs slightly by one or two. However, there is a marked variation of number of students from aggregate ten to fifteen. The modal aggregate is aggregate seventeen in performances of elective subjects. Further, the percentage of students

who failed all the core subjects is 22.39% higher than percentage of elective students of the same aggregate. In general from Table 3 students performed better in elective subjects than core subjects. Exceptions are aggregate three and six in which performance are the same. However, core students performed better in aggregate seven than elective students.

Figure 4 shows the percentage distribution of students' total aggregate by sex.

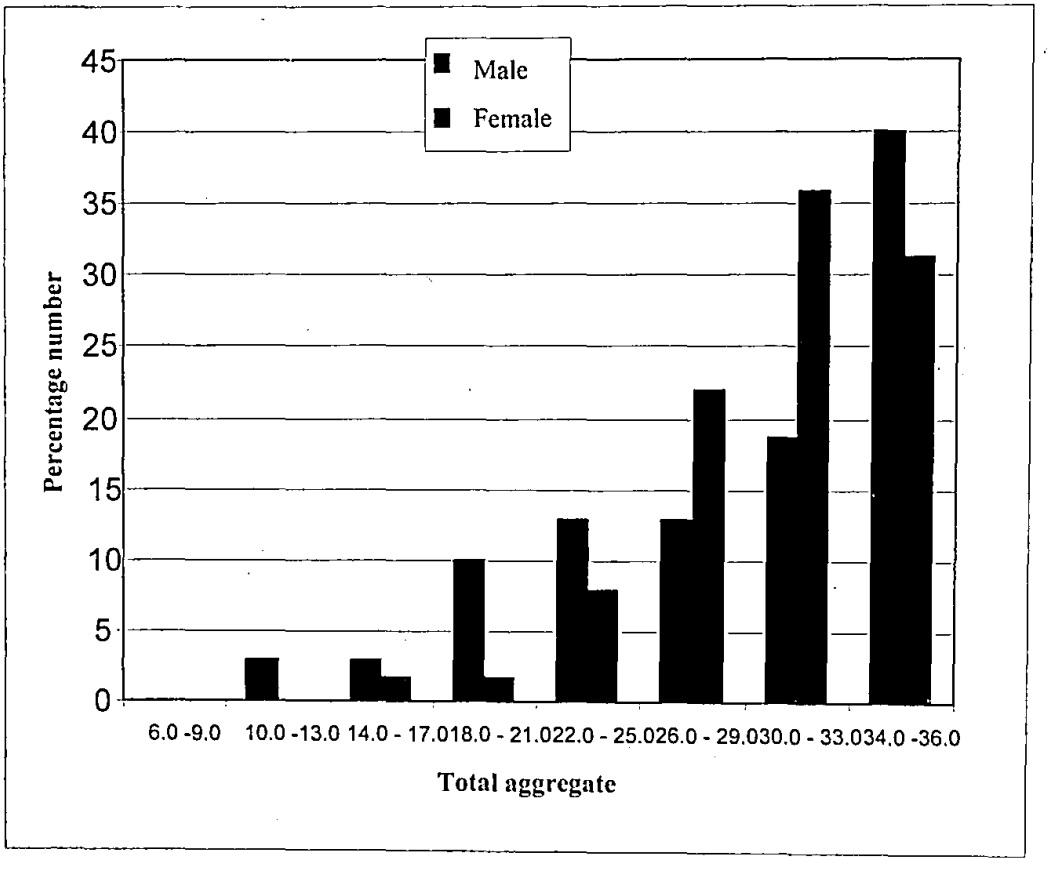

Figure 4: Percentage distribution of total aggregate by sex (2001)

We observe that no student was able to score aggregate (6-9). The best aggregate (10-13) was obtained by a male student. No female student scored this aggregate. Moreover, the proportion of females who obtained aggregate (14 -17)

and (18 - 21) are the same. This proportion is far less than the percentage of males who obtained aggregate (18-21). Similarly, females dominated in aggregate (30-33). The ratio of males to females in this aggregate is almost 1:2. Further, we observe that exactly 40% of the males and a little above 30% of the females either failed all, or nearly failed all the six subjects (obtained aggregate 34 -36). Males performed worse in this respect. Apart from aggregates (26-29) and (30-33) where females dominated males in performance, males performed better than females.

In figure5, the percentage distribution of students' aggregate by programmes is represented.

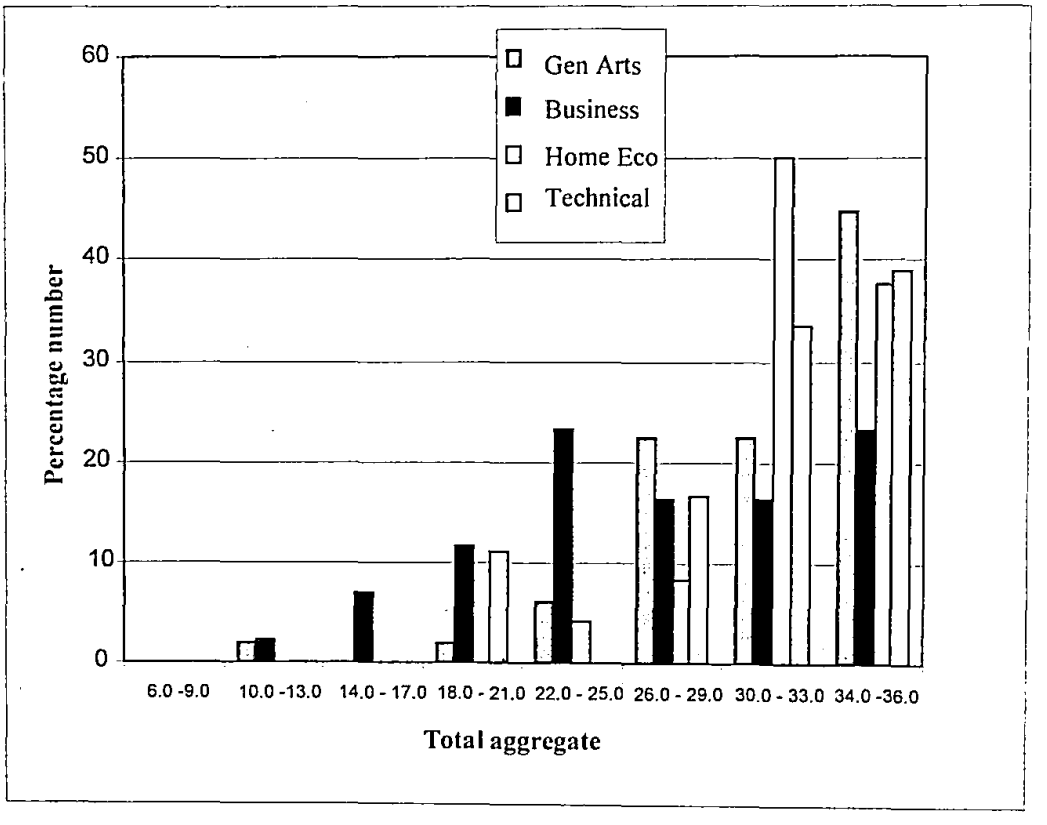

Figure 5: Percentage distribution of total aggregate by programme (2001)

We observe from Figure 5 that no student was able to score aggregate (6-9). The best aggregate (10-13) was obtained by students offering General Arts and Business programmes. Apart from business students who were able to score aggregate (14-17), students of other programmes did not make a score in this aggregate. The corresponding score is almost 10%.

Further, it can be observed that almost equal percentage of Business and Technical students obtained aggregate (18-21). The corresponding score of General Arts is far less. No student offering Home Economics scored this aggregate. In addition we observe that, Business programmes dominated in aggregate (22-25). The respective scores General Arts and Home Economics are 20% less. General Arts dominated in aggregates (26-29) and (34-36). Business and Technical students obtained almost the same score in aggregate (26-29). However, Home Economics scored below 10%. In addition, it is observed that Home Economics and Technical programmes have higher scores in aggregate (30-33). The percentage score of Home Economics is exactly 50%. Further, exactly 45% of General Arts failed all, or nearly failed all the six subjects (obtained aggregate 34 – 36). Business students performed better than students of other programmes. Also the worse performing programme is Home Economics.

The percentage distribution of students' total aggregate by religion is shown in Figure 6 below.

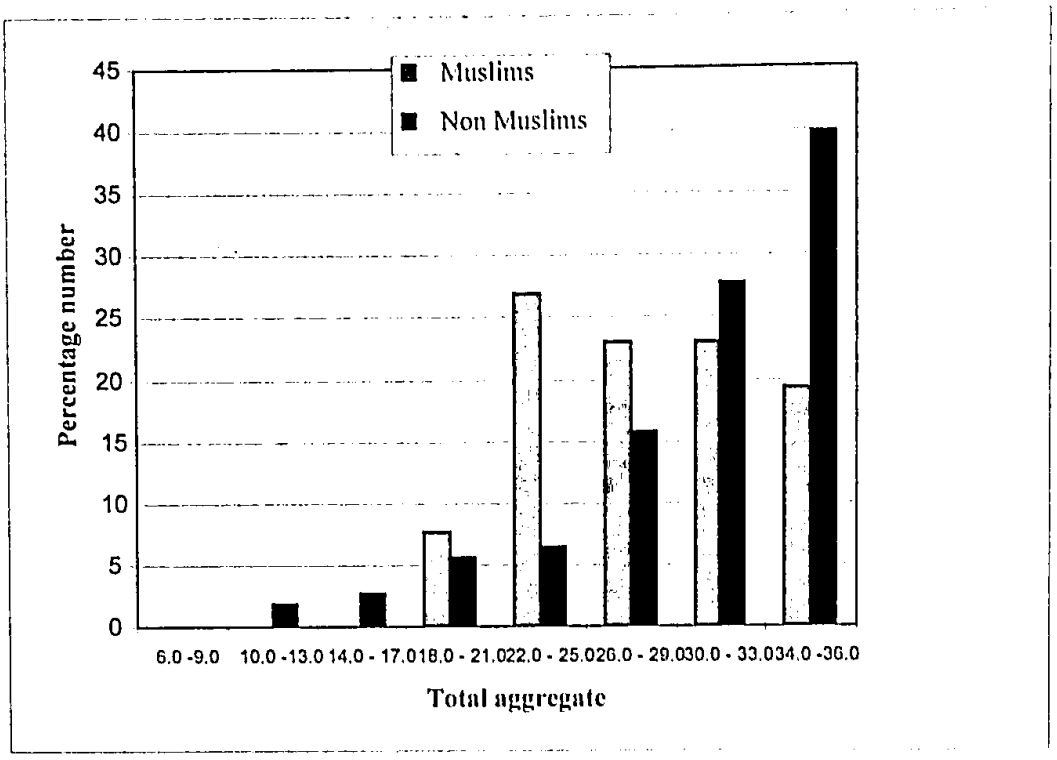

Figure 6: Percentage distribution of total aggregate by religion (2001)

We observe that no Muslim or Non-Muslim student was able to score aggregate (6-9). The best aggregates (10-13) , was obtained by less than 5% of Non-Muslims. Also we observed that the percentage of Muslims scoring aggregate (22-25) far outnumbers the score of Non-Muslims of the same aggregate. This score of Muslims is four times the respective percentage of Non-Muslims. Further, it can be seen that exactly half the percentage of Non – Muslims who obtained aggregate (34-36) were Muslims. That is 50% of Non-Muslims who failed all, or nearly failed all the six subjects were the same as Muslims of the same of aggregate. Non-Muslims performed worse in this respect. Further Muslims performed better in aggregates (18-21), (22-25) and (26-29).

Summary of Preliminary Analysis of 2001 Results

Fifty two (52) students representing almost two – fifth of the students (38.81%) failed all the three core subjects. Whilst twenty two (22) students constituting 16.42% failed all the elective subjects. Students performed better in elective subjects than core subjects. The best aggregate (10-13) was obtained by male students. These students were Non – Muslims who offered General Arts and Business programmes. However, majority of the students who had worse performance were Non-Muslims. The best performing programme is Business. Home Economics and General Arts students formed majority who had worse performance.

Analysis of 2002 Results

Table 4 shows the percentage distribution of students' aggregates by core and elective subjects.

Table 4: Percentage distribution of students' aggregate by subjects in 2002

	Core		Elective	
Aggregate	Number	%	Number	%
3	0	0.00	0	0.00
4	0	0.00	0	0.00
5	0	0.00	2	1.47
6	0	0.00	1	0.74
7	1	0.74	2	1.74
8	0	0.00	5	3.68
9	0	0.00	6	4.41
10	2	1.74	4	2.94
11	0	0.00	2	1.47
12	1	0.74	10	7.35
13	3	2.21	12	8.82
14	8	5.88	13	9.29
15	11	8.09	13	9.56
16	14	10.00	13	9.56
17	25	18.39	27	19.85
18	71	52.21	26	19.12
Total	136	100.0	136	100.0

The table shows that no student was able to score between aggregate three and nine in the three core subjects. The only exception is aggregate seven. This was scored by one student which accounts for 0.74%. It can be seen that seventy one (71) students representing 52.21% failed all the three core subjects. The modal aggregate is aggregate eighteen. Similarly, it can be seen that elective students are widely distributed between aggregate five and eighteen. The best aggregate in this respect is aggregate five. This was obtained by two students which constitutes 1.47%. Other aggregates that were not scored in core subjects but were scored in elective subjects are aggregates five, six, eight, nine and

eleven. These represent 1.47%, 3.68%, 4.41% and 1.47% respectively. Further, we can see that twenty six students constituting 19.12% failed all the three elective subjects. This score (19.12%) is 33.09% less than students who failed (obtained aggregate eighteen) all the core subjects. From Table 4, we observe that between aggregate five and fourteen, there is a marked variation in number as well as the percentages of students of core and elective subjects. The modal aggregate for elective subjects is aggregate seventeen. In general, we observe from Table 4 that students performed better in elective subjects than core subjects.

Figure 7 shows the distribution of students' total aggregate by sex.

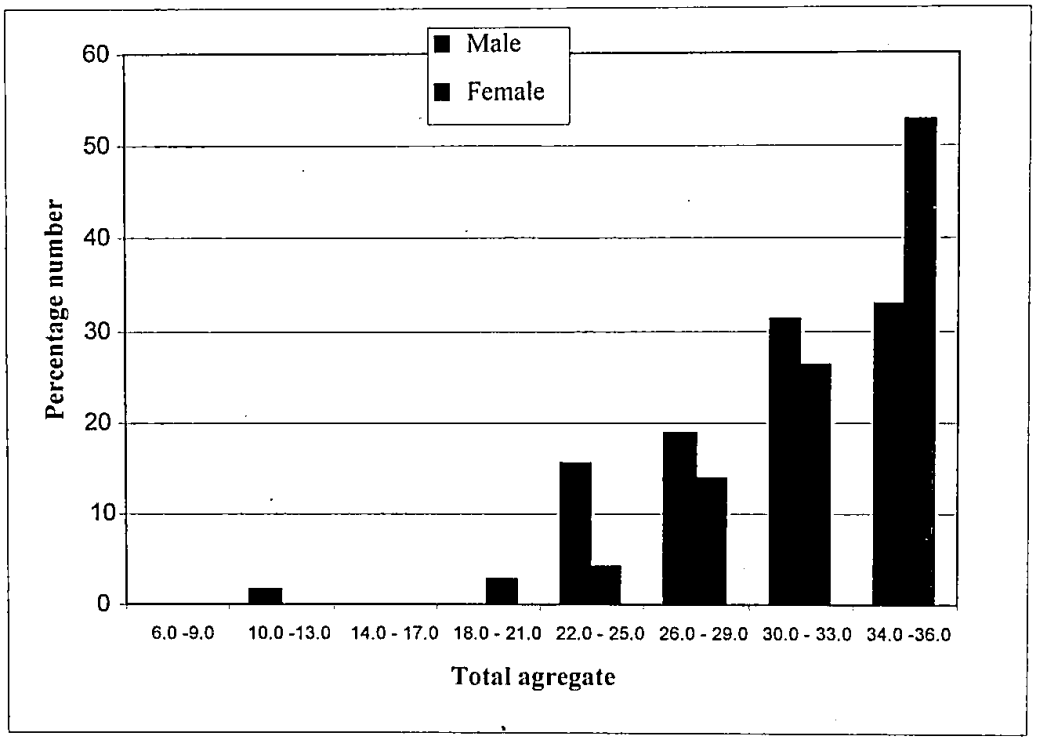

Figure 7: Percentage distribution of total aggregate by sex (2002)

We observe that no student was able to score aggregate (6 -9) and (14 - 17). The best aggregate (10 -13) was scored by a male student. This accounts for less than 5%. No female student was able to make a score in this respect. Also we

observe that no male student scored aggregate (18-21). Further, the proportion of males scoring aggregate (22-25) far outnumbers the corresponding number of females. The same observation can be made with aggregate (26-29) and (30-33). We can see that almost equal proportion of males obtained aggregate (30-33) and (34 -36). In addition, percentage of females scoring aggregate (30-33) is exactly half the proportion of females scoring aggregate (34 -36). Further, we can see that over 50% of females either failed all, or nearly failed all the six subjects (obtained aggregate 34 -36). The corresponding number of males is a little above 30%. We observe that, in general males performed better than females, the only exception is aggregate (18 -21).

Figure 8 shows the percentage distribution of students' aggregate by programmes.

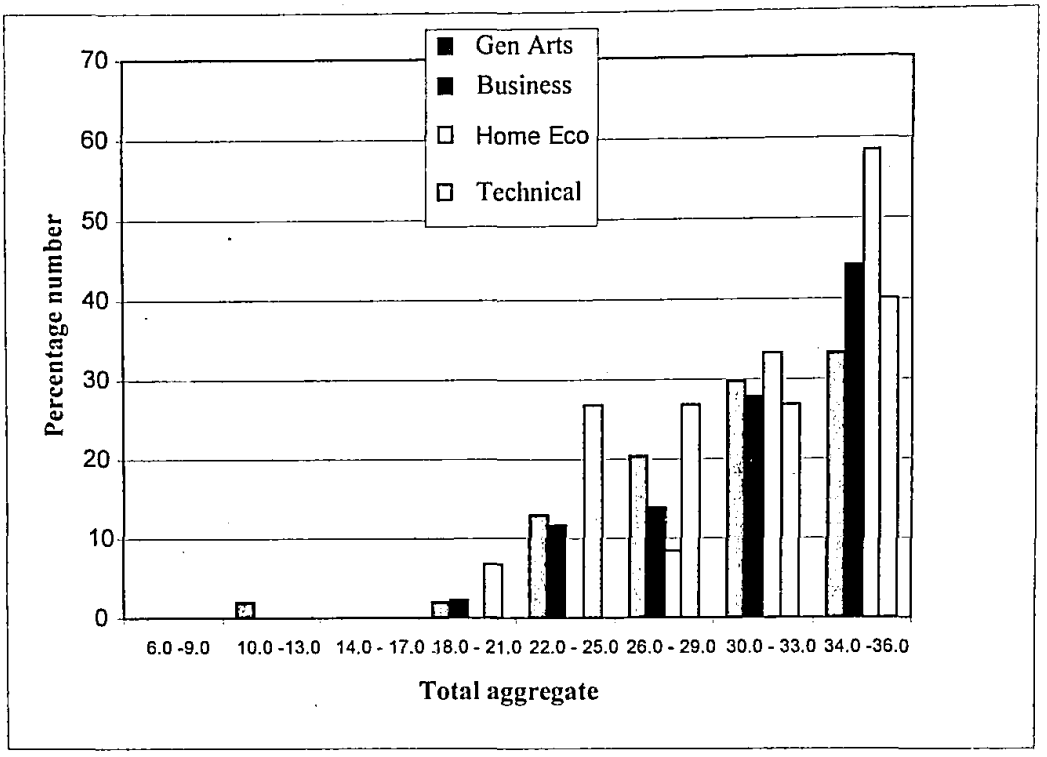

Figure 8: Percentage distribution of total aggregate by programme (2002)

We can see from Figure 8 that, no student was able to score aggregate (6-9) and (14-17). The best aggregate (10 -13) was obtained General Arts student. This accounts for less than 5%. Further, we observe that almost equal numbers (less 5%) of General Arts and Business students obtained aggregate (18-21). Students offering Home Economics did not make a score in this aggregate. Performances of Technical students were dominant in aggregates (18-21), (22-25) and (26-29). Further, from aggregate (30-33) we can see that, apart from Home Economics in which the performance is almost 35%, the scores of the remaining programmes are almost the same (nearly 30%). Nearly 60% of Home Economics student either failed all, or nearly failed all the six subjects. This score is almost;

20% higher than scores of Technical students, 15% above the percentage for Business students and 25% higher than scores of General Arts students. Home Economics performed worse. Technical students performed well in all the aggregates. Exceptions are aggregate (10-13) and (34-36).

Figure 9 shows the percentage distribution of students' total aggregate by religion.

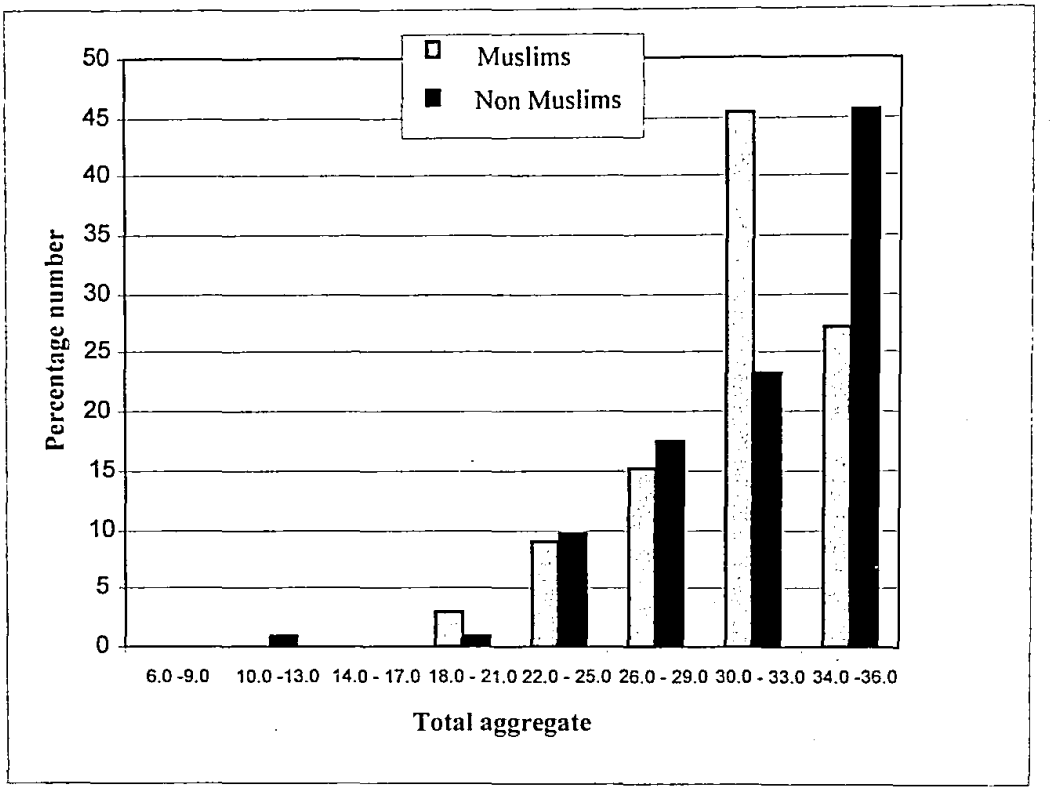

Figure 9: Percentage distribution of total aggregate by religion (2002)

We observe that no Muslim or Non-Muslim was able to score aggregate (6-9) and (14-17). The best aggregate (10-13) constitutes only a small fraction (less than 5%) of Non-Muslims. In addition, we observe that almost equal numbers of Muslims and Non –Muslims obtained aggregate (22-25) and (26-29). Far larger percentage (45%) of Muslims obtained aggregate (30 – 33). This is

exactly two times the score of Non-Muslims. Higher percentage (45%) of Non-Muslims either failed all, or nearly failed all the six subjects. The corresponding percentage of Muslims is almost 20% less. Non-Muslims performed worse in this regard. Non- Muslims dominated throughout. Exceptions are aggregates (18 – 21) and (30 – 33).

Summary of Preliminary Analysis of 2002 Results

Majority of the students, that is over fifty percent (52.2%) of the students failed all the three core subjects whilst 19.12% failed all the three elective subjects. Students performed well in elective subjects than core subjects. The best student obtained aggregate (10 -13). This student was a male offering General Arts who was Non-Muslim. The best performing programme is Technical Subjects whilst the worse performance programme is Home Economics. Also Muslims performed better than Non–Muslims. Males performed better than females.

Analysis of 2003 Results

Table 5: Percentage distribution of students' aggregate by subjects in 2003

	Core		Elective	
Aggregate	Number	%	Number	%
3	0	0.00	1	0.55
	0	0.00	2	1.11
5	0	0.00	1	0.55
6	2	1.11	2	1.11
7	1	0.55	2	1.11
8	2	1.11	9	4.97
9	5	2.76	8	4.42
10	1	0.55	8	4.42
11	7	3.87	16	8.84
12	11	6.08	12	6.63
13	3	1.67	12	6.62
14	13	7.18	16	8.84
15	29	16.02	24	13.26
16	44	24.30	25	13.81
17	29	16.02	19	10.50
18	34	18.78	24	13.26
Total	181	100.0	181	100.0

Table 5 shows the percentage distribution of students' aggregate by core and elective subjects.

We observe that, no student offering core subjects obtained between aggregate three and five. The best aggregate obtained in core subjects was aggregate six. This represents 1.11%. Thirty four (34) students constituting 18.78% failed all the three elective subjects. The modal aggregate in core subjects is aggregate sixteen. However, unlike aggregate scores in core subjects, students of elective subjects are distributed over the entire aggregate (i.e. between aggregate three and eighteen). The best aggregate in this respect is aggregate three and this was obtained by one student which constitutes 0.55%. Other aggregates that were not obtained in core subjects but were scored in elective

subjects are aggregates; three, four and five. These represent 0.55%, 1.11% and 0.55% respectively. It can be seen that twenty four students representing 13.26% failed all the elective subjects. Further, we observe that between aggregate eight and eighteen, there is a marked variation in number as well as the percentage of students of core and elective subjects. However, exceptions are aggregate nine, twelve and fourteen. The modal aggregate for elective subjects is aggregate sixteen. Table 5 seems to suggest that students performed well in elective subjects than core subjects.

Figure 10 shows the percentage distribution of students' total aggregate by sex.

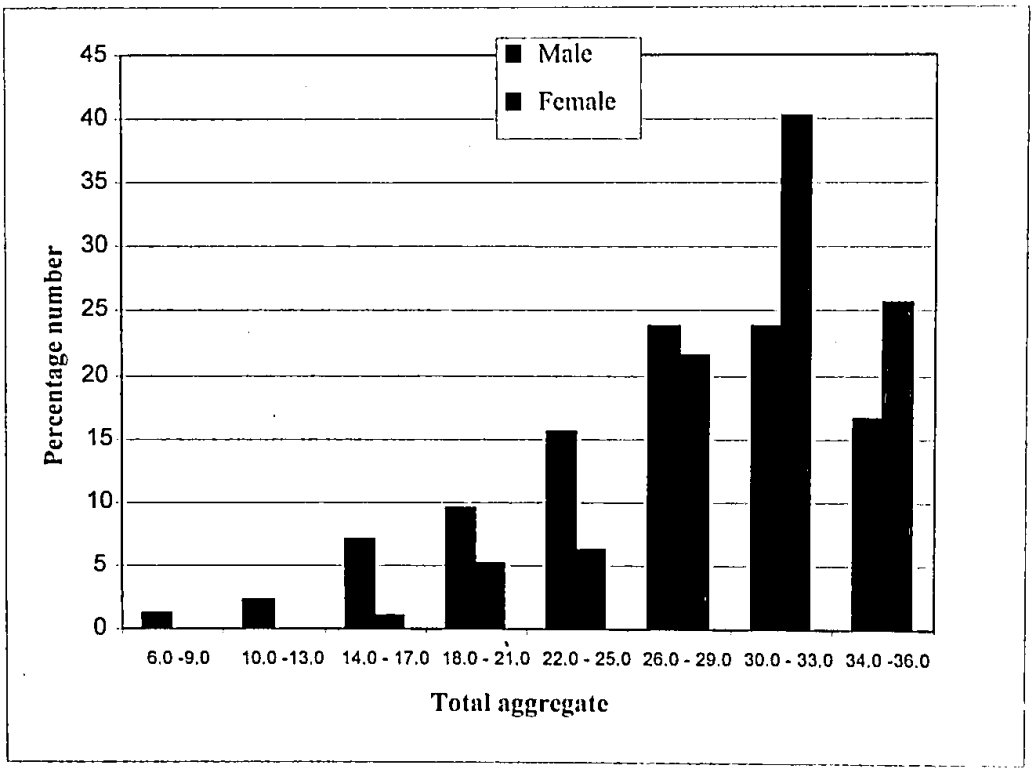

Figure10: Percentage distribution of total aggregate by sex (2003)

We observe that best aggregate (6-9) was obtained by a male student. This score represents less than 5%. No female was able to score between aggregate six and thirteen. Performance of males was dominant between aggregate six and twenty nine. Females dominated in aggregate (30-33) and (34 -36). Hence females performed worse in this respect. Further, we observe from Figure10 that, males dominated in good aggregates.

The percentage distribution of students' aggregate by programme of study is shown in Figure 11.

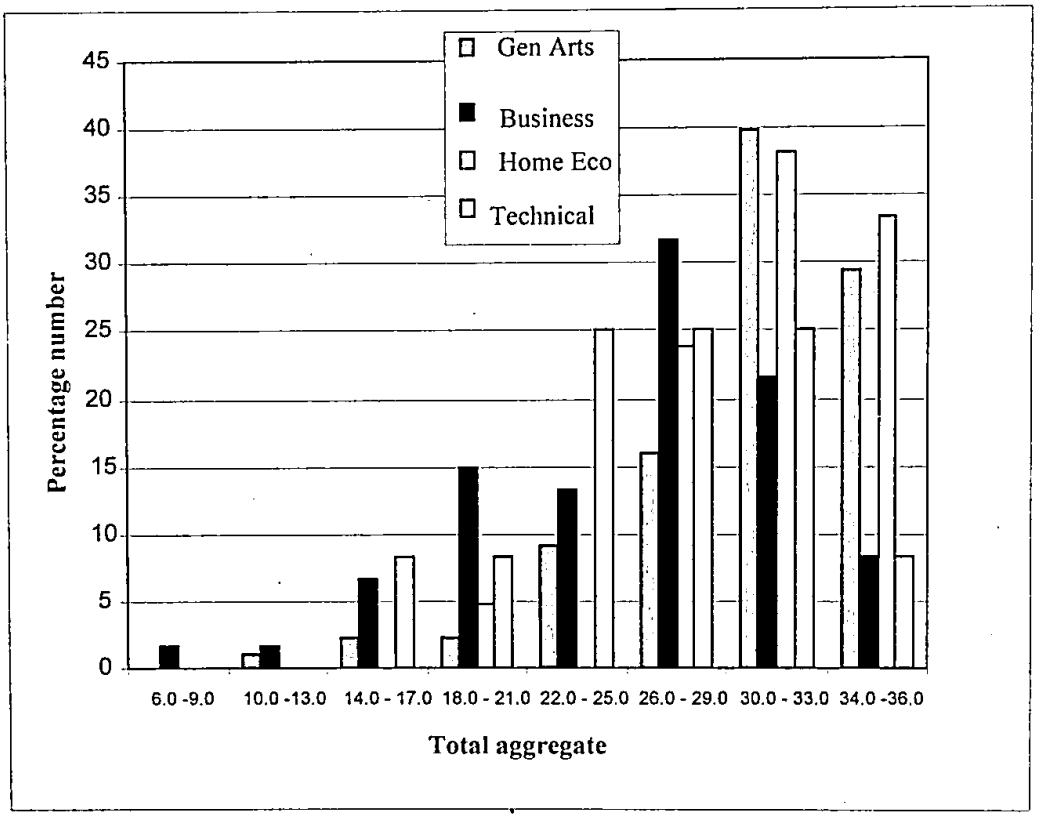

Figure11: Percentage distribution of total aggregate by programme (2003)

It can be seen from Figure 11 that best aggregate (6 – 9) was obtained by less than 5% of the Business students. Also a negligible percentage of General Arts and Business students obtained aggregate (10 -13). Business students

dominated in aggregates six to twenty nine. Exceptions are aggregates (14 -17) and (22 -25). Further, Technical students performed well in aggregate (14 -17) and (22 -27). The best score of Home Economics, aggregate (18-21) constitutes exactly 5%. This score is exactly one-third the scores of Business students. Further, far larger proportion of General Arts and Home Economics students either failed all, or nearly failed all the six subjects. The corresponding score of Business and Technical students is less than 10%. General Arts and Home Economics programme performed worse. The best performing programme is Business.

Figure 12 shows the percentage distribution of students' total aggregate by religion.

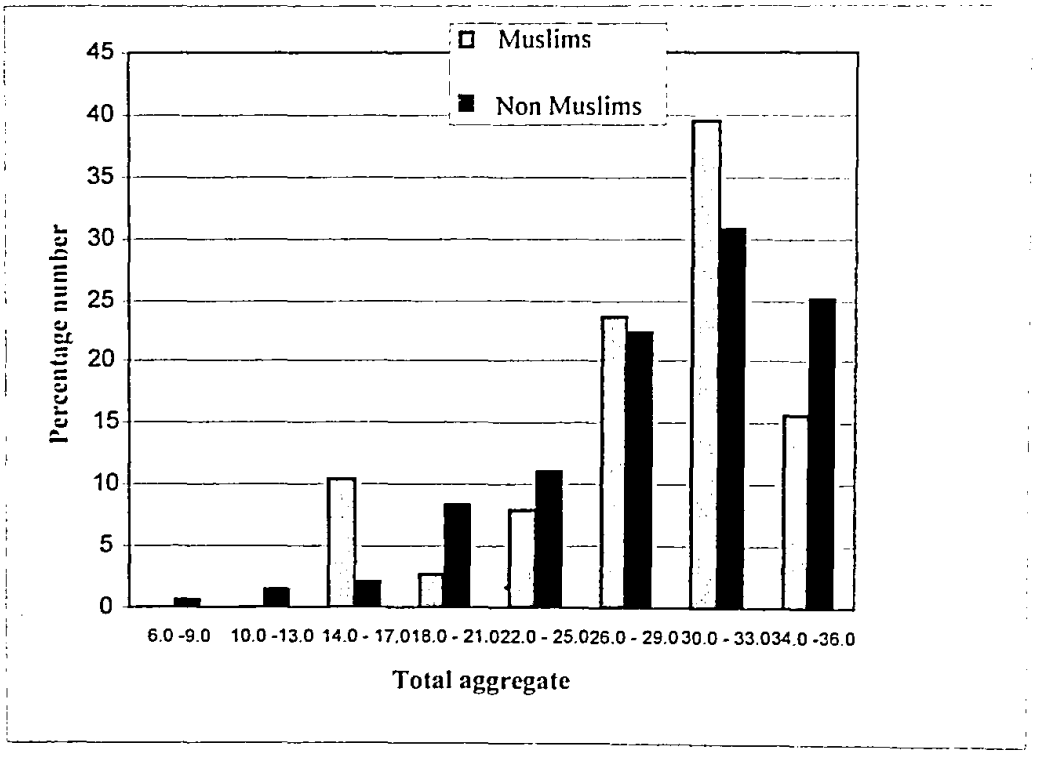

Figure 12: Percentage distribution of total aggregate by religion (2003)

We observe that the best aggregates (6 - 9) and (10-13) were obtained by Non-Muslims. These constitute less than 5%. Exactly 10% of Muslims obtained aggregate (14-17). This number (10%) is far larger than the score of Non-Muslims. Further, almost 40% of Muslims obtained aggregate (30-33). This score is nearly 10% higher than the corresponding score of Non-Muslims. Exactly 25% of Non -Muslims either failed all, or nearly failed all the six subjects. The respective number of Muslims is 10%. We observe that Muslims dominated in aggregate (14 -17), (26-29) and (30-33). Negligible percentage of Non-Muslims obtained good score of aggregates (6 – 9), (10 – 13) and (14 –17). Generally, Non-Muslims performed better than Muslims.

Summary of Preliminary Analysis of 2003 Results

The percentage (18.78%) of students who failed all the three core subjects is 4.54% higher than corresponding percentage of students who failed all the three elective subjects. Students performed well in elective subjects than core subjects. The best student scored aggregate (6 –9). This student was a male Business student who was Non-Muslim. The best performing programme is Business whilst the worse performing programme is Home Economics. Males performed better than females. Also, Non–Muslims performed better than Muslims.

Analysis of Overall (2000- 2003) Results

Figure 13 below is the percentage distribution of students' total aggregate by sex.

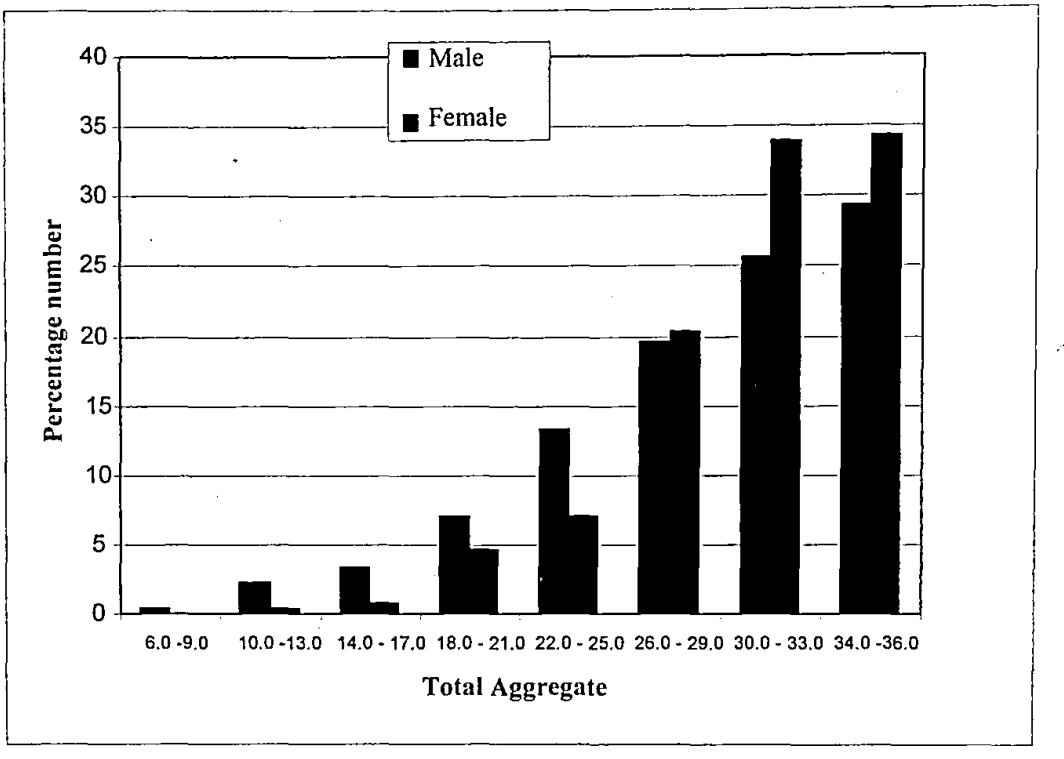

Figure 13: Percentage distribution of total aggregate by sex (2000-2003)

We observe that the best aggregate (6-9) for the overall study period was obtained by a male student. This constitutes a negligible proportion (less than 1%). No female student made a score in this respect. Also, males dominated in good aggregates between six and twenty five. In addition, we observe that females dominated in aggregates, (30-33) and (34-36). It can be seen that nearly 35% of the females either failed all, or nearly failed all the six subjects. This number (35%) exceeded the corresponding marks of males by nearly 5%. It can be seen from Figure 13 that, males dominated females in good aggregates six to twenty

five by larger percentages whilst females dominated males in weak aggregate between twenty six and thirty six. In general, males performed better than females.

Figure 14 shows the percentage distribution of students' aggregates by programmes.

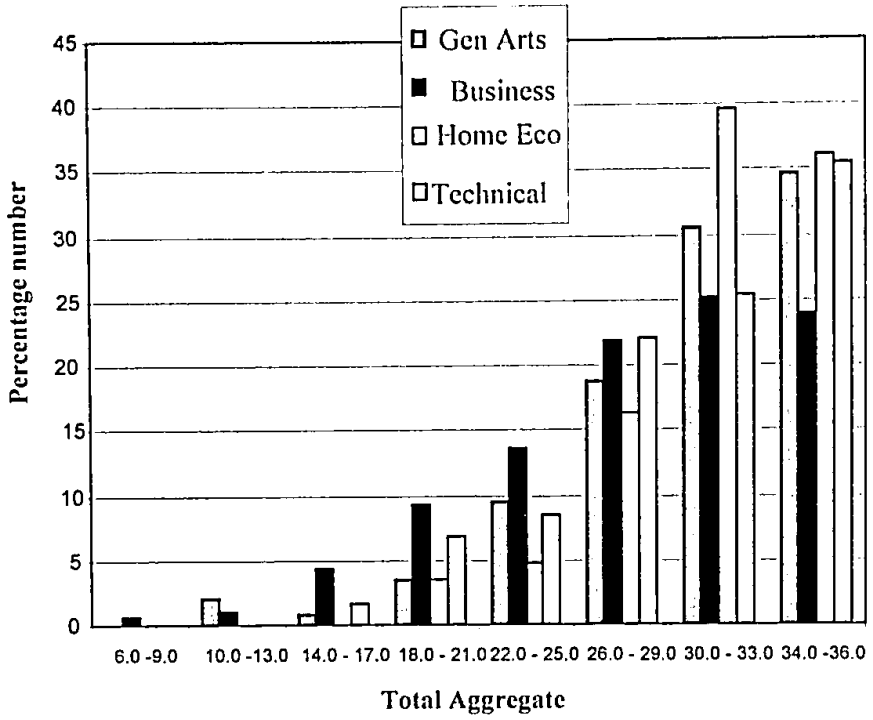

Figure 14: Percentage distribution of total aggregate by programme (2000-2003)

It can be seen that the best aggregate (6-9) was obtained by a negligible proportion (less than 1%) of Business students. No student from other programmes obtained this aggregate. Business students dominated in aggregates six to twenty nine. The only exception is aggregate (10-13). In addition, we observe that far larger proportion of General Arts and Home Economics students scored between aggregate thirty and thirty six. We realize that almost 40% of

Home Economics students obtained aggregate (30-33). The respective percentage of Business and Technical students are the same. Also it can be seen that almost equal proportion (35%) of General Arts, Home Economics and Technical students either failed all, or nearly failed all the six subjects. The corresponding score of Business students is almost 10% less than this number. It can be seen that throughout the period Business students performed better than students of other programmes. Although smaller fraction (less than 5%) of General Arts students obtained aggregate between ten and twenty one, far larger proportions performed poorly. It can be seen that Home Economics is the worse performing programme.

We can see below the percentage distribution of students' total aggregate by religion in Figure 15.

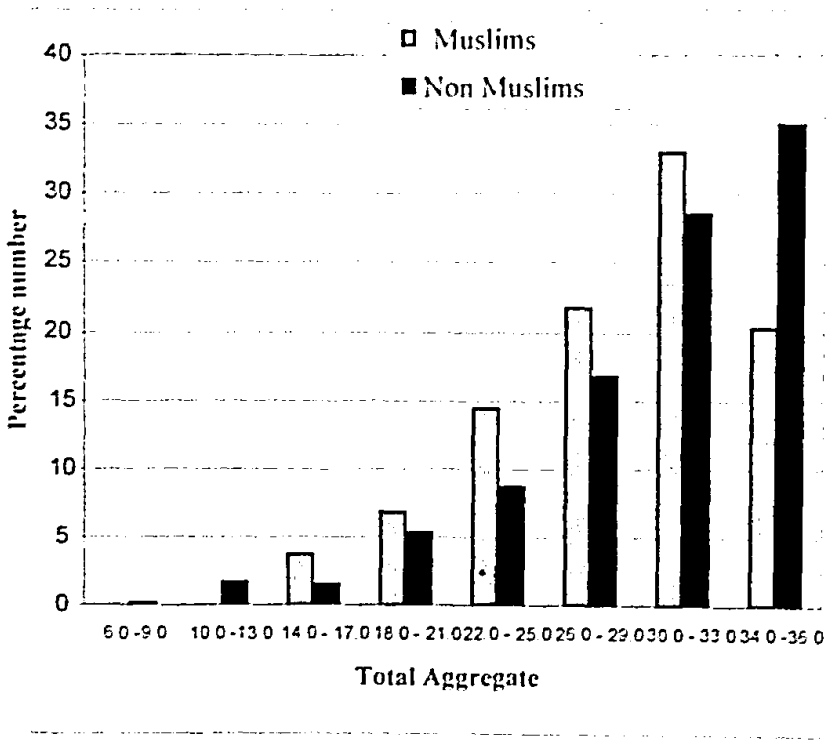

Figure15: Percentage distribution of total aggregate by religion (2000-2003)

We observe that the best aggregate (6-9) was obtained by a negligible fraction less than 1% of Non-Muslims. No Muslim was able to score between aggregate six and thirteen. It is observed that either 35% of Non-Muslims failed all, or failed almost all the six subjects. The corresponding proportion of Muslims is exactly 15% less than Non-Muslims. Although smaller fraction (less than 5%) of Non-Muslims obtained good aggregates six to thirteen. It can be seen that throughout the period greater percentage of Non-Muslims consistently failed in all or almost all six subjects. However, Non-Muslims consistently obtained the best grade each year throughout the study period.

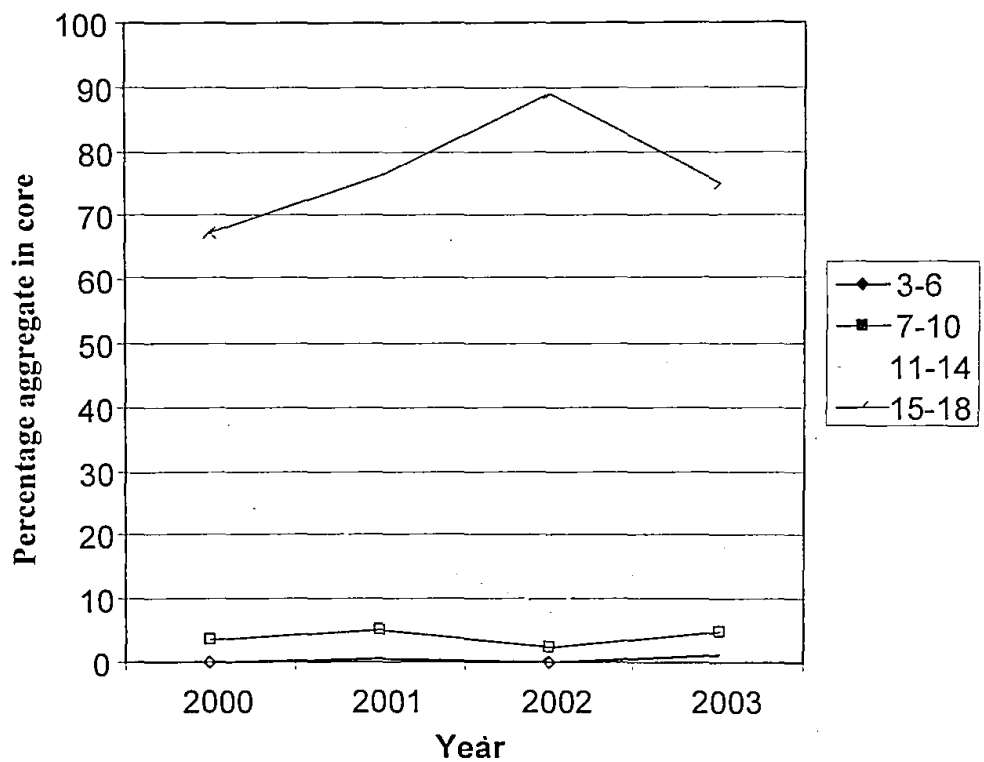

Figure 16: Percentage distribution of total aggregate by core subjects (2000-2003)

Figure 16 above shows the percentage distribution of aggregate by core subjects over the study period (2002-2003).

Using Figure 16 we can see that in the year 2000, no student was able to score aggregate (3-6). However, a negligible fraction of the students scored this aggregate in 2001. The performance declined to zero in the following year until in 2003 when it rose a little higher than in 2001. In addition, we can see that, students' performance in aggregate (7-10) follows the same trend as in aggregate (3-6) over the study period. Students' performance increases between 2000 and 2001, decreases between 2001 and 2002 and finally increases in 2003. However, there is a marked variation in percentages between the performance in aggregate (3-6) and (7-10). Because when students made no score in aggregate (3-6) in 2000 and 2002, the corresponding scores in aggregate (7-10) were almost 5% and a little above 0% respectively.

Unlike aggregate (3-6) and (7-10), aggregate (11-14) shows a downward trend to the right from 2000 and 2002. However, there is an upward growth from 2002 to 2003. It can be observed that, performance in 2000 is almost; 10%, 20% and 10% higher than performance in 2001, 2002 and 2003 respectively. Further, we observe that scores in aggregate (15-18) are higher than scores in aggregates (3-6), (7-10), (11-14). The scores are distributed between slightly above 65% and almost 90%. The peak of this weak aggregate is almost 90% and this occurred in 2002. Hence in this respect 2002 is the worse performing year, followed by 2001, 2003 and 2000. There is an upward growth from 2000 to 2003.

In general, it can be seen that, less than 5% of the students scored good aggregates (3-6), (7-10) whilst majority (over 65%) obtained poor marks. Also we

can see that 2000 is the best performing year in core subjects while 2002 is the poor performing year.

Figure17 shows the percentage distribution of aggregate by elective subjects over the study period (2002-2003).

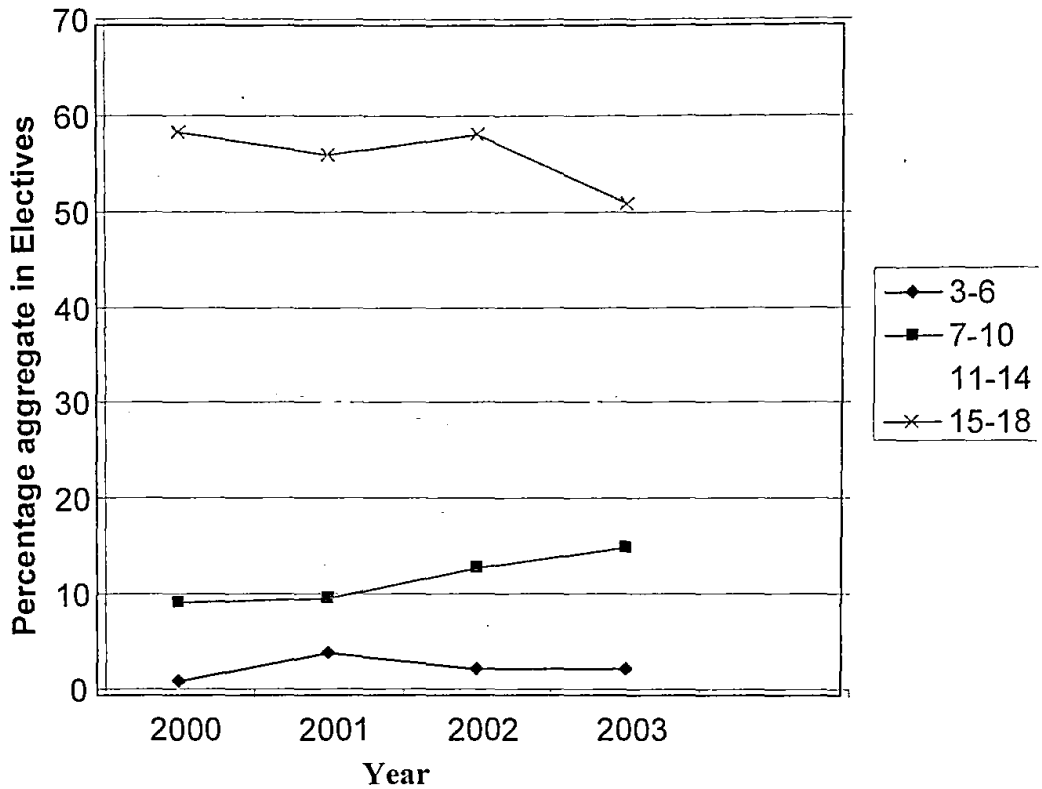

Figure 17: Percentage distribution of total aggregate by elective subjects (2000-2003)

Unlike the core subjects, aggregate (3-6) of the elective subjects are distributed between zero (0%) and 5%. The percentage rose from the year 2000 to 2001 and declined slightly through 2002 and finally to 2003. The peak of this aggregate is almost 5% which occurred in 2001. Also we can see that the number of quality performance in elective subjects was best in 2001. The least performing year in this respect is 2000 while 2002 and 2003 scored the same percentage.

Similarly, we observe that aggregate (7-10) was distributed between almost 10% and 15%. There is a slight increase in percentage between 2000 and 2001. However, the growth continues sharply from 2001 to 2002 and eventually in 2003.

Gener ally, there is an increase in percentages over the years with the highest percentage (15%) attained in 2003. Hence, 2003 is the best in performance in this respect. Also we can see that, aggregate (11-14) is ranged between 25% and 35%. This shows a downward trend from 2001 to 2002. However, the percentage increased a little between 2002 and 2003. Further, we observe that, apart from 2002, the change in percentages over the years varies slightly by a negligible (almost 1%) fraction. The highest score is little above 30% and this occurred in 2000.

Further, we observe that, aggregate (15-18) was distributed between 50% and almost 60%. This category of aggregate shows a downward trend for the first two years (2000-2001), increased from 2001 to 2002 and finally decreased in 2003. The lowest score is a little above 50% and this occurred in 2003; while the highest score almost 60% was recorded in 2002. Since this is a weak region of aggregate, it means that, the best performing year in this respect is 2003 while the worst year in performance is 2002. From the above analyses, we observe that, the strong aggregates (3-6), (7-10) are distributed between less than 15% over the study period. Aggregate (11-14) ranges between 25% and 35% over the study period. However, large proportions of the students (over 50%) were distributed over aggregate (15-18). Based on this trend analyses, we observe that in general,

2000 is the worse performing year in elective subjects whiles 2003 is the best performing year.

Summary of Preliminary Analysis

In the year 2000, the best aggregate (14 -17) was obtained by a male Business student who was Non -Muslim. However majority of students who performed worse were Non -Muslims. Student performed better in elective subjects than core subjects. Also males performances were better than females. General Arts and Technical students performed worse. In addition, 2001 data revealed that fifty two (52) students representing 38.81% failed all the three core subjects. The respective number, (24) students constituting 16.42% failed the three elective subjects. Students performed better in elective subjects than core subjects. The best aggregate (10-13) was obtained by male General Arts and Business students who were Non–Muslims. Majority of students who had worse performance were Non–Muslims. The best performing programme was Business whilst General Arts and Home Economics performed worse.

Throughout the study, the best aggregate (6- 9) was obtained by male. This student was a Non–Muslim who offered Business. The best performing programme is Business whilst the worse performing programme is Home Economics. Also, over fifty percent (52.2%) of the students failed the three core subjects in 2002, whilst 19.12% failed all the three elective subjects. Students performed well in elective subjects than core subjects. The best aggregate (10-13) was scored by Non–Muslim who offered General Arts. The best performing programme in 2002 is Technical whilst Home Economics performed worse.

Males performed better than females. Also Muslims did well than Non–Muslims. Further, in 2003 (18.78%) of the students failed all the three core subjects. The respective number of elective students was 13.26%. Students performed well in elective subjects than core subjects. The best aggregate (6-9) was obtained by male Business student who was Non–Muslim. The best performing programme is Business whilst Home Economics performed worse. Males performed better than females. Also Non–Muslims performed better than Muslims.

In general, males performed better than females, also Muslims performed better than Non–Muslims. In addition, the year 2000 emerged as the best performing year in core subjects whilst 2002 performed worse. Similarly, 2003 is the best performing year in elective subjects whilst 2000 performed worse. Further, we observed that good aggregate (3-6) and (7-10) in core subject were scored by less than 10% of the students whiles between 65% and 90% obtained poor aggregate (15–18). However, the corresponding good aggregate in elective subjects are distributed between 0% and 15% whilst between 50% and almost 60% scored aggregate (15-18).

CHAPTER FOUR

FURTHER ANALYSIS

It is evident from the summary of the preliminary analysis that academic performance of the students differ with regard to sex, programme of study, religious affiliation, core and elective subjects. However, conclusion based on this preliminary evidence about academic performance of P –AMASS students can only be made after a further analysis of the data. A further analysis of the data is therefore made in this chapter using statistical methods such as Analysis of Variance and Multiple Linear Regression.

One-way analyses of variance for aggregate results among the various programmes of study

Based on the difference in academic performance among the various programmes of study observed in the preliminary analysis, one-way analysis of variance is conducted among the programmes of study. The result is shown in Table 6 and the confidence interval analysis is given in Table 7.

Table 6: One-way ANOVA among the various Programmes of study

Source	DF	SS	MS	F	P
Treatment	3	837.2	279.1	10.02	0.000
Error	552	15379.0	27.9		
Total	555	16216.2			

The standard deviation of the analysis is $S = 5.278$. The coefficient of variation and the adjusted coefficient of variation are given respectively by $R-Sq = 5.16\%$ and $R-Sq(adj) = 4.65\%$. Table 6 gives a negligible p-value which is equal to 0.000 and F-value of 10.02. The small p-value and F-value means that we can reject the null hypothesis

$$H_o : \mu_1 = \mu_2 = \mu_3 = \mu_4$$

that all group means of the four programmes are equal. The small value of coefficient of determination means that students' performance has little to do with programme of study alone. The value $R-Sq = 5.16\%$ indicates that 5.16% of students' academic performance of P-AMASS is explained by programme of study alone. Therefore, the performance of a student may be determined by considering other variables in addition to programme.

Table 7: Individual 95% Confidence Interval for Mean

Progamme	Number of students	Mean aggregate	StDev	------+---------+---------+---------+-
G. Arts	234	30.470	5.119	(---*----)
Business	186	28.366	6.058	(----*----)
H. Econs	81	31.889	3.630	(-------*------)
Technical	55	30.164	5.145	(--------*--------)
				------+---------+---------+---------+-
				28.5 30.0 31.5 33.0

Table 7 is generated based on pooled standard deviation of 5.278. The table gives the sample size (the total number of students) allocated to the various programmes i.e. General Arts, Business, Home Economic and Technical. It also graphically shows the interval estimates of the population means. We can see that the interval of General Arts, Home Economics and Technical are to the right of Business at different points. This confirms what the test statistic states that there is enough evidence that the population means differ. The p-value of 0.00 and $F = 10.2$ means that there is enough evidence to conclude that the mean academic performance among the programmes of study are different. This is illustrated by the individual 95% confidence interval for the mean in Table 7. We can see from this section of the table that Business was the best performing programme followed by Technical, General Arts and Home Economics. The respective mean performances are aggregates 28.36, 30.16, 30.47 and 31.89 (more appropriately aggregates are 28, 30, 30 and 32).

Correlation Analysis

Table 8 shows the correlation between the study variables for the overall study period.

Table 8: Correlation Matrix of the Study Variables

Variable	aggregate	core	elective	Sex	religion	P_1	P_2
core	0.888						
elective	0.938	0.674					
sex	-0.046	-0.175	0.058				
religion	-0.162	-0.161	-0.139	-0.020			
P_1	0.045	0.007	0.066	0.037	-0.024		
P_2	-0.096	-0.120	-0.064	0.019	-0.029	-0.543	
P_3	-0.068	0.116	-0.196	-0.377	0.104	-0.336	-0.317

Table 8 is the correlation matrix of the study variables. The highest correlation of 0.938 is observed between elective subjects and aggregate. The next highest correlation of 0.888 is observed between core subjects and aggregate. This indicates that elective subject is more strongly related to overall academic performance than core subjects. Also correlation of 0.674 between core and elective subjects means that, students who do well in core subjects also perform well in elective subjects. Low correlations are seen between aggregate and religious affiliation, sex and programme (P_1, P_2, P_3) of study. These low

correlations imply that sex, religious affiliation and programme have virtually no relationship with academic performance.

Another interesting observation is the correlation -0.543 between General Arts (P_1) and Business (P_2). This means that students who do well in Business related subjects tend not to perform equally well in subjects that are related to General Arts subjects. We observe that there is high correlation between core and elective subjects.

Best Subset Regression

In choosing explanatory variables to academic performance, best regression subsets were formed from the set of five variables under study in addition to either core or elective subjects. Both core and elective subjects cannot be included in the same model because of high correlation that exists among them. The high correlation among them suggests that they are substitutes for each other in the same model. The best regression subset of performance in terms of core subjects and other variables are given in Table 9. The table shows all the eleven best regression subsets of performance in terms of core subjects and the other variables. These subsets were obtained in a manner described in Chapter Two.

Table 9: Best Subsets Regression: Aggregate versus Core, Sex, Religion and Programme

Vars	R-Sq	R-Sq (adj)	Mallow C-P	Stdev	CORE	SEX	RELIGION	P_1	P_2	P_3
1	75.6	75.5	4.6	2.7355	X					
1	4.3	4.1	1636.0	5.4127					X	
2	75.7	75.6	3.8	2.7312	X				X	
2	75.6	75.5	5.0	2.7341	X		X			
3	75.8	75.6	4.0	2.7291	X				X	X
3	75.7	75.6	4.1	2.7293	X		X		X	
4	75.8	75.6	4.3	2.7275	X		X		X	X
4	75.8	75.6	4.9	2.7289	X	X			X	X
5	75.9	75.7	5.0	2.7266	X	X	X		X	X
5	75.8	75.6	6.3	2.7299	X		X	X	X	X
6	75.9	75.6	7.0	2.7291	X	X	X	X	X	X

From Table 9, we observe that the best combinations involve only core subjects and programme, P_2. Thus the best regression model using core subjects is

$$\text{Aggregate} = 0.740 + 1.85\,\text{Core} - 0.413P_2 \qquad (4.1)$$

This is because it has a high coefficient of determination R^2 (75.7%), the smallest Mallows C-P (3.8) and a small standard deviation (2.7312).

Table 10 gives subsets of best regression using elective subjects and five other variables.

Table 10: Best Subsets Regression: aggregates versus elective, sex, religion and programme

Vars	R-Sq	R-Sq(adj)	Mallow C-P	Stdev	ELECTIVE	SEX	RELIGION	P_1	P_2	P_3
1	84.9	84.8	12.4	2.1518	X					
1	4.3	4.1	3035.0	5.4127					X	
2	85.1	85.1	4.2	2.1343	X					X
2	85.0	85.0	8.3	2.1421	X				X	
3	85.3	85.2	2.4	2.1289	X				X	X
3	85.2	85.1	5.2	2.1343	X			X		X
4	85.3	85.2	3.5	2.1292	X	X			X	X
4	85.3	85.2	3.7	2.1296	X		X		X	X
5	85.3	85.1	5.0	2.1301	X	X	X		X	X
5	85.3	85.1	5.5	2.1311	X	X		X	X	X
6	85.3	85.1	7.0	2.1320	X	X	X	X	X	X

In the table, P_1, P_2 and P_3 denotes General Arts, Business and Home Economics respectively. It shows all the possible best combinations of the predictor variables that can be used to build the regression equations. The extracted regression equation is therefore given as

$$\text{Aggregate} = 8.70 + 1.49\,\text{Elective} - 0.389P_2 + 0.466P_3 \qquad (4.2)$$

Associated with the model are standard deviation of 2.1289, coefficient of determination, R-Sq, of 85.3% and adjusted coefficient of determination, R-Sq(adj), of 85.2% and Mallow C-P value of (2.4).

Comparing the models in Equations (4.1) and (4.2), we observe that the model in (4.2) is preferred to that in (4.1) because model (4.2) has higher R^2, smaller Mallow C-P and smaller standard deviation. Further, we can see that the

regression model obtained from Table 9 has more unusual observations than unusual observations from Table 10. These unusual observations are shown in the Appendix (2 & 3). The regression analysis of the model in Equation (4.2) is given in Table 11.

Table 11: Regression Analysis: aggregate versus elective, P_2, P_3

Predictor	Coefficient	Standard Error Coefficient	T	P
Constant	8.7009	0.4113	21.15	0.000
Elective	1.4941	0.0272	54.97	0.000
P_2	-0.3851	0.1973	-1.95	0.049
P_3	0.4687	0.1668	2.81	0.005

It can be seen from Table 11 that, the *p*-values of the test of significance of the selected variables in the model are all negligible. The only exception is P_2. This suggests that student performance is significantly determined by the selected variables: the elective subjects offered, Business and Home Economics.

Interpretation of Regression Coefficients

Although each assessment measurement offers a different perspective, all agree in their assessments measurement of how well the model fits the data, because all are based on the sum of squares for error, SS_E. We now interpret and test the individual coefficients and use the model to predict and estimate.

It is recalled from Chapter Two that the general regression equation is

$$Y = \beta_o + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_k X_k + \varepsilon$$

With reference to Equation (4.2), $k = 3$, since only three variables are involved. The intercept, $\beta_o = 8.70$ is the average academic performance when no independent variables are included in the equation. In other words, the student scores aggregate 9 when he/she has not taken any elective subject, and his/her programme is ignored. This is actually impracticable, because zero is outside the range of values of the explanatory variables (as is the case here). The relationship between academic performance (aggregate) and elective subjects is described by $\beta_1 = 1.4941$. We interpret this number to mean that for each elective subject offered the aggregate increases by 1.4941 (assuming that programme does not change). The coefficient $\beta_2 = 0.3851$ specifies that for each additional Business subject studied the aggregate decreases (i.e. academic performance improves) by 0.3851 provided elective subjects and other programmes are held constant. Similarly, the relationship between performance (aggregate) and Home Economics is described by $\beta_3 = 0.4687$. This is interpreted to mean that for each Home Economics subject offered, the aggregate increases (i.e. academic performance decreases) by 0.4687 (assuming that elective subjects and other programmes are held fixed).

Also based on Equation (4.2), the coefficient of determination is obtained to be R^2 = 85.3% in Table 10. This means that 85.3% of the variations in academic performance of P-AMASS is explained by the three independent variables elective subjects, Business, and Home Economics. The remaining 14.7% could be attributed to other factors.

Further, since the sample size (558) is considerably larger than the number of the independent variables (3), the actual and the adjusted R^2 values have similar values indicating good model's fit. This is confirmed in Table 10 where R^2 = 85.3% and adjusted R^2 = 85.2%. It is also noted that R-sq (adj) is the coefficient of determination adjusted for degree of freedom which has been adjusted to take into account the sample size and the number of independent variables. This adjusted value (85.2%) is almost the same as the unadjusted value. Table 11 is the analysis of variance based on the extended model equation (4.2).

Table 12: Analysis of Variance

Source	DF	SS	MS	F	P
Regression	3	14531.9	4844.0	1068.77	0.000
Residual Error	555	2515.4	4.5		
Total	558	17047.4			

We see from the analysis of variance of that F = 1068.77 is extremely large. This leads to a very negligible p-value. These values imply that the extracted model can be used to predict the academic performance of students with a very high degree of precision.

Use of the Regression Equation

We have assessed the regression model, interpreted and tested the coefficients and realized that elective subjects, Business and Home Economics programmes are significant in determining student's academic performance. The

regression equation (4.2) is now used to predict results of the students based on these variables. The actual results, elective subjects, programme of study, predicted results and residuals are shown in Appendix 1. Using the regression equation, we can see that students' output can be overestimated or underestimated as is usually the case with prediction. Under estimated results are results in which the actual results are greater than the predicted results leading to positive(+) residual. On the other hand, with over-estimated results the actual results are less than the predicted results leading to negative (-) residual.

The regression equation in (4.2) was validated using the results of (558) students. Out of this number, 40 of them were considered as unusual observations. These are shown in Table 13.

Table 13: 40 unusual observations

Year	Cases	Actual Result	Predicted Result	Core Result	Elective Result	Programme	Residual
2000	17	23	28.1	10	13	A	-5.1
	7	31	36.0	13	18	H	-5.0
	51	29	25.6	18	11	H	3.4
	70	32	29.1	18	14	A	2.9
2001	8	18	23.6	8	10	T	-5.6
	30	30	27.0	18	12	H	5.0
	60	28	32.5	12	16	A	-4.5
	71	11	16.2	6	5	A	-5.2
	79	11	14.3	7	4	B	-3.3
	88	30	26.2	18	12	B	3.8
	91	25	29.2	11	14	B	-4.2
	119	22	29.2	10	12	B	-4.2
2002	20	29	24.7	18	11	A	4.3
	28	12	16.2	7	5	A	-4.2
	42	30	26.2	18	12	T	3.8
	48	25	31.5	10	15	T	-6.5
	62	26	20.6	18	8	T	5.4
	65	24	18.7	17	7	B	5.3
	73	28	24.1	18	10	A	3.9
	79	26	20.2	18	8	B	5.8
	81	24	20.6	16	8	A	3.4
	88	21	15.8	16	5	B	5.2
	103	30	26.6	18	12	A	3.4
	116	26	22.1	17	9	A	3.9
	131	31	27.7	18	13	A	3.3
2003	1	17	20.6	9	8	T	-3.6
	5	10	14.7	6	4	A	-4.7
	28	18	23.2	8	10	B	-4.7
	39	12	17.3	16	6	B	4.7
	56	18	21.8	9	9	A	-3.8
	64	32	28.8	18	14	B	3.2
	68	14	17.5	8	6	A	-3.5
	69	17	20.0	9	8	B	-3.0
	92	23	26.2	11	12	A	-3.2
	98	15	20.6	7	8	A	-5.6
	104	27	22.1	18	9	A	4.9
	130	28	33.0	12	16	A	-5.0
	160	20	24.7	9	11	B	-4.7
	171	28	32.5	12	16	A	-3.5
	172	24	20.6	16	8	A	3.4

Table 13 comprises two categories of results when we use the regression equation. These are results in which the regression equation overestimated the students results by aggregates (3) to (6) and the results in which the regression equation under estimated students by results by aggregate (3) to (6). Using Table 13 we can see that, the results of 21 students were over estimated(-) by the regression model. Out of this number, General Arts constitutes (11), Business (6), Home Economics (1) and Technical Subjects (3). The respective proportions are 52.4%, 28.5%, 4.8% and 14.3%. Similarly, the remaining results of 19 students were under-estimated (+) by the regression model. Also corresponding numbers of the various programmes are General Arts (9), Business (6), Home Economics (2) and Technical subjects (2). These constitute 47.4%, 39.6%, 10.5% and 10.5% respectively. Further, we observe that out of these 40 strange observations, General Arts constitutes the majority (exactly 50%). The percentages of the other programmes are Business (30%), Home Economics (7.5%), and Technical subjects (12.5%).

We observe from Table 13 that, generally students' whose results were underestimated by the regression model had better scores in elective subjects than the corresponding core subjects. However, students who had over estimated results had better marks in core subjects than corresponding elective subjects.

Table 14 shows the distribution of students with respect to two classes of results; under estimated (+) and over estimated (-) results.

Table 14 : Distribution of underestimated and overestimated results

Year	Sign of estimate	A	B	H	T	Totals
2000	overestimated (-)	23	22	6	10	61
	underestimated (+)	13	15	8	3	39
2001	overestimated (-)	13	15	0	5	33
	underestimated (+)	26	27	22	8	83
2002	overestimated (-)	9	7	3	5	24
	underestimated (+)	37	35	15	10	97
2003	overestimated (-)	37	23	4	6	70
	underestimated (+)	43	31	7	10	91
Overall	overestimated (-)	82	67	13	26	186
	underestimated (+)	119	108	42	31	300

We observe that, apart from the year 2000 in which the students' results are over estimated by the regression model, the results of the remaining years were favoured (underestimated) by the regression equation. The number of Home Economic students whose results were under estimated was three times greater than those over-estimated. No result of students offering this programme was over-estimated in 2001. Also we observe that, the overall under estimated results is far greater than overall over-estimated results in all the progammes except Technical programme where the numbers of students are almost equal. As many as three hundred (300) students' results were underestimated by the regression model as opposed to one hundred and eighty six (186) students whose results were over-estimated by the regression model.

The above analysis is displayed pictorially in Figure 18. Also we observe from Appendix 1 that in the year 2000, the actual results of five students are the same as predicted value. Most of the students' results were over estimated by the model. This is confirmed by quite a sizable number of the residuals falling below

the horizontal axis of Figure 18. Also we observe that results of two students were over estimated by aggregate five (5).

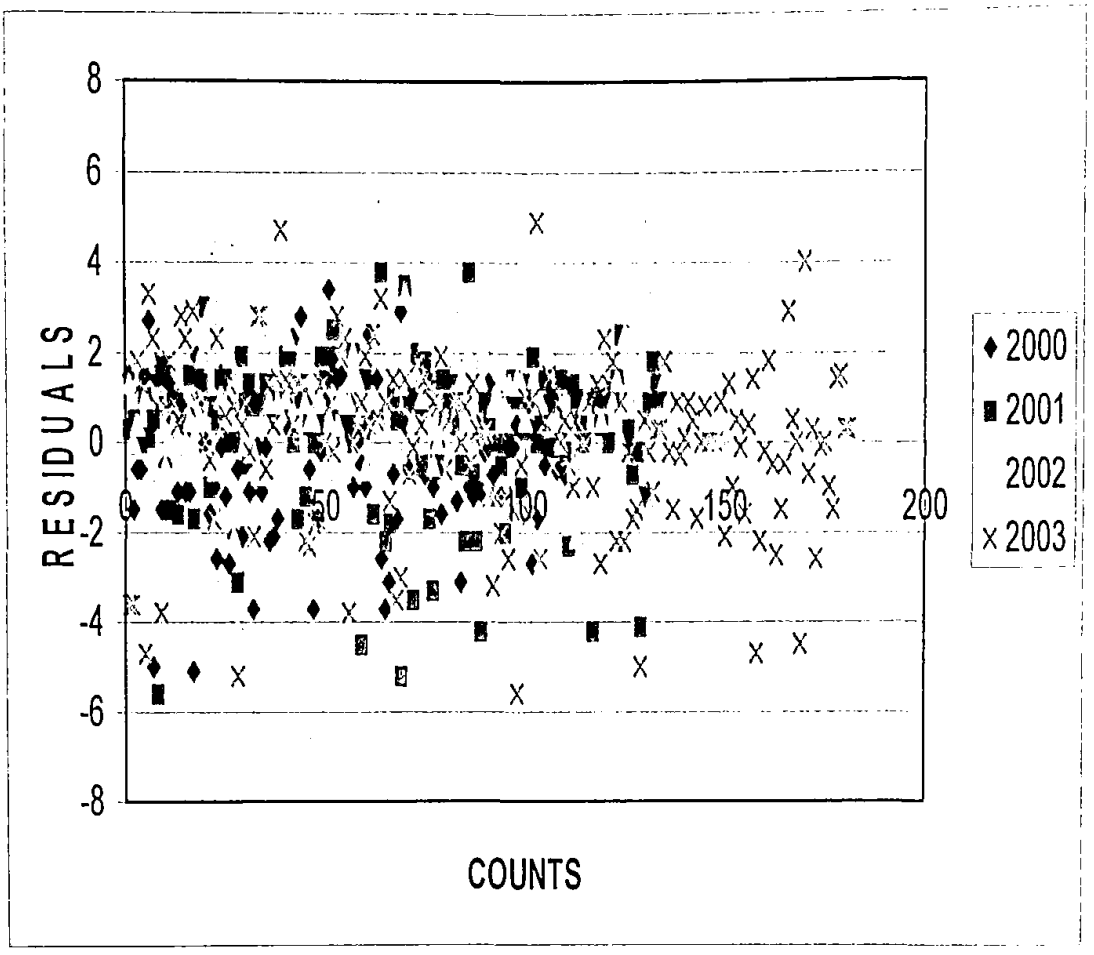

Figure 18: Distribution of residuals over the study period

However, in 2001 apart from fourteen (14) students whose actual and predicted results are the same as shown in Appendix 1, most of the students results were under estimated by the regression equation. This is shown by majority of the residuals above the horizontal line of Figure 18.

Similarly, we observe in Appendix 1 that in 2002 students whose actual and predicted results are the same are twelve. The model far underestimated students' output in 2002 than in 2000 and 2001. As many as four times the over

estimated results were under estimated. The highest over estimation and under estimation is by aggregate seven (7) and six (6) respectively. Finally in 2003, the number of under predicted results is slightly higher than the over predicted results. From Appendix 1 we observe that actual results of twelve (12) students are the same as predicted results. The highest over estimated and under estimated result is by aggregates six (6) and five (5) respectively. Using the results of Appendix 1, we observe that generally the model is 51.82%, 54.48%, 51.47% and 49.72% precise within 1.00 of actual results in 2000, 2001, 2002 and 2003 respectively.

Summary

Further analysis of the results revealed some pertinent observations. The best performing programme is Business followed by Technical subjects. The worse performing programme is Home Economics. Both core and elective subjects are major determinants of students' academic output at P-AMASS. However, elective subjects play a more significant role than core subjects. As a result, the output of students generally depends mainly on their elective subject. In addition, Business and Home Economics were found to be programmes that influence students' performance. Sex and religious affiliation were found not to be important variables that determine academic performance.

Using the regression model, performance in 2000 was highly under-estimated. That is students' aggregate were over-estimated by the developed model. Also apart from year 2000, results of the remaining years were under

estimated by the model. Performance in 2002 was highly over estimated. That is the students' aggregate were under estimated by the model. In sum, the developed regression model is favourable in predicting the academic output of students. It was observed that in 2001 the model was most precise in predicting the academic output of the students.

Further, we realize that the regression model explains 85.3% of the academic performance of the students. This is also seen in 33.5% of predicted values within 0.5 of the actual aggregates and 54.3% of predicted values within 1.00 of actual aggregates.

CHAPTER FIVE

SUMMARY, DISCUSSION AND CONCLUSIONS

This chapter deals with summary of findings, discussion, conclusions and recommendations. Also Policy makers of education, teachers, parents, students and the general public may find this work useful for total improvement of academic performance.

Summary

Preliminary analysis of the year 2000 results revealed that nineteen (19) students representing 17.2% failed all the three core subjects whilst seventeen students constituting 15.4% failed all the three elective subjects. The best aggregate in core subjects is aggregate ten. The best aggregate in elective subjects is aggregate six. The modal aggregate for both core and elective subjects is aggregate seventeen. In addition, males performed better than females. Students' academic output in elective subjects was better than performance in core subjects. The overall best aggregate (sixteen (16)) in 2000 was scored by a male Business student who was Non-Muslim. Non-Muslims performed worse than Muslims.

Further, 2001 data analysis showed that fifty-two (52) students representing 37.2% failed all the core subjects. The corresponding failure in elective subjects is eighteen (18) students which constitutes 16.1%. The best aggregate in core subjects is aggregate six whilst the best aggregate in elective subjects is aggregate four. A lot of the students scored aggregate seventeen in

subjects is aggregate four. A lot of the students scored aggregate seventeen in core and elective subjects. Students performed better in elective subjects than core subjects. Males performed better than females. The best performing programme is Business, whilst the worse performing programme is General Arts. The best students in this respect obtained aggregate eleven (see Appendix 1). These students were males who offered General Arts and Business and Non-Muslims.

In addition, we observed that in 2002, out of one hundred and thirty eight (138) students presented for the examination, seventy one (71) students constituting more than half of the total number failed all the core subjects. This failure represents 52.2% while twenty six (26) students representing 19.12% failed all the elective subjects. The modal aggregates for both core and elective subjects are aggregates eighteen and seventeen respectively. Approximately 14% of males scored between aggregate twelve and twenty four. The respective percentage of males and females between aggregate thirty one and thirty six are 22.79% and 30.15%. Again students' academic output in elective subjects is higher than output in core subjects. The worse performing programme is Home Economics. The best student obtained aggregate twelve. This student was a male offering General Arts who was Non-Muslim.

Also in 2003, thirty four (34) students accounting for 18.6% failed all the core subjects whilst twenty four (24) students representing 13.1% failed all the elective subjects. Students performed well in elective subjects than in core subjects. The modal aggregate for both core and elective subjects is aggregate

sixteen (16). The best student obtained aggregate nine. This was a male Business student who was Non-Muslim.

Furthermore, studies of the overall results revealed that students made no score in aggregate (3-6) in core subjects in 2000, 2002. However, the corresponding scores in 2001 and 2003 is between 0% and 5%. The peak of weak region of aggregate (15-18) is almost 90% which occurred in 2002. Students of elective subjects made scores in aggregate (3-6) (distributed between 0% and almost 5%). The percentage grows from 2000 to 2001 and declined slightly through 2002 and finally to 2003. The best total aggregates were aggregates (6-9). These were scored by Business students who were Non-Muslims. However, the worse aggregates were aggregate (30-36). Most of the students of this region were females. A lot of them comparatively studied General Arts. Majority were Non-Muslims.

Also we observed that, the worse performing year was 2002 and the best performing year was 2003. In addition, the best performing programme is Business followed by Technical subjects. The worse performing programme is Home Economics. Both core and elective subjects are major determinants of students' academic output at P-AMASS. Elective subjects significantly determine students' academic performance than core subjects. In general, academic output of students depends largely on the elective subjects.

Students whose scores in core and elective subjects vary considerably had highly over-predicted or under-predicted results. Apart from the year 2000, where most of the students' results were overestimated, academic outputs of the

Discussion

Some important results in both the preliminary and further analysis need some extent of discussions. These are:

1. Analysis of results from the individual years.
2. Analysis of results from the overall study period.
3. The variables, sex and religious affiliation on which the data were collected in relation to some literature.
4. One way analysis of variance among the programmes of study.
5. The high correlation that exists between total aggregate; core and elective subjects, and low correlation between the other variables.
6. The real variables that significantly determine students' academic output at P-AMASS.
7. How the predictors affect academic performance.
8. The reliability of the developed model in predicting the students' academic performance.

The data analyses of the various years as well as the overall study period indicate that students' performance in elective subjects is better than performance in core subjects. This is evidenced by a lot of the students scoring aggregate eighteen in core subjects while most scored aggregate seventeen in elective subjects. Further, the trend analysis revealed that students' performance in strong aggregate (3-5) in core subjects is between 0.5% and 2.00% whilst the corresponding scores in elective subjects of the same aggregate is 0.91% and

corresponding scores in elective subjects of the same aggregate is 0.91% and 3.74%. In addition, the peak of the weak aggregates (15-18) in core subjects is almost 90% while the respective score in elective subjects is 67%.

Another area of concern is the results of 2002. This year recorded the highest failure in the core subjects. Over fifty percent (52.2%) of the students failed the core subjects. Also, 19.12% failed the elective subjects.

The year 2003 was the best performing year because it was second highest in aggregate (3-5), highest in aggregate (7-10) and lowest in aggregate (15-18) in the elective subjects. This trend of dominance can be witnessed in core subjects except that in aggregate (15-18) it was the second highest. This can be seen on the graphs of the trend analysis.

It was observed from the preliminary analysis that most of the strong aggregate results were scored by Business students. It is therefore not a surprise that Business programme emerged as the best performing programme in the analysis variance among the various programme of study. The mean performance of Business students differs slightly from the mean performance of General Arts and Technical students but considerably from the mean performance of Home Economics students. Much was not seen of Technical programme in the preliminary analysis; however it is rated as the second best performing programme. Majority of the student's over the study period offered General Arts however the performance of these students was low. This is because higher numbers of these students scored between aggregate thirty and thirty six. Home Economics students performed worse because apart from three students who

scored between aggregate nineteen and twenty one, majority of them obtained weak aggregates (thirty to thirty six).

The small value of $R^2 = 5.16$ from the ANOVA of Chapter Four shows that programme of study explains 5.16% of the academic performance of P-AMASS students. This is in support of the regression model

$$\text{Aggregate} = 8.70 + 1.49\,\text{Elective} - 0.389P_2 + 0.466P_3$$

that most of the variation in academic performance is explained by elective subjects. Moreover, the high correlation between aggregate and elective subjects in Table 8 gives evidence that elective subjects significantly determines academic performance. It can also be inferred that students who perform well in elective subjects are likely to do well in the total aggregate.

The existence of high correlation between core and elective subjects also deserves some attention. It means that both variables cannot be used simultaneously to explain the academic output of the students since this may a times lead to wrong conclusion. Further, best regression subsets of Table 9 and Table 10 reveal the explanatory variables to the academic output as core subjects, elective subjects and programme of study. However, Elective subjects, Business programme (P_2) and Home Economic (P_3) are used to explain students academic output. Based on the output of Table 9 and Table 10, we realize that core or elective subjects, programme (P_2) play a major role in students' academic performance. This buttresses the fact that most of the strong aggregates were scored by Business students and also the best students in the exploratory analysis were found to offer Business programme except the year 2002.

Another area of note worthy is the sex and religious affiliation on which the data were collected. These variables infinitesimally explain the academic performance of the students. This is evidenced in the Table 9 and Table 10. Also it was revealed that for each elective subject offered, academic performance decreased by 1.49409 assuming other factors are held constant. In addition for each Business programme offered, academic performance improves by 0.3851 provided other variables are held constant. And for each Home Economics programme offered, academic performance decreased by 0.4687 provided other variables are held constant. Also, it was revealed that 33.5% of predicted values within 0.5 actual aggregate and 54.3% of predicted values within 1.00% actual aggregate.

Sex was not found to be a variable that helps to determine students' academic performance. This is in line with literature. In the literature, it was observed from the work of Tayman and Pressey that findings on the influence of sex difference in academic performance or intelligence were conflicting and sometimes inconsistent and inconclusive. In this work, however, the issue of importance of sex is made conclusive; that is, it does not help in determining students performance.

In Chapter Four, the regression equation was obtained as

$$\text{Aggregate} = 8.70 + 1.49\ \text{Elective} - 0.389P_2\ 0.466P_3.$$

The equation makes use of three variables; Elective subject, Business and Home Economics. It means that in P-AMASS, these variables could be used to determine students' academic performance. In particular, Elective subject is most

dominant variable that influences academic performance. That is if a student perform well in his/her Elective subject he/she is likely to perform well in the examination. This point is supported by the negligible p- value (from Table 11).

Also the high correlation between core and elective subjects suggest that if the person does well in Elective subjects he/she is likely to do well in the core subjects. In addition, despite the fact that religious affiliation shows some difference with respect to academic performance, it was not included in the model. This is in line with same finding on sex in determining academic performance.

Conclusions and Recommendations

The research identifies variables that explain academic performance of Potsin T. I. Ahmadiyya Secondary School using multiple linear regression. Results of West Africa Examinations Council, (WAEC) for the period 2000 to 2003 constitute the data used for the study. The main objective of the study is to identify variables that determine the academic performance of the school over the study period. The regression analyses identify Elective subjects as the main explanatory variable that determines academic performance. In addition, Business and Home Economics programmes were also found to determine academic performance. However, sex and religious affiliation do not determine academic performance. Also the developed regression model was found to explain 85.3% of variations of students' academic performance. This is seen in 54.3% reliable of predicted values within 1.00 actual aggregates.

A related research (Aleemiyau, 1998) attempted to associate the final results at SSSCE with BECE results. The results showed that there is association between the two. Hence, inclusion of the variable "entry results" might have enhanced the precision of the developed model in this study. It is therefore recommended that, in future studies this variable must be factored into the research.

In addition, the Muslim students were identified in the data collection based on their names. This is because, generally Muslim names are easy to be identified or distinguished from other names or Christian names. It is therefore suggested that in a related further research student religious affiliations are identified by contacting them personally.

Further, the research was conducted in only one school. It is therefore suggested that in further studies, data of similar structure from different schools be used and compared with this work. This will help make a generalization in terms of the predictors of the academic performance, reliability and precision of the developed model.

Last but not the least, factors affecting academic performance are far from what has been discussed. Other non-cognitive factors such as finances, housing and transportation, student attitude, other curricular activities, teacher empowerment, parent responsibility and academic environment must be researched into.

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APPENDIX 1
2000 SSSCE Results

Case	Agg (Y)	Core (C)	Elect (E)	Sex (S)	Relig (R)	Pred $\hat{Y}$	Resid (Y-$\hat{Y}$)	Programme P_1	P_2	P_3
1	34	18	16	1	1	32.5	1.5	1	0	0
2	31	15	16	1	0	32.5	-1.5	1	0	0
3	33	16	17	0	0	33.6	-0.6	0	1	0
4	33	16	17	1	1	33.6	-0.6	0	1	0
5	30	17	13	0	1	28.5	1.5	0	0	1
6	26	14	12	0	0	23.3	2.7	0	1	0
7	31	13	18	1	1	36.0	-5.0	0	0	1
8	30	17	13	0	1	28.6	1.4	0	0	1
9	31	15	16	0	1	32.5	-1.5	1	0	0
10	35	17	18	1	0	35.5	-0.5	0	0	0
11	32	17	15	1	1	30.7	1.3	0	1	0
12	36	18	18	1	1	35.5	0.5	0	0	0
13	30	15	15	1	0	31.1	-1.1	1	0	0
14	36	18	18	1	0	35.1	0.9	0	1	0
15	27	14	13	0	1	28.1	-1.1	1	0	0
16	18	11	7	1	1	19.1	-1.1	1	0	0
17	23	10	13	0	0	28.1	-5.1	1	0	0
18	33	18	15	0	1	31.1	1.9	1	0	0
19	28	16	12	0	0	27.0	1.0	0	0	1
20	34	17	17	0	1	34.0	0.0	1	0	0
21	25	13	12	1	1	26.6	-1.6	0	0	0
22	26	14	12	0	0	27.0	-1.0	0	0	1
23	31	14	17	0	0	33.6	-2.6	0	1	0
24	35	17	18	1	0	35.1	-0.1	0	0	0
25	25	13	12	1	0	26.2	-1.2	1	0	0
26	28	13	15	1	0	30.7	-2.7	0	0	0
27	30	14	16	1	0	32.1	-2.1	0	1	0
28	25	14	11	0	1	25.6	-0.6	0	0	1
29	20	11	9	1	0	22.1	-2.1	1	0	0
30	32	16	16	0	0	32.5	-0.5	1	0	0
31	31	15	16	0	0	32.1	-1.1	0	1	0
32	21	10	11	0	0	24.7	-3.7	1	0	0
33	26	14	12	0	1	26.1	-0.1	1	0	0
34	34	16	18	1	1	35.1	-1.1	1	0	0
35	32	16	16	1	0	32.1	-0.1	0	1	0
36	21	11	10	1	0	23.2	-2.2	0	1	0
37	33	15	18	0	1	35.1	-2.1	0	1	0
38	29	14	15	1	0	30.7	-1.7	0	1	0
39	36	18	18	0	0	35.1	0.9	1	0	0
40	36	18	18	0	0	35.1	0.9	1	0	0
41	28	15	13	0	1	27.7	0.3	0	1	0

Appendix 1 continued

Case	Agg (Y)	Core (C)	Elect (E)	Sex (S)	Reiig (R)	Pred $\hat{Y}$	Resid (Y- $\hat{Y}$)	Programme P_1	P_2	P_3
42	33	18	15	1	0	30.7	2.3	1	0	0
43	29	14	15	1	1	30.7	-1.7	0	0	0
44	26	16	10	1	0	23.2	2.8	0	1	0
45	36	18	18	1	0	35.1	0.9	1	0	0
46	33	16	17	0	0	33.6	-0.6	0	1	0
47	24	11	13	1	1	27.7	-3.7	0	1	0
48	23	12	11	1	0	24.7	-1.7	0	1	0
49	32	16	16	1	0	32.2	-0.2	0	0	0
50	36	18	18	0	0	35.1	0.9	0	1	0
51	29	18	11	0	0	25.6	3.4	0	0	1
52	28	16	12	0	0	26.2	1.8	0	1	0
53	24	15	9	0	0	22.6	1.4	0	0	1
54	30	17	13	0	0	28.5	1.5	0	0	1
55	36	18	18	0	1	36.0	0.0	0	0	1
56	36	18	18	0	0	35.1	0.9	0	1	0
57	35	17	18	0	1	36.0	-1.0	0	0	1
58	33	17	16	1	0	33.0	0.0	1	0	0
59	31	16	15	1	0	31.5	-0.5	1	0	0
60	26	14	12	1	0	27.0	-1.0	1	0	0
61	28	17	17	0	0	25.6	2.4	0	0	1
62	35	18	17	0	0	34.5	0.5	1	0	0
63	35	18	17	0	0	33.6	1.4	0	1	0
64	31	14	17	1	0	33.6	-2.6	1	0	0
65	21	10	11	1	1	24.7	-3.7	0	0	0
66	-	-	-	-	-	-	-	-	-	-
67	29	13	16	0	0	32.1	-3.1	1	0	0
68	27	14	13	0	0	27.7	-0.7	1	0	0
69	26	13	13	1	0	27.7	-1.7	0	1	0
70	32	18	14	0	0	29.1	2.9	1	0	0
71	34	17	17	0	1	33.6	0.4	0	1	0
72	33	16	17	1	0	33.6	-0.6	0	1	0
73	30	16	14	1	0	29.2	0.8	0	1	0
74	36	18	18	1	0	35.1	0.9	0	0	0
75	21	13	8	0	0	20.2	0.8	0	1	0
76	24	13	11	1	1	24.7	-0.7	0	1	0
77	24	15	9	0	1	22.6	1.4	0	0	1
78	30	15	15	1	0	31.0	-1.0	0	0	0
79	20	12	8	1	1	20.6	-0.6	1	0	0
80	25	13	12	0	0	26.6	-1.6	1	0	0
81	35	18	17	0	0	33.6	1.4	0	1	0
82	35	18	17	1	0	33.6	1.4	0	0	0
83	34	17	17	0	0	33.6	0.4	1	0	0

Appendix 1 continued

Case	Agg (Y)	Core (C)	Elect (E)	Sex (S)	Relig (R)	Pred $\hat{Y}$	Resid (Y-$\hat{Y}$)	Programe P_1	P_2	P_3
84	16	10	6	1	0	17.3	-1.3	0	1	0
85	21	11	10	0	0	24.1	-3.1	0	0	1
86	34	17	17	0	0	35.4	-0.5	1	0	0
87	35	17	18	1	0	36.0	-1.0	1	0	0
88	31	15	16	1	1	32.2	-1.2	0	1	0
89	34	17	17	1	0	33.6	0.4	1	0	0
90	34	16	18	1	0	35.1	-1.1	1	0	0
91	29	15	14	0	1	29.2	-0.2	1	0	0
92	32	17	15	0	0	30.7	1.3	1	0	0
93	18	11	7	0	1	18.7	-0.7	0	1	0
94	34	17	17	1	0	34.0	0.0	1	0	0
95	31	15	16	1	0	32.2	-1.2	0	1	0
96	31	17	14	0	0	30.0	1.0	0	0	1
97	29	15	14	1	0	29.1	-0.1	0	1	0
98	29	15	14	0	0	29.1	-0.1	0	1	0
99	34	17	17	0	0	33.6	0.4	0	1	0
100	28	15	13	1	0	27.7	0.3	1	0	0
101	34	17	17	1	0	33.6	0.4	1	0	0
102	33	17	16	0	0	32.1	0.9	0	1	0
103	28	13	15	1	0	30.7	-2.7	0	0	0
104	26	13	13	1	1	27.7	-1.7	1	0	0
105	33	17	16	0	0	33.0	0.0	0	0	1
106	34	17	17	1	0	34.5	-0.5	0	0	0
107	34	18	16	0	0	33.0	1.0	0	0	1
108	34	18	16	0	0	33.0	1.0	1	0	0
109	29	15	14	1	1	29.6	-0.6	1	0	0
110	34	17	17	1	0	33.6	0.4	0	1	0
111	-	-	-	-	-	-	-	-	-	-
112	27	14	13	0	1	27.7	-0.7	0	1	0

Appendix 1
2001 SSSCE RESULTS

Case	Agg (Y)	Core (C)	Elect (E)	Sex (S)	Relig (R)	Pred $\hat{Y}$	Resid Y- $\hat{Y}$	Programme P_1	P_2	P_3
1	22	13	9	1	1	21.7	0.3	0	1	0
2	32	17	15	0	0	31.5	0.5	0	1	1
3	33	17	16	1	0	33.0	0.0	1	0	0
4	36	18	18	1	0	36.0	0.0	0	0	0
5	34	18	16	1	0	33.0	1.0	1	0	0
6	36	18	18	1	0	35.9	0.1	0	1	0
7	36	18	18	1	0	35.5	0.5	1	0	0

Appendix 1 continued

Case	Agg (Y)	Core (C)	Elect (E)	Sex (S)	Relig (R)	Pred $\hat{Y}$	Resid (Y- $\hat{Y}$)	Programme P_1	P_2	P_3
8	18	8	10	1	0	23.6	-5.6	0	0	0
9	29	16	13	1	1	27.3	1.7	0	1	0
10	36	18	18	1	0	34.3	1.7	1	0	0
11	23	12	11	1	0	24.5	-1.5	0	1	0
12	35	18	17	1	0	34.0	1.0	1	0	0
13	28	14	14	0	0	29.6	-1.6	1	0	0
14	31	16	15	0	0	30.7	0.3	0	1	0
15	34	17	17	1	0	33.6	0.4	0	1	0
16	30	17	13	0	0	28.5	1.5	0	0	1
17	23	12	11	1	1	24.7	-1.7	0	1	0
18	33	18	15	0	1	31.5	1.5	0	0	1
19	26	15	11	0	1	24.7	1.3	0	1	0
20	30	18	12	0	0	27.0	3.0	0	0	1
21	29	15	14	1	0	30.0	-1.0	0	0	0
22	33	17	16	0	0	32.2	0.8	0	1	0
23	35	18	17	0	0	34.5	0.5	0	0	1
24	35	18	17	0	0	33.6	1.4	0	1	0
25	33	18	15	0	0	31.5	1.5	0	0	1
26	33	17	16	0	1	33.0	0.0	1	0	0
27	33	17	16	0	0	33.0	0.0	0	0	1
28	19	10	9	0	1	22.1	-3.1	1	0	0
29	33	18	15	1	0	31.1	1.9	1	0	0
30	36	18	18	1	0	35.1	0.9	0	1	0
31	32	17	15	1	0	30.7	1.3	0	1	0
32	33	17	16	1	0	32.2	0.8	1	0	0
33	36	18	18	1	0	35.1	0.9	0	0	0
34	36	18	18	1	0	35.1	0.9	1	0	0
35	29	16	13	0	0	27.7	1.3	1	0	0
36	21	13	8	1	0	30.2	0.8	0	1	0
37	35	18	17	1	0	34.0	1.0	0	0	0
38	36	18	18	0	0	35.1	0.9	0	1	0
39	36	18	18	1	0	35.1	0.9	1	0	0
40	34	18	16	0	0	32.1	1.9	0	1	0
41	33	18	15	0	0	31.1	1.9	0	0	1
42	36	18	18	1	0	36.0	0.0	1	0	0
43	23	12	11	1	1	24.7	-1.7	0	1	0
44	31	17	14	0	0	30.0	1.0	0	0	1
45	-	-	-	-	-	-	-	-	-	-
46	22	12	10	1	0	23.2	-1.2	0	1	0
47	34	17	17	1	0	33.6	0.4	0	0	0
48	36	18	18	0	0	36.0	0.0	0	1	1

Appendix 1 continued

Case	Agg (Y)	Core (C)	Elect (E)	Sex (S)	Relig (R)	Pred $\hat{Y}$	Resid (Y- $\hat{Y}$)	Programme P_1	P_2	P_3
49	34	17	17	0	1	33.6	0.4	0	0	0
50	24	15	9	0	1	22.1	1.9	1	0	0
51	28	16	12	0	0	26.6	1.4	1	0	0
52	33	18	15	1	0	31.1	1.9	0	0	0
53	31	18	13	0	0	28.5	2.5	0	0	1
54	35	18	17	0	0	34.5	0.5	0	0	1
55	36	18	18	1	0	36.0	0.0	1	0	0
56	30	16	14	1	0	30.0	0.0	0	0	0
57	34	17	17	0	0	33.6	0.4	0	1	0
58	32	18	14	0	0	30.0	2.0	0	0	1
59	16	11	5	1	0	15.8	0.2	0	1	0
60	28	12	16	0	1	32.5	-4.5	1	0	0
61	35	18	17	0	0	33.6	1.4	0	1	0
62	31	16	15	1	0	30.7	0.3	0	0	0
63	32	15	17	0	0	33.6	-1.6	0	1	0
64	34	17	17	1	0	33.6	0.4	1	0	0
65	-	-	-	-	-	-	-	-	-	-
66	24	16	8	1	1	20.2	3.8	0	1	0
67	18	10	8	1	0	20.2	-2.2	0	0	0
68	14	9	5	1	0	15.8	-1.8	0	1	0
69	35	18	17	0	1	34.0	1.0	1	0	0
70	36	18	18	1	0	35.5	0.5	0	0	0
71	11	6	5	1	0	16.2	-5.2	1	1	0
72	36	17	16	1	0	32.5	3.5	1	1	0
73	35	17	17	1	0	34.0	1.0	0	0	0
74	32	14	18	0	0	35.5	-3.5	0	0	0
75	32	18	14	0	0	30.0	2.0	0	0	1
76	25	14	11	0	0	25.5	-0.5	1	0	0
77	28	16	12	0	0	26.2	1.8	0	1	0
78	20	11	9	1	0	21.7	-1.7	0	1	0
79	11	7	4	1	0	14.3	-3.3	0	1	0
80	26	14	12	0	1	26.2	-0.2	0	1	0
81	31	17	14	0	1	29.6	1.4	1	0	0
82	36	18	18	0	0	35.5	0.5	1	0	0
83	29	16	13	0	0	28.1	0.9	1	0	0
84	36	18	18	0	0	35.5	0.5	1	0	0
85	34	18	16	0	1	32.5	1.5	1	0	0
86	32	16	16	1	0	32.5	-0.5	0	0	0
87	24	12	12	0	0	26.2	-2.2	0	1	0
88	13	18	12	0	0	26.2	3.8	0	1	0
89	18	11	7	1	0	18.7	-0.7	0	1	0
90	24	12	12	1	1	26.2	-2.2	0	1	0

Appendix 1 continued

Case	Agg (Y)	Core (C)	Elect (E)	Sex (S)	Relig (R)	Pred $\hat{Y}$	Resid (Y- $\hat{Y}$)	Programme P_1	P_2	P_3
91	25	11	14	1	0	29.2	-4.2	0	1	1
92	33	17	16	1	0	32.1	0.9	1	0	0
93	35	18	17	0	1	34.5	0.5	0	0	1
94	30	16	14	1	1	30.0	0.0	1	0	0
95	27	15	12	0	0	27.0	0.0	1	0	0
96	34	17	17	1	0	34.5	-0.5	1	0	0
97	28	14	14	1	0	30.0	-2.0	1	0	0
98	30	16	14	1	0	30.0	0.0	0	0	0
99	33	18	15	1	0	31.5	1.5	0	0	0
100	33	18	15	0	1	32.0	1.0	0	0	1
101	33	16	17	0	0	34.0	-1.0	1	0	0
102	20	13	7	1	0	18.7	1.3	0	1	0
103	35	18	17	0	0	34.7	0.3	0	0	1
104	26	16	10	0	0	24.1	1.9	0	0	1
105	36	18	18	1	0	36.0	0.0	1	0	0
106	35	18	17	0	0	34.5	0.5	0	0	1
107	35	18	17	0	0	33.6	1.4	0	1	0
108	35	18	18	1	0	35.1	-0.1	1	0	0
109	36	18	18	1	0	35.1	0.9	1	0	0
110	35	17	18	1	0	35.1	-0.1	1	0	0
111	35	18	17	1	0	33.6	1.4	1	0	0
112	26	14	12	0	0	26.2	-0.2	1	0	0
113	15	9	6	0	0	17.3	-2.3	0	1	0
114	26	15	11	1	0	24.7	1.3	0	1	0
115	34	18	16	0	0	33.0	1.0	0	0	1
116	32	17	15	1	0	31.5	0.5	1	0	0
117	33	17	16	0	1	33.0	0.0	1	0	0
118	25	18	10	1	1	24.1	0.9	0	0	1
119	22	10	12	0	0	26.2	-4.2	0	1	0
120	34	18	16	1	0	33.0	1.0	0	0	1
121	26	15	11	0	1	25.6	0.4	1	0	0
122	35	18	17	1	0	34.0	1.0	1	0	0
123	34	17	17	1	1	34.0	0.0	1	0	0
124	29	16	13	1	0	28.1	0.9	0	0	0
125	28	16	12	1	0	26.6	1.4	1	0	0
126	28	17	11	0	0	25.6	2.4	0	0	1
127	36	18	18	1	0	36.0	0.0	0	0	0
128	31	16	15	0	0	30.7	0.3	0	1	0
129	27	14	13	0	1	27.7	-0.7	0	1	0
130	26	14	12	1	0	26.2	-0.2	1	0	0
131	28	12	16	1	0	32.1	-4.1	0	0	0
132	-	-	-	-	-	-	-	-	-	-

Appendix 1 continued

Case	Agg (Y)	Core (C)	Elect (E)	Sex (S)	Relig (R)	Pred $\hat{Y}$	Resid (Y- $\hat{Y}$)	Programme P_1	P_2	P_3
133	22	12	10	0	0	23.2	-1.2	1	0	0
134	36	18	18	0	0	35.1	0.9	1	0	0
135	25	11	10	1	1	23.2	1.8	0	1	0
136	29	16	18	1	0	27.7	1.3	0	1	0
137	34	18	16	0	0	33.0	1.0	0	0	1

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Case	Agg (Y)	Core (C)	Elect (E)	Sex (S)	Relig (R)	Pred $\hat{Y}$	Resid (Y- $\hat{Y}$)	Programme P_1	P_2	P_3
1	32	17	15	1	1	30.7	1.3	0	1	0
2	33	17	16	0	1	33.0	0.0	0	0	1
3	34	17	17	0	0	33.6	0.4	0	1	0
4	31	17	14	0	1	29.1	1.9	1	0	0
5	34	18	16	0	0	33.0	1.0	0	0	1
6	32	18	14	0	0	30.0	2.0	0	0	1
7	26	14	12	1	1	26.6	-0.6	1	0	0
8	34	18	16	0	0	33.0	1.0	0	0	1
9	30	18	12	1	1	27.0	3.0	1	0	0
10	31	16	15	1	1	31.5	-0.5	0	0	1
11	36	18	18	0	1	36.0	0.0	0	0	1
12	30	16	14	1	0	29.6	0.4	0	0	0
13	36	18	18	1	0	36.0	0.0	0	0	0
14	33	17	16	0	0	33.0	0.0	1	0	0
15	36	18	18	0	0	36.0	0.0	1	0	0
16	35	18	17	1	1	34.5	0.5	0	0	0
17	35	17	18	0	0	35.1	-0.1	0	1	0
18	34	17	17	1	0	33.6	0.4	1	0	0
19	34	18	16	0	0	32.1	1.9	1	0	0
20	29	18	11	1	0	24.7	4.3	1	0	0
21	22	15	7	1	1	19.1	2.9	1	0	0
22	23	13	10	0	1	23.6	-0.6	1	0	0
23	24	16	8	1	1	20.6	3.4	1	0	0
24	35	18	17	1	0	34.0	1.0	1	0	0
25	36	18	18	0	0	35.1	0.9	0	1	0
26	33	18	15	1	0	31.1	1.9	0	0	0
27	26	13	13	0	1	28.1	-2.1	1	0	0
28	12	7	5	1	0	16.2	-4.2	1	0	0
29	35	18	17	0	1	34.5	0.5	0	0	1
30	27	15	12	1	0	27.0	0.0	0	0	0
31	32	16	16	1	1	32.2	-0.2	0	1	0

Appendix 1 continued

Case	Agg (Y)	Core (C)	Elect (E)	Sex (S)	Relig (R)	Pred $\hat{Y}$	Resid (Y- $\hat{Y}$)	Programme P1	P2	P3
32	26	14	12	1	0	26.2	-0.2	0	0	0
33	30	15	15	1	0	30.7	-0.7	1	0	0
34	33	18	15	1	0	30.7	2.3	0	1	0
35	34	17	17	0	0	33.6	0.4	0	1	0
36	36	18	18	0	0	35.1	0.9	0	1	0
37	31	17	14	0	1	29.2	1.8	1	0	0
38	36	18	18	0	0	35.1	0.9	0	1	0
39	35	18	17	1	0	33.6	1.4	1	0	0
40	35	18	17	0	0	34.0	1.0	1	0	0
41	30	17	13	1	0	27.7	2.3	0	1	0
42	30	18	12	1	0	26.2	3.8	0	0	0
43	35	18	17	0	0	33.6	1.4	0	1	0
44	31	17	14	1	0	29.2	1.8	0	1	0
45	36	18	18	1	0	35.1	0.9	0	0	0
46	35	18	17	0	0	34.5	0.5	0	0	1
47	35	18	17	1	0	34.5	0.5	0	0	0
48	25	10	15	1	0	31.5	-6.5	0	0	0
49	36	18	18	1	0	35.1	0.9	0	0	0
50	22	12	10	1	0	23.2	-1.2	0	1	0
51	35	18	17	0	0	34.5	0.5	0	0	1
52	33	17	16	1	0	33.0	0.0	1	0	0
53	34	17	17	1	0	33.6	0.4	0	1	0
54	36	18	18	0	1	36.0	0.0	0	0	1
55	36	18	18	1	0	35.1	0.9	0	1	0
56	31	17	14	0	0	29.2	1.8	0	1	0
57	29	17	12	0	0	27.0	2.0	0	0	1
58	19	13	6	0	1	17.6	1.4	1	0	0
59	24	15	9	0	0	22.1	1.9	0	1	0
60	26	14	12	1	0	26.6	-0.6	0	0	0
61	31	18	13	0	0	28.1	2.9	1	0	0
62	26	18	8	1	0	20.6	5.4	0	0	0
63	28	15	13	1	0	27.7	0.3	0	1	0
64	28	15	13	1	0	27.7	0.3	0	0	0
65	24	17	7	1	0	18.7	5.3	0	1	0
66	33	18	15	1	0	31.1	1.9	1	0	0
67	32	16	16	1	0	32.2	-0.2	0	1	0
68	32	16	16	1	0	32.2	-0.2	1	0	0
69	29	16	13	1	0	27.7	1.3	0	1	0
70	31	18	13	0	0	27.7	3.3	1	0	0
71	33	18	15	0	0	31.5	1.5	0	0	1
72	32	17	15	1	1	31.5	0.5	0	0	0

Appendix 1 continued

Case	Agg (Y)	Core (C)	Elect (E)	Sex (S)	Relig (R)	Pred $\hat{Y}$	Resid (Y- $\hat{Y}$)	Programme P_1	P_2	P_3
73	28	18	10	0	0	24.1	3.9	1	0	0
74	31	17	14	0	1	30.0	1.0	0	0	1
75	24	15	9	1	0	21.7	2.3	0	1	0
76	34	17	17	0	0	33.6	0.4	0	1	0
77	34	17	17	0	1	34.5	-0.5	0	0	1
78	36	18	18	1	0	36.0	0.0	1	0	0
79	26	18	8	1	0	20.2	5.8	0	1	0
80	35	18	17	0	0	34.5	0.5	0	0	1
81	24	16	8	1	0	20.6	3.4	1	0	0
82	29	17	12	1	0	26.2	2.8	0	1	0
83	31	17	14	1	1	29.2	1.8	1	0	0
84	35	18	17	1	0	33.6	1.4	0	1	0
85	35	18	17	1	1	34.0	1.0	0	0	0
86	33	18	15	0	0	31.1	1.9	1	0	0
87	35	18	17	0	0	34.5	0.5	0	0	1
88	21	16	5	1	0	15.8	5.2	0	1	0
89	35	18	17	0	0	33.6	1.4	0	1	0
90	34	18	16	0	0	32.1	1.9	0	1	0
91	33	18	15	0	1	30.7	2.3	0	1	0
92	30	16	14	1	0	29.2	0.8	0	1	0
93	36	18	18	0	0	35.1	0.9	0	1	0
94	36	18	18	0	0	35.1	0.9	1	0	0
95	33	17	16	0	1	32.2	0.8	0	1	0
96	29	16	13	1	1	27.7	1.3	1	0	0
97	34	18	16	0	1	32.5	1.5	1	0	0
98	35	18	17	0	0	33.6	1.4	1	0	0
99	26	15	11	0	1	24.7	1.3	1	0	0
100	35	18	17	0	0	34.5	0.5	0	0	1
101	31	18	13	1	0	28.1	2.9	1	0	0
102	35	18	17	0	0	33.6	1.4	0	1	0
103	30	18	12	1	0	26.6	3.4	1	0	0
104	36	18	18	1	0	35.1	0.9	0	1	0
105	19	10	9	0	0	21.7	-2.7	0	1	0
106	32	18	14	0	0	30.0	2.0	0	0	1
107	26	14	12	0	0	27.0	-1.0	1	0	0
108	36	18	18	0	0	35.5	0.5	1	0	0
109	36	18	18	0	0	36.0	0.0	0	0	1
110	36	18	18	1	0	35.5	0.5	1	0	0
111	36	18	18	0	0	35.5	0.5	1	0	0
112	29	15	14	0	0	29.6	-0.6	1	0	0
113	29	14	15	1	0	31.1	-2.1	0	0	0
114	32	18	14	0	0	29.6	2.4	1	0	0

Appendix 1 continued

Case	Agg (Y)	Core (C)	Elect (E)	Sex (S)	Relig (R)	Pred $\hat{Y}$	Resid (Y- $\hat{Y}$)	Programme P_1	P_2	P_3
115	36	18	18	0	0	35.1	0.9	0	1	0
116	26	17	9	0	0	22.1	3.9	1	0	1
117	32	16	16	1	0	32.2	-0.2	1	0	0
118	24	15	9	1	0	22.1	1.9	1	0	0
119	35	18	17	0	0	34.5	0.5	0	0	1
120	32	16	16	0	0	33.0	-1.0	1	0	0
121	24	16	8	0	0	20.6	3.4	1	0	0
122	36	18	18	0	1	35.1	0.9	1	0	0
123	22	14	8	0	1	20.6	1.4	1	0	0
124	36	18	18	0	1	36.0	0.0	0	0	1
125	26	16	10	0	1	23.6	2.4	1	0	1
126	-	-	-	-	-	-	-	-	-	-
127	36	18	18	0	0	35.1	0.9	0	1	0
128	24	15	9	1	0	22.1	1.9	1	0	0
129	28	14	14	1	0	29.2	-1.2	0	1	0
130	34	17	14	1	0	29.2	4.8	0	1	0
131	31	18	13	0	0	27.7	3.3	1	0	0
132	27	14	13	0	0	28.5	-1.5	0	0	1
133	-	-	-	-	-	-	-	-	-	-
134	35	18	17	0	0	34.5	0.5	1	0	0
135	31	18	13	0	0	28.5	2.5	0	0	1
136	36	18	18	0	1	36.0	0.0	0	0	1
137	35	18	17	1	0	33.6	1.4	0	1	0
138	36	18	18	1	0	35.1	0.9	0	1	0

2003 SSSCE RESULTS

Case	Agg (Y)	Core (C)	Elect (E)	Sex (S)	Relig (R)	Pred $\hat{Y}$	Resid (Y- $\hat{Y}$)	Programme P_1	P_2	P_3
1	17	9	8	1	1	20.6	-3.6	0	0	0
2	23	11	12	1	0	26.6	-3.6	1	0	0
3	28	16	12	0	0	26.2	1.8	0	1	0
4	19	6	13	1	0	27.7	1.3	0	1	0
5	10	6	4	1	0	14.7	-4.7	1	0	0
6	28	17	11	1	1	24.7	3.3	0	1	0
7	27	16	11	1	1	24.7	2.3	0	1	0
8	30	16	14	1	0	29.2	0.8	1	0	0
9	9	6	3	1	0	12.8	3.8	0	1	0
10	33	17	16	0	0	32.2	0.8	0	1	0
11	31	17	14	0	1	29.2	1.8	1	0	0

Appendix 1 continued

Case	Agg (Y)	Core (C)	Elect (E)	Sex (S)	Relig (R)	Pred $\hat{Y}$	Resid (Y- $\hat{Y}$)	Programme P_1	P_2	P_3
12	36	18	18	1	0	35.1	0.9	1	0	0
13	34	17	17	1	1	33.6	0.4	1	0	0
14	32	18	14	1	1	29.2	2.8	1	0	0
15	24	15	9	0	1	21.7	2.3	0	1	0
16	31	16	15	1	0	30.2	0.8	0	1	0
17	31	18	13	0	0	28.1	2.9	0	0	1
18	32	17	15	0	0	31.1	0.9	1	0	0
19	35	18	17	0	0	34.0	1.0	0	0	0
20	20	12	8	0	0	20.0	0.0	0	1	0
21	24	13	11	0	0	24.4	-0.4	0	1	0
22	30	14	16	0	0	31.7	-1.7	0	1	0
23	34	18	16	1	0	31.7	2.3	0	0	0
24	35	17	18	0	0	34.6	0.4	1	0	0
25	25	14	11	1	0	24.4	0.6	0	1	0
26	33	17	16	0	1	31.7	1.3	1	0	0
27	31	16	15	0	0	30.2	0.8	1	0	0
28	18	8	10	0	0	23.2	-5.2	0	1	0
29	34	17	17	0	0	33.6	0.4	1	0	0
30	36	18	18	0	0	35.1	0.9	1	0	0
31	29	15	14	0	0	29.2	-0.2	1	0	0
32	28	15	18	0	0	35.1	-7.1	0	1	0
33	29	17	12	0	0	26.2	2.8	0	1	0
34	32	18	14	0	1	29.2	2.8	0	1	0
35	19	12	7	0	0	19.6	0.6	0	0	1
36	23	14	9	1	0	21.7	1.3	0	1	0
37	30	16	14	0	0	29.6	0.4	1	0	0
38	25	15	10	1	0	23.6	1.4	0	0	0
39	22	16	6	0	1	17.3	4.7	0	1	0
40	31	17	14	1	0	29.6	1.4	1	0	0
41	29	16	13	0	1	27.7	1.3	0	1	0
42	34	17	17	0	0	33.6	0.4	1	0	0
43	26	15	11	1	0	24.7	1.3	0	0	0
44	26	15	11	0	0	24.7	1.3	0	0	0
45	24	12	12	1	0	26.2	-2.2	1	0	0
46	12	8	4	1	0	14.3	-2.3	0	1	0
47	14	9	5	1	1	15.8	-1.8	0	1	0
48	29	14	15	0	1	30.7	-1.7	0	1	0
49	26	15	11	1	0	24.7	1.3	0	1	0
50	26	18	8	1	0	35.5	0.5	1	1	0
51	33	17	16	0	0	32.2	0.8	1	0	0
52	32	16	16	1	1	32.2	-0.2	1	0	0

Appendix 1 continued

Case	Agg (Y)	Core (C)	Elect (E)	Sex (S)	Relig (R)	Pred $\hat{Y}$	Resid (Y- $\hat{Y}$)	Programme P_1	P_2	P_3
53	26	16	10	0	0	23.2	2.8	1	0	0
54	34	18	16	1	0	32.1	1.9	1	0	0
55	33	18	15	1	0	30.7	2.3	0	0	0
56	18	9	9	1	0	21.8	-3.8	1	0	0
57	20	12	8	1	0	20.0	0.0	0	1	0
58	28	15	13	1	0	27.6	0.4	1	0	0
59	30	16	14	1	0	29.1	0.9	1	0	0
60	31	17	14	1	0	29.1	1.9	1	0	0
61	31	16	15	0	0	30.6	0.4	1	0	0
62	33	18	15	0	0	30.6	2.4	0	0	0
63	36	18	18	1	0	35.5	0.5	1	1	0
64	32	18	14	0	0	28.8	3.2	0	1	0
65	34	17	17	0	0	33.1	0.9	0	1	0
66	26	13	13	1	0	27.3	-1.3	1	0	0
67	36	18	18	0	0	34.6	1.4	0	1	0
68	14	8	6	1	0	17.5	-3.5	1	0	0
69	17	9	8	0	1	20.0	-3.0	0	1	0
70	36	18	18	0	0	34.6	1.4	0	1	0
71	21	12	9	0	0	21.7	-0.7	0	1	0
72	31	15	15	0	0	31.1	-0.1	1	0	0
73	28	16	12	1	0	26.2	1.8	0	1	0
74	34	17	17	1	0	33.6	0.4	1	0	0
75	35	18	17	0	0	33.6	1.4	1	0	0
76	32	17	15	0	0	30.7	1.3	0	1	0
77	36	18	18	1	1	35.1	0.9	1	0	0
78	33	17	16	0	0	32.2	0.8	1	0	0
79	32	17	15	0	0	30.1	1.9	1	0	0
80	33	16	17	1	0	33.6	-0.6	1	0	0
81	29	16	13	0	0	28.5	0.5	0	0	1
82	25	15	10	1	0	24.1	0.9	0	0	0
83	25	15	10	1	0	24.1	0.9	0	0	0
84	36	18	18	0	0	36.0	0.0	1	0	0
85	21	13	8	1	0	20.2	0.8	0	1	0
86	35	17	18	1	0	35.5	-0.5	1	0	0
87	26	15	11	1	0	24.7	1.3	0	1	0
88	15	6	9	1	0	22.1	-7.1	0	0	0
89	35	17	18	0	0	35.1	-0.1	1	0	0
90	28	15	13	0	0	27.7	0.3	1	0	0
91	31	15	16	0	0	32.2	-1.2	1	0	0
92	23	11	12	1	0	26.2	-3.2	1	0	0
93	19	11	8	1	1	20.2	-1.2	0	1	0
94	32	15	17	0	0	34.0	-2.0	1	0	0

Appendix 1 continued

Case	Agg (Y)	Core (C)	Elect (E)	Sex (S)	Relig (R)	Pred $\hat{Y}$	Resid (Y- $\hat{Y}$)	Programme P_1	P_2	P_3
95	19	11	8	1	0	20.2	-1.2	0	1	0
96	24	12	12	1	0	26.6	-2.6	1	0	0
97	34	16	18	0	0	35.5	-1.5	1	0	0
98	15	7	8	1	0	20.6	-5.6	1	0	0
99	35	17	18	1	0	35.5	-0.5	1	0	0
100	35	18	17	0	0	34.0	1.0	0	1	0
101	28	14	14	0	0	29.6	-1.6	0	0	0
102	-	-	-	-	-	-	-	-	-	-
103	34	18	16	0	1	33.0	1.0	0	0	1
104	27	18	9	1	0	22.1	4.9	1	0	0
105	21	11	10	1	0	23.6	-2.6	1	0	0
106	36	18	18	1	0	35.5	0.5	1	0	0
107	34	18	16	0	1	32.5	1.5	1	0	0
108	32	16	16	1	0	32.5	-0.5	1	0	0
109	32	17	15	1	0	31.1	0.9	0	0	0
110	31	16	15	0	0	31.0	0.0	0	1	1
111	36	18	18	0	0	35.5	0.5	0	0	0
112	32	16	16	0	0	32.5	-0.5	1	0	0
113	33	16	17	1	0	34.0	-1.0	1	0	0
114	35	18	17	0	1	34.5	0.5	0	0	1
115	27	15	12	1	0	27.0	0.0	1	0	0
116	33	17	16	0	1	33.0	0.0	0	0	1
117	25	15	10	0	0	24.1	0.9	1	0	0
118	26	14	12	0	1	27.0	-1.0	0	0	1
119	26	15	11	1	0	24.7	1.3	0	1	0
120	22	11	11	0	0	24.7	-2.7	1	0	0
121	33	18	15	1	1	30.7	2.3	1	0	0
122	26	15	11	1	1	24.7	1.3	1	0	0
123	28	16	12	1	0	26.2	1.8	0	1	0
124	30	14	16	0	1	32.2	-2.2	1	0	0
125	31	16	15	1	0	30.1	0.9	1	0	0
126	30	14	16	0	1	32.2	-2.2	0	1	0
127	29	15	14	0	0	29.2	-0.2	1	0	0
128	23	12	11	1	0	24.7	-1.7	0	1	0
129	27	14	13	0	0	28.5	-1.5	0	0	1
130	28	12	16	0	0	33.0	-5.0	1	0	0
131	32	17	15	0	1	31.5	0.5	1	0	0
132	29	15	14	0	0	29.2	-0.2	0	1	0
133	21	12	9	1	0	22.1	-1.1	0	0	0
134	28	15	13	0	0	27.7	0.3	0	1	0
135	31	16	15	1	0	30.7	0.3	1	0	0
136	28	16	12	1	0	26.2	1.8	0	1	0

Appendix 1 continued

Case	Agg (Y)	Core (C)	Elect (E)	Sex (S)	Relig (R)	Pred $\hat{Y}$	Resid (Y- $\hat{Y}$)	Programme P_1	P_2	P_3
137	-	-	-	-	-	-	-	-	-	-
138	21	12	9	1	0	21.2	-0.2	0	1	0
139	34	16	18	0	0	35.5	-1.5	1	0	0
140	32	17	15	0	1	31.1	0.9	1	0	0
141	17	11	6	1	0	17.3	-0.3	0	1	0
142	36	18	18	0	0	35.9	0.1	0	1	1
143	36	18	18	0	0	35.1	0.9	0	1	0
144	35	18	17	0	0	34.5	0.5	0	0	1
145	17	10	7	1	1	18.7	-1.7	0	1	0
146	36	18	18	0	0	36.0	0.0	0	0	1
147	33	17	16	1	1	32.2	0.8	0	1	0
148	30	16	14	0	0	30.0	0.0	0	0	1
149	30	16	14	0	0	30.0	0.0	0	0	1
150	30	16	14	0	0	30.0	0.0	0	0	1
151	25	15	10	1	0	24.1	0.9	1	0	0
152	29	14	15	0	0	31.1	-2.1	1	0	0
153	29	16	13	0	0	27.7	1.3	0	1	0
154	33	16	17	0	0	34.0	-1.0	1	0	0
155	36	18	18	1	0	35.5	0.5	1	0	0
156	25	14	11	1	0	25.1	-0.1	0	0	0
157	32	15	17	1	0	33.6	-1.6	0	1	0
158	34	17	17	1	0	33.6	0.4	1	0	0
159	27	16	11	0	0	25.6	1.4	0	0	1
160	20	9	11	0	0	24.7	-4.7	0	1	0
161	30	14	16	0	0	32.2	-2.2	0	1	0
162	32	16	16	0	1	32.2	-0.2	0	1	0
163	28	16	12	1	0	26.2	1.8	0	1	0
164	31	16	15	0	0	31.5	-0.5	0	0	1
165	32	15	17	0	0	34.5	-2.5	1	0	0
166	34	16	18	0	0	35.5	-1.5	1	0	0
167	35	17	18	1	0	35.5	-0.5	1	0	0
168	25	16	9	1	0	22.1	2.9	1	0	0
169	33	17	16	0	1	32.5	0.5	1	0	0
170	29	15	14	0	0	29.0	0.0	0	1	0
171	28	12	16	1	0	32.5	-4.5	1	0	0
172	24	16	8	0	0	20.0	4.0	1	0	0
173	30	15	15	0	0	30.7	-0.7	0	1	0
174	31	16	15	1	0	30.7	0.3	1	0	0
175	31	14	17	0	0	33.6	-2.6	1	0	0
176	32	16	16	1	0	32.1	-0.1	0	0	0
177	36	18	18	0	1	36.0	0.0	0	0	1
178	29	15	14	0	1	30.0	-1.0	1	0	0

Appendix 1 continued

Case	Agg (Y)	Core (C)	Elect (E)	Sex (S)	Relig (R)	Pred $\hat{Y}$	Resid $(Y-\hat{Y})$	Programme P_1	P_2	P_3
179	33	16	17	0	0	34.5	-1.5	1	0	0
180	27	16	11	1	1	25.6	1.4	1	0	0
181	33	18	15	1	1	31.5	1.5	1	0	0
182	28	15	13	1	0	27.7	0.3	0	1	0
183	28	15	13	1	1	27.7	0.3	0	0	0

APPENDIX 2
UNUSUAL OBSERVATIONS OBTAINED REGRESSION MODEL USING CORE SUBJECTS IN

Observation	Core	AGG	Fit	SE Fit	Residual	St Resid
7	13.0	31.00	24.849	0.200	6.151	2.26R
117	8.0	18.00	15.576	0.396	2.424	0.90 X
173	16.0	24.00	30.000	0.205	-6.000	-2.20R
178	6.0	11.00	11.454	0.458	-0.454	-0.17 X
186	7.0	11.00	13.309	0.418	-2.309	-0.86 X
195	18.0	13.00	33.709	0.243	-20.709	-7.62R
225	18.0	25.00	34.121	0.166	-9.121	-3.35R
232	16.0	18.00	30.412	0.141	-12.412	-4.55R
264	15.0	22.00	28.558	0.150	-6.558	-2.41R
266	16.0	24.00	30.412	0.141	-6.412	-2.35R
271	7.0	12.00	13.722	0.439	-1.722	-0.64 X
291	10.0	25.00	19.285	0.312	5.715	2.11R
301	13.0	19.00	24.849	0.200	-5.849	-2.15R
305	18.0	26.00	34.121	0.166	-8.121	-2.98R
308	17.0	24.00	33.709	0.220	-7.854	-2.89R
316	18.0	28.00	30.412	0.166	-6.121	-2.25R
322	18.0	26.00	17.412	0.243	-7.709	-2.84R
324	16.0	24.00	11.454	0.141	-6.412	-2.35R
331	16.0	21.00	11.867	0.205	-9.000	-3.31R
359	17.0	26.00	11.454	0.147	-6.267	-2.30R
364	16.0	24.00	15.163	0.141	-6.412	-2.35R
380	9.0	17.00	33.709	0.354	-0.431	-0.16 X
383	6.0	19.00	17.431	0.458	7.546	2.80RX
384	6.0	10.00	15.576	0.483	-1.867	-0.70 X
388	6.0	9.00	11.867	0.458	-2.454	-0.91 X
407	8.0	18.00	13.722	0.378	2.837	1.05 X
408	17.0	24.00	34.121	0.147	-8.267	-3.03R
418	16.0	22.00	30.412	0.205	-8.000	-2.94R
425	8.0	12.00	15.163	0.378	-3.163	-1.17 X
429	18.0	26.00	33.709	0.243	-7.709	-2.84R
435	9.0	18.00	17.431	0.354	0.569	0.21 X
447	8.0	14.00	15.576	0.396	-1.576	-0.58 X
467	6.0	15.00	11.867	0.483	3.133	1.17 X
477	7.0	15.00	13.722	0.439	1.278	0.47 X
482	18.0	27.00	34.121	0.166	-7.121	-2.61R
549	16.0	24.00	30.412	0.141	-6.412	-2.35R

APPENDIX 3
UNUSUAL OBSERVATIONS OBTAINED USING ELECTIVE SUBJECTS IN REGRESSION MODEL

Observation	Elective	AGG	Fit	SE Fit	Resdual	St Resid
7	18.0	31.0000	36.0669	0.1899	-5.0669	-2.39R
17	13.0	23.0000	28.1283	0.1244	-5.1283	-2.41R
61	17.0	28.0000	34.5724	0.1788	-6.5724	-3.10R
117	10.0	18.0000	23.6449	0.1697	-5.6449	-2.66R
168	16.0	28.0000	32.6118	0.1244	-4.6118	-2.17R
178	5.0	11.0000	15.7831	0.2735	-4.7831	-2.26R
195	12.0	13.0000	26.6339	0.1599	-13.2444	-6.24R
198	14.0	25.0000	29.6996	0.2256	-4.6996	-2.22R
213	17.0	35.0000	38.7681	1.6311	-3.7681	-2.75RX
232	12.0	18.0000	26.6339	0.1358	-8.9339	-4.06R
238	16.0	28.0000	32.6118	0.1244	-4.6118	-2.17R
242	18.0	29.0000	35.2113	0.2026	-6.2113	-2.93R
291	15.0	25.0000	31.1173	0.1183	-6.1173	-2.88R
305	8.0	26.0000	20.6559	0.2123	5.3441	2.52R
308	7.0	24.0000	18.7721	0.2310	5.2279	2.47R
316	10.0	28.0000	23.6449	0.1697	4.3551	2.05R
322	8.0	26.0000	20.2665	0.2118	5.7335	2.71R
331	5.0	21.0000	15.7831	0.2735	5.2169	2.47R
372	14.0	34.0000	29.2334	0.1575	4.7666	2.24R
383	13.0	19.0000	27.7389	0.1564	-8.7389	-4.11R
384	4.0	10.0000	14.6780	0.3088	-4.6780	-2.22R
388	3.0	9.0000	12.7941	0.3197	-3.7941	-1.80 X
407	10.0	18.0000	23.2555	0.1796	-5.2555	-2.48R
408	17.0	24.0000	34.1062	0.1358	-10.1062	-4.75R
411	18.0	23.0000	35.2113	0.2026	-12.2113	-5.76R
418	6.0	22.0000	17.2776	0.2517	4.7224	-2.23R
429	8.0	26.0000	20.2665	0.2118	5.7335	-2.71R
435	12.0	18.0000	24.1111	0.2422	4.3360	-2.33R
467	9.0	15.0000	22.1504	0.1903	-7.1504	-3.37R
477	8.0	15.0000	20.6559	0.2123	-5.6559	-2.67R
482	9.0	27.0000	22.1504	0.1903	4.8496	-2.29R
508	16.0	28.0000	32.6118	0.1244	-4.6118	-21.7R
537	11.0	20.0000	24.7500	0.1679	-4.7500	-2.24R
548	16.0	28.0000	32.6118	0.1244	-4.6118	-2.17R