

PREDICTION OF STUDENT ACHIEVEMENT AT
A.N.U. FROM A.C.T. COLLEGE ASSESSMENTS

by

WARREN JOHN MÜLLER

A case study submitted to the Australian National
University as part of the requirement for the
degree of Master of Science.

April 1982.

The material contained in this case study
is the product of my own work.

CONTENTS

CONTENTS	i
ACKNOWLEDGMENTS	iii
SUMMARY	iv
CHAPTER 1 : INTRODUCTION	1
CHAPTER 2 : THE NATURE OF THE DATA	6
2.1 College Data	6
2.2 Students Entering A.N.U.	7
2.3 A.N.U. Data	8
Tables 2.1 - 2.8	13
CHAPTER 3 : RELATIONSHIPS BETWEEN COLLEGE VARIABLES	21
3.1 Correlations	21
3.2 Principal Components Analyses	21
3.3 Principal's Recommendations	23
3.4 Use of Principal Components Analyses in Regressions	24
Tables 3.1 - 3.5	27
CHAPTER 4 : PREDICTION OF MARKS IN A.N.U. UNITS	32
4.1 Correlations with College Variables	32
4.2 Correlations with Principal Component Scores	34
4.3 Comparison of Regressions	35
4.4 Percent Variation Explained by College Variables	36
4.5 Effect of SEX	38
4.6 Percent Variation Explained by Principal Component Scores	39
Tables 4.1 - 4.7	41

CHAPTER 5 : GRADE SCORES AND THEIR PREDICTION	54
5.1 Grade Scores	54
5.2 Correlations with College Variables	58
5.3 Percent Variation Explained by College Variables	60
5.4 Correlations for Marginal Students	62
Tables 5.1 - 5.15	64
CHAPTER 6 : COMPARISONS BETWEEN A.C.T. COLLEGES	82
6.1 Grade Scores and Pass Rates	82
6.2 Regression Analyses	84
6.3 Representation of Relative Achievement	86
Tables 6.1 - 6.6	90
Figures 6.1 - 6.6	99
CHAPTER 7 : DISCUSSION AND RECOMMENDATIONS	106
7.1 Discussion	106
7.2 Implications for A.N.U. Admission Procedures	110
7.3 Possible Further Studies	112
REFERENCES	115
APPENDIX 1 : TES PERCENTILE FREQUENCIES FOR A.C.T. COLLEGES	119
APPENDIX 2 : FREQUENCIES OF GRADES IN INDIVIDUAL UNITS	122
APPENDIX 3 : FORTRAN PROGRAMS	129
APPENDIX 4 : GENSTAT PROGRAMS	158

ACKNOWLEDGMENTS

I wish to thank my two supervisors, Dr D.M. Paton, Botany Department, and Dr D.F. Nicholls, Statistics Department, for the encouragement and advice they gave me at all stages of the study. Much advice and information was supplied by the A.N.U. Admissions Officer, Mr Clive Johnson, and by Ms H.R. Hamilton of the Admissions Office. Mr P.B. Telford, the A.N.U. Statistical Officer, made available records of A.N.U. results and information on first year courses at A.N.U., and participated in useful discussions on this aspect of the work. Miss Alyson Stibbard of the Statistical Office did all the data preparation and much of the checking necessary to ensure the accuracy of the results. Finally, the A.C.T. Schools Accrediting Agency supplied listings of results of A.C.T. Year 12 students, without which the study would not have been possible.

SUMMARY

Relationships between measures of student performance in A.C.T. colleges and results achieved in first year at A.N.U. are investigated. The college variables are those produced by the A.C.T. Schools Accrediting Agency and made available to A.N.U. for admission purposes, namely Tertiary Entrance Score (TES), Australian Scholastic Aptitude Test (ASAT) and Principal's Recommendations. There are three ASAT variables, Verbal, Quantitative and Total, and three Principal's Recommendations, Academic, Personal and Overall. Sex and college attended are also considered as possible variables to predict A.N.U. results.

Analyses were performed on three years of data; students entering A.N.U. from A.C.T. colleges in 1978, 1979 and 1980. There were 241, 258 and 272 such students, respectively, in these years. Results of all of these students in all first year units attempted were available, as well as actual marks obtained in the majority of cases.

Correlations and regressions of marks in individual A.N.U. units against college variables showed that, for all faculties except Law, TES was the best predictor of mark obtained. Addition of other college variables significantly improved the regressions for some units, however not consistently over the three years. Sex was significant in a few instances. In the Faculty of Law, ASAT was generally a better predictor than TES.

Grade scores were defined to summarise results obtained by students in large groups of units, based either on faculty or subject area. As for marks, TES was the best predictor of grade score, and addition of other variables significantly improved the relationship in very few cases. Sex was still significant for a few grade scores and ASAT was still a better predictor than TES in the Faculty of Law.

The larger number of student results summarised by grade score meant that the effect of A.C.T. college attended could be tested. There were substantial differences between colleges in 1978 and 1979, when addition of college as a variable significantly improved regressions with grade score. However no such differences were obtained in 1980, and the inconsistency of results over the three years means no general inferences can be made on relative performances in relation to college attended.

Implications of the results for A.N.U. admission procedures and possible further studies in this general area are discussed.

CHAPTER 1

INTRODUCTION

Before 1977, students in Year 12 in A.C.T. high schools and colleges sat for the N.S.W. Higher School Certificate examination. The score obtained from this examination was then used as the sole criterion for entry into the Australian National University (hereafter 'A.N.U.') or any other Australian university. However a few years earlier, changes had been recommended to this system of public examinations at the terminal secondary school stage in the A.C.T. Full details of the proposed new system are contained in Campbell (1972) and Thomson (1974), and a synopsis of the system as it presently operates is given in the A.C.T. Schools Accrediting Agency booklet (1980).

The fundamental change to assessment in this new system was that continuous internal assessment would replace external examinations. This introduced the need for standardising and scaling marks obtained in each course to adjust for differences between assessments from different schools and colleges. The procedures adopted to do this are detailed by the A.C.T. Schools Accrediting Agency booklet (1978), supplemented by details of later changes described by Knight (1981). Statistical aspects of these procedures have been discussed in detail by Rust (1980). Using these procedures, a Tertiary Entrance Score (hereafter 'TES') is obtained for each student. Briefly, it is the sum of the 3 best major subject scaled scores and either 0.6 of the

best minor subject scaled score, or 0.6 of the next best major subject scaled score, whichever is the greater. Few individual subject scaled scores are greater than 100, hence only a small number of outstanding students obtain a TES greater than 360.

To achieve the scaling on which the TES depends, the Australian Scholastic Aptitude Test (hereafter 'ASAT') is used. The validity of ASAT as a moderator variable has been discussed extensively (Lees, 1979). For example, the papers from the Australian Council for Educational Research 1978 conference (Research Papers, 1978) deal with many general aspects and Cooney (1975) gives a good account of theoretical considerations in standardisation. With particular reference to the effectiveness of ASAT in the A.C.T. system, studies have been made by Keeves (1977, 1980) and Morgan (1978, 1981a, 1981b) which show that ASAT results are sufficiently well related to college assessment measures. It is not the purpose of the present study to question the validity of ASAT as a moderator, so these earlier studies will not be discussed further.

In considering students from A.C.T. Colleges who apply for admission to A.N.U., the A.N.U. Admissions Committee thus has available the TES and the ASAT result, which is in three parts :

- VERBAL - a score assessing "verbal reasoning"
- QUANTITATIVE - a score assessing "quantitative thinking"
- TOTAL - an overall score of "scholastic aptitude".

The verbal and quantitative scores are made up from relevant items in the ASAT tests, and all three scores are scaled to have, over all students, a mean of 65 and a standard

deviation of 15. In addition each student receives a Principal's Recommendation, which is a set of three scores from 1 to 6 :

ACADEMIC - the recommendation on academic grounds
PERSONAL - the recommendation on personal grounds
OVERALL - the overall recommendation

and within each of these recommendations the actual scores denote the subjective attitudes :

1 : not recommended	4 : fairly strong support
2 : without enthusiasm	5 : very strong support
3 : mild support	6 : enthusiastic.

When considering student admission, the Admissions Committee first decides on an 'upper' TES level, above which all students are automatically admitted, and a 'lower' TES level, below which all students are rejected. For students in the band between these upper and lower levels, consideration is given additionally to the Principal's Recommendations and, to a minor extent, the ASAT scores. Thus it is in this marginal area, which in the years under study corresponded approximately to students with TES between 260 and 240, where the predictive abilities of the Principal's Recommendations and ASAT are of particular interest.

Many previous studies have examined how well student assessment variables at the end of secondary education predict student achievement at the tertiary level. A number of these are described briefly by Lees (1979). The more general issues of the validity of various methods of using secondary assessments for tertiary entrance are discussed by McGaw (1977a, 1977b) and Cooney (1974), the latter giving emphasis to the statistical methodology used.

Specific relationships between secondary and tertiary achievement are given for Queensland engineering students by O'Connor (1974), for some overall tertiary grade point averages in Queensland by McGaw (1977b), for Victorian first year university success by Smurthwaite (1973), and for Arts and Science students at the University of Adelaide by Otto (1976). In all of these studies correlations between secondary assessment variables and university results were greater than those between ASAT and university results.

Two studies involving performance at A.N.U. yield similar results. Sutherland (1973) examined first year performance at A.N.U. in 1969 and at the University of W.A. in 1969 and 1971 in relation to TEEP and ASAT scores. Both TEEP and ASAT were inferior predictors to Higher School Certificate results in most instances. The Tertiary Education Entrance Project (1975) examined TEEP scores as a predictor of first year law results at A.N.U. in 1971-1973, and concluded that neither TEEP nor the Higher School Certificate examination was a good predictor of success in the A.N.U. Faculty of Law.

In the present study we examine the achievement in their first year at A.N.U. of all students who came from A.C.T. colleges in the first three years of operation of the new system. Only immediate school leavers are included, hence our three years of data, each with approximately 250 students, are for 1977 Year 12 at college, 1978 first year A.N.U.; 1978 Year 12 college, 1979 first year A.N.U.; 1979 Year 12 college, 1980 first year A.N.U. The only variables that are used for each student are those currently considered by the

Admissions Committee, namely TES, ASAT and Principal's Recommendations, together with sex of the student and college at which the student studied. Relationships are obtained firstly between these variables, as predictors, and actual marks obtained in A.N.U. units or groups of units. Secondly, measures of A.N.U. achievement based on grades obtained in A.N.U. units are defined, and relationships between these and the predictive variables are obtained.

Within this study, no attempt has been made to compare the first year A.N.U. results of the A.C.T. college students with those of other first year A.N.U. students. This could yield interesting results, but was regarded as outside the scope of the present study. Secondly, no attempt has been made to relate scaled scores of individual college subjects to A.N.U. performance. The derivation of such relationships could provide a useful supplement to the present work, but the magnitude of the task was beyond time and resources available.

CHAPTER 2

THE NATURE OF THE DATA

2.1 College Data

Each year, the A.C.T. Schools Authority supplies A.N.U. with the detailed results obtained by all students who attempt a tertiary entrance package and hence obtain a TES. Attached to these records is a table giving frequencies of each TES and its rank by Year 12 candidature and by 18 year old age cohort.

For Year 12 1977 and Year 12 1978 the following information was extracted from the detailed file for each college student with a TES :

TES

ASAT Verbal

ASAT Quantitative

ASAT Total

Principal's Recommendation - Academic

Principal's Recommendation - Personal

Principal's Recommendation - Overall

College attended.

From the ranks in the frequency tables the TES percentile of each student was also known. 'Percentile', throughout this study, means the percent of students obtaining the same or a higher TES as the student referred to. The number of such students in each of the years was :

1977 Year 12	-	1701 students
1978 Year 12	-	1759 students

Using the above data certain preliminary information could be obtained. In particular the number of students from each college in each 5% percentile band of TES was readily obtainable. Students from each college generally were spread fairly evenly over the whole TES range in each of the two years. If this had not been the case, problems may have arisen in making comparisons between colleges of A.N.U. results achieved. The full frequency counts for TES percentiles are presented in Appendix 1.

Full information was not extracted for Year 12 1979 students as had been for the first two years, primarily because the enormity of the task would not have justified the extra information thus available. Reasons for this become apparent in Chapter 3. There were :

1979 Year 12	-	2003 students
--------------	---	---------------

and whilst the numbers in each TES percentile were known from the frequency table supplied by the Authority, no break-up by college was possible.

2.2 Students Entering A.N.U.

In the three years of the study the following numbers of students entered A.N.U. directly in the year following their final college year :

1977 Year 12/1978 A.N.U.	-	241 students
1978 Year 12/1979 A.N.U.	-	258 students
1979 Year 12/1980 A.N.U.	-	272 students.

These numbers exclude mature age students, whose TES is calculated in a different way, preventing them from being included in the study.

Proportions of eligible students entering A.N.U. overall and within each 5% percentile band of TES are given in Tables 2.1, 2.2 and 2.3. For the three years, a steady figure of about 28% of eligible students took up a place at A.N.U. However proportions varied markedly over TES percentiles, with generally high proportions in the top 15% of students and a gradual decline down to the 40-50% range where generally less than 20% of eligible students took up a place. The range of proportions in the third year, 1980, seems less than that for the first two years, but it would be difficult to attach significance to this observation.

For the first two years of data, proportions of eligible students entering A.N.U. can also be obtained for each A.C.T. college. These proportions are presented in Tables 2.4 and 2.5. The range of proportions is much larger in 1978 than 1979, but otherwise there are no consistent patterns. Further years of data would be needed to see if entrance to A.N.U. is significantly affected by college attended.

2.3 A.N.U. Data

The following information was obtained for each student in the study from A.N.U. records :

Course area

Full-time or Part-time

Sex

Results obtained in all units attempted.

Course area is the actual faculty or combination of faculties in which the student is enrolled. There are thirteen possible course areas; Arts, Arts/Law, Law, Economics, Asian Studies, Science, Science (Forestry), Economics/Law, Asian Studies/Law, Economics/Asian Studies, Economics/Science, Economics/Forestry and Science/Law. A number of these attract very low student numbers, and students often choose units outside their faculty of enrolment. Thus in the study, course area in which the student is enrolled has been ignored. Rather, any grouping of student results is based on faculty in which the A.N.U. unit is based, or on general subject area.

Whilst whether a student is full-time or part-time may affect that student's achievement, no attempt was made in the study to allow for this due to very low numbers of part-time students amongst immediate school leavers. In our sample there was only 20 part-time out of 241 in 1978, 35 out of 258 in 1979, and 31 out of 272 in 1980.

For each unit attempted by a student, the following information was recorded :

Point value of unit

Grade obtained

Actual mark obtained.

The point value is 2 for full-year units and 1 for semester units or full-year units with half weight. All units attempted by students in the study could be classified as

one of these. There were ten grades obtained by students, these being :

HD	-	High Distinction
D	-	Distinction
HM	-	Pass with High Merit (awarded in Economics 1 only; regarded equivalent to D)
CR	-	Credit
PM	-	Pass with Merit (awarded in Economics 1 only; regarded equivalent to CR)
P	-	Pass
P1	-	Pass level 1 (used only in Science faculty units and equivalent to P)
P2	-	Pass level 2 (used only in Science faculty units; a 'terminating' pass where the student is prevented from proceeding to higher units in that subject)
N	-	Failure
W	-	Withdrawal

Summaries of numbers of students achieving various grades in various groupings of units by faculty or subject area are given in Tables 2.6, 2.7 and 2.8. In 1978 the 241 students attempted 1106 units, in 1979 the 258 students attempted 1191 units and in 1980 the 272 students attempted 1281 units. No attempt has been made in these tables to discriminate between units worth 1 or 2 points, each simply being counted as a unit attempted. The right hand column in these tables, '% N+W', could be called a 'wastage' rate. Wastage values conform with already known patterns from the whole A.N.U. student population, for

example the high wastage rates in Economics. It is also interesting to note the consistently lower wastage rates in Mathematical Sciences and the tendency in this group to award much higher numbers of HD and D grades.

In the three years of the study, 89 A.N.U. units were attempted by at least one student in one year. Almost all of these were units generally available to first year students, the exceptions being Italian 2 and Modern Chinese 2, each attempted in 1979 by a student with special language qualifications, and Pure Maths B05H, Pure Maths B06H, Physics B06, attempted by one outstanding student in 1979. Not all 89 units were attempted by students in all years, mainly due to restructuring of courses by terminating units and introducing others. In 1978, 67 units were attempted by one or more student in the study; in 1979, 74 units were attempted; in 1980, 67 units were attempted. However in many units numbers of students were very low, with only 26 units in 1978 having at least 20 students, only 24 units in 1979 and only 23 units in 1980. Full details of numbers of students in each unit and the distribution of grades obtained are given for each of the three years in Appendix 2.

Actual marks obtained were generally available for all results where a student achieved P2 or better. The main exception to this was in some Pure Maths units where the assessment system prevented an actual mark being assigned to the student. In addition marks were also available for some students who failed (graded N), but naturally none for withdrawals. Marks were generally in the range 0 to 100 with the P borderline being at 50, CR at 65 (60 in Statistics

units), D at 75 (70 in Statistics units, 72 in Law units) and HD at 85 (80 in Statistics units). Where marks were not in this general range they were rescaled. The marks were obtained from A.N.U. records of student results or in some instances were supplied by individual Departments.

TABLE 2.1

Students entering A.N.U. from A.C.T. Colleges - 1978

<u>TES</u> <u>Percentile</u> ^A	<u>TES</u> <u>Range</u>	<u>No. students</u> <u>entering ANU</u>	<u>No. students</u> <u>in colleges</u>	<u>Proportion</u> <u>entering ANU</u>
0- 5	360-332	24	83	0.29
5-10	331-313	37	87	0.43
10-15	312-302	33	79	0.42
15-20	301-292	27	84	0.32
20-25	291-284	25	88	0.28
25-30	283-277	21	86	0.24
30-35	276-270	19	83	0.23
35-40	269-265	20	81	0.25
40-45	264-259	16	93	0.17
45-50	258-253	11	74	0.15
> 50	< 253	6		
TOTAL ^B		239 ^C	838 ^B	0.28 ^B

A Percentiles are based on ranking of students by Year 12 Candidature.

B Total and overall proportion are for students with TES $\geq$ 253.

C There were 241 students from 1978 in the study, but two were not given a TES.

TABLE 2.2

Students entering A.N.U. from A.C.T. Colleges - 1979

<u>TES</u> <u>Percentile</u> ^A	<u>TES</u> <u>Range</u>	<u>No.students</u> <u>entering ANU</u>	<u>No.students</u> <u>in colleges</u>	<u>Proportion</u> <u>entering ANU.</u>
0- 5	412-334	37	89	0.42
5-10	333-316	30	86	0.35
10-15	315-302	38	88	0.43
15-20	301-293	22	95	0.23
20-25	292-285	23	84	0.27
25-30	284-278	24	82	0.29
30-35	277-271	25	92	0.27
35-40	270-264	21	96	0.22
40-45	263-258	15	84	0.18
45-50	257-253	17	90	0.19
> 50	< 253	6		
TOTAL ^B		258	886 ^B	0.28 ^B

A Percentiles are based on ranking of students by Year 12 Candidature.

B Total and overall proportion are for students with TES $\geq$ 253.

TABLE 2.3

Students entering A.N.U. from A.C.T. Colleges - 1980

<u>TES</u> <u>Percentile</u> ^A	<u>TES</u> <u>Range</u>	<u>No.students</u> <u>entering ANU</u>	<u>No.students</u> <u>in colleges</u>	<u>Proportion</u> <u>entering ANU</u>
0- 5	384-336	34	97	0.35
5-10	335-316	35	100	0.35
10-15	315-303	32	100	0.32
15-20	302-293	27	100	0.27
20-25	292-283	29	100	0.29
25-30	282-275	24	95	0.25
30-35	274-268	23	93	0.25
35-40	267-261	21	109	0.19
40-45	260-256	21	92	0.23
45-50	255-250	19	102	0.19
> 50	< 250	7		
TOTAL ^B		272	988 ^B	0.27 ^B

A Percentiles are based on ranking of students by Year 12 Candidature.

B Total and overall proportion are for students with TES $\geq$ 250.

TABLE 2.4

College of origin of students entering A.N.U. - 1978

<u>College</u>	<u>No.students</u> <u>entering</u> <u>A.N.U.</u>	<u>No.students</u> <u>in college</u> ^A	<u>Proportion</u> <u>entering</u> <u>A.N.U.</u> ^A
Braddon Catholic High	12	33	0.36
Daramalan College	21	47	0.45
Dickson College	32	154	0.20
St.Edmund's College	14	35	0.40
Canberra Girls Grammar	15	70	0.21
St.Clar'e's College Griffith	16	41	0.39
Hawker College	43	144	0.30
Marist College	14	46	0.30
Narrabundah College	18	59	0.27
Phillip College	54	210	0.24

A No.students in college and proportion entering A.N.U.

are for students with TES in upper 50% by Year 12

Candidature.

TABLE 2.5

College of origin of students entering A.N.U. - 1979

<u>College</u>	<u>No.students entering A.N.U.</u>	<u>No.students in college</u> ^A	<u>Proportion entering</u> ^A <u>A.N.U.</u>
Braddon Catholic High	8	25	0.32
Daramalan College	18	65	0.28
Dickson College	39	146	0.25
St. Edmund's College	9	27	0.33
Canberra Girls Grammar	15	56	0.27
St.Clare's College Griffith	15	58	0.26
Hawker College	50	165	0.30
Marist College	13	37	0.35
Narrabundah College	20	60	0.32
Phillip College	35	113	0.31
Stirling College	36	125	0.28

A No.students in college and proportion entering A.N.U.
are for students with TES in upper 50% by Year 12
Candidature.

TABLE 2.6

Frequencies of grades obtained by students from A.C.T. Colleges - 1978

<u>Grouping of Units</u>	<u>HD</u>	<u>D</u>	<u>HM</u>	<u>CR</u>	<u>PM</u>	<u>P</u>	<u>P1</u>	<u>P2</u>	<u>N</u>	<u>W</u>	<u>TOTAL</u>	<u>% N+W</u>
Faculty of Arts	10	32	0	94	0	115	0	0	22	45	318	21.1
Faculty of Asian Studies	3	6	0	9	0	6	0	0	3	6	33	27.3
Non-language units in Arts and Asian Studies	8	27	0	86	0	111	0	0	20	45	297	21.9
Language units in Arts and Asian Studies	5	11	0	17	0	10	0	0	5	6	54	20.4
Faculty of Economics	7	11	0	36	3	98	0	0	46	18	219	29.2
Faculty of Economics excluding Statistics	0	1	0	6	3	49	0	0	28	11	98	39.8
Faculty of Law	1	2	0	29	0	53	0	0	2	4	91	6.6
Faculty of Science	10	21	0	97	0	8	202	17	34	56	445	20.2
Mathematical Sciences	13	26	0	86	0	57	86	3	35	21	327	17.1
Empirical Sciences	4	5	0	41	0	0	116	14	17	42	239	24.7
All Units	31	72	0	265	3	280	202	17	107	129	1106	21.3

TABLE 2.7

Frequencies of grades obtained by students from A.C.T. Colleges - 1979

<u>Grouping of Units</u>	<u>HD</u>	<u>D</u>	<u>HM</u>	<u>CR</u>	<u>PM</u>	<u>P</u>	<u>P1</u>	<u>P2</u>	<u>N</u>	<u>W</u>	<u>TOTAL</u>	<u>% N+W</u>
Faculty of Arts	14	40	0	93	0	118	0	0	14	36	315	15.9
Faculty of Asian Studies	3	4	0	3	0	6	0	0	0	7	23	30.4
Non-language units in Arts and Asian Studies	5	32	0	83	0	113	0	0	12	29	274	15.0
Language units in Arts and Asian Studies	12	12	0	13	0	11	0	0	2	14	64	25.0
Faculty of Economics	5	18	2	40	5	121	0	0	54	26	271	29.5
Faculty of Economics excluding Statistics	0	1	2	7	5	52	0	0	34	21	122	45.1
Faculty of Law	2	6	0	20	0	65	0	0	7	1	101	7.9
Faculty of Science	45	60	0	87	0	20	145	24	46	54	481	20.8
Mathematical Sciences	40	61	0	86	0	69	84	7	44	23	414	16.2
Empirical Sciences	10	16	0	34	0	20	61	17	22	36	216	26.9
All Units	69	128	2	243	5	330	145	24	121	124	1191	20.6

TABLE 2.8

Frequencies of grades obtained by students from A.C.T. Colleges - 1980

<u>Grouping of Units</u>	<u>HD</u>	<u>D</u>	<u>HM</u>	<u>CR</u>	<u>PM</u>	<u>P</u>	<u>P1</u>	<u>P2</u>	<u>N</u>	<u>W</u>	<u>TOTAL</u>	<u>% N+W</u>
Faculty of Arts	3	23	0	92	0	130	0	0	11	57	316	21.5
Faculty of Asian Studies	3	3	0	2	0	0	0	0	5	8	21	61.9
Non-language units in Arts and Asian Studies	2	14	0	78	0	113	0	0	15	53	275	24.7
Language units in Arts and Asian Studies	4	12	0	16	0	17	0	0	1	12	62	21.0
Faculty of Economics	6	20	0	42	4	141	0	0	56	40	309	31.1
Faculty of Economics excluding Statistics	0	1	0	5	4	68	0	0	35	29	142	45.1
Faculty of Law	0	5	0	13	0	54	0	0	8	9	89	19.1
Faculty of Science	30	74	0	134	0	0	193	26	34	55	546	16.3
Mathematical Sciences	28	74	0	128	0	73	92	15	43	28	481	14.8
Empirical Sciences	8	19	0	43	0	0	101	11	12	38	232	21.6
All Units	42	125	0	283	4	325	193	26	114	169	1281	22.1

CHAPTER 3

RELATIONSHIPS BETWEEN COLLEGE VARIABLES

3.1 Correlations

Relationships between the seven quantitative college variables were investigated for all college students in the first two years. Details of the data are given in section 2.1.

Correlation matrices for the two years are given in Table 3.1. All correlations are positive and highly significant ($P < 0.001$). The highest correlations are between the three Principal's Recommendations, with values greater than 0.9 between the overall recommendation and both the academic and personal. Correlations between TES and Principal's Recommendations are higher than those between TES and the ASAT scores. Within ASAT, correlations are very high between the total score and each of verbal and quantitative. The overall pattern of correlations is very consistent for the two years.

3.2 Principal Components Analyses

From the correlation matrices it was clear that the seven variables could not in any way be regarded as independent i.e. the dimensionality of the space of independent variables was much less than seven. Thus to determine the true dimensionality a principal components

analysis was run on the correlation matrices for each of the first two years.

Results of these principal components analyses are presented in Table 3.2. In 1977, the first 3 principal components accounted for 94.4% of the variation, and in 1978 the first 3 principal components accounted for 94.0% of the variation. Thus there were only effectively about 3 dimensions for the independent variables. However the most important aspects of the results from the analyses were the readily interpretable latent vectors and the consistency of results for the two years.

In each analysis the first component, accounting for about 73% of the variation, simply gives the magnitude of student 'ability', as contributed to by all variables with roughly equal loadings. This is hardly a surprising result given the nature of the variables. The second component, accounting for about 16% of the variation, gives a contrast between scores obtained in ASAT and scores awarded by Principals in their recommendations. Loadings within ASAT and Principal's Recommendations are of similar magnitude in this component. Thus the Principals are clearly doing more than just reflecting ability as measured by ASAT when they do their recommendations. The third component, accounting for about 6% of the variation, gives a contrast between ASAT verbal scores and ASAT quantitative scores. Thus to some extent, ASAT is managing to discriminate between two types of abilities.

The consistency of the results from the two principal components analyses is remarkable. It was this

consistency, and the related high similarity between correlation matrices for the two years, that determined that there was no point examining detailed figures for all college students for the third year of the study. However the consistency did not stop there. For each of the two years, principal components analyses were also run for each college and remarkably similar results were obtained for all colleges. Naturally the magnitudes of the loadings in the latent vectors and the actual percentages of variation explained vary slightly, especially for colleges with smaller numbers of students. However the general magnitudes of percent variance explained and the interpretation of the components remains the same. As an example, the results of the principal components analyses on results of students from St. Clare's College Griffith are presented in Table 3.3. This college has smaller Year 12 student numbers than most others.

3.3 Principal's Recommendations

A most prominent aspect of the results of the principal components analyses is the lack of discrimination between the three Principal's Recommendations in the 94% of variation in the first three components. Consistent with this, it was noted that correlations between these recommendations were very high. This indicates that Principals may be giving effectively only one recommendation from the point of view of the whole data set.

To gain further insight into the nature of Principal's Recommendations, frequencies of various types of recommendations are presented in Table 3.4. For about 50% of the students, Principals give the same score for each component, academic, personal and overall, and in about a further 35% of cases the personal score is one greater than the academic score with overall taking one of the two values. Additionally in about a further 10% of cases the personal score is one less than the academic score, with overall taking one of the two values. Thus there is a tendency for Principals, if awarding different scores, to give personal a higher score than academic. However with this tight structure of scores accounting for about 95% of cases, it is not difficult to see why there is no effective overall discrimination between the three recommendations.

3.4 Use of Principal Components Analyses in Regressions

A major reason for doing a principal components analysis on independent variables is so that these independent variables are not then used in regression analyses as if there was no relationship between them. In this study we wish to use the college variables as independent variables to predict marks obtained in A.N.U. units, or to predict other measures of achievement. It would be desirable if the 3 components identified by the analyses could replace to some extent the seven original variables in later analyses.

In order to use a component, we need to calculate a 'Principal Component Score' to replace the observed data. Such a score is defined by :

$$\text{PC Score for component } j = \sum_{i=1}^n \frac{x_i - \mu_i}{\sigma_i} d_{ij}$$

where n = no. of independent variables

μ_i = mean of variable i

σ_i^2 = variance of variable i

$(x_1, \dots, x_n)$ = observations for which score is being calculated

d_{ij} = loading of variable i in component j

Thus to apply the results of the principal components analyses to our data, we need to determine values of

μ_i and σ_i^2 for each of the 7 variables and d_{ij} for each component for each variable.

The close similarity of the analyses for the two years enable values of μ_i , σ_i^2 and d_{ij} to be adopted which will yield PC scores applicable to all three years of data. This involves adopting means m_i , variances s_i^2 and loadings l_{ij} which will suffice in defining a meaningful component score. In Table 3.5, observed values of means and standard deviations are given, as well as the adopted means (m_i), standard deviations (s_i) and latent vectors (loadings l_{ij}). Observed latent vectors are in Table 3.2. Note that in the case of ASAT variables, the means and standard deviations adopted are those theoretically expected, as the observed values were close enough to enable this to be done. Also the standard deviations adopted for the Principal's Recommendations were made equal as the observed values were very close. The PC

scores for an observation $(x_1, \dots, x_7)$ are then defined by

$$\text{PC Score for component } j = \sum_{i=1}^7 \frac{x_i - m_i}{s_i} l_{ij}$$

PC scores obtained in the above manner were calculated in each regression analysis described in Chapters 4 and 5. Theoretically the scores should be independent, hence the amount of variation explained by each component separately should add to the amount explained by including all three in the regression.

TABLE 3.1

Matrices of Correlations between college variables

1977 College Year 12

1697 students^A

1 TES	1.00						
2 ASAT Verbal	0.60	1.00					
3 ASAT Quant.	0.65	0.58	1.00				
4 ASAT Total	0.71	0.84	0.92	1.00			
5 P. Rec. Academic	0.81	0.58	0.54	0.63	1.00		
6 P. Rec. Personal	0.76	0.49	0.43	0.51	0.85	1.00	
7 P. Rec. Overall	0.82	0.56	0.51	0.60	0.93	0.93	1.00
	1	2	3	4	5	6	7

A Of the 1701 students (Appendix 1), 4 were not given ASAT or Principal's Recommendations so were omitted

1978 College Year 12

1758 students^B

1 TES	1.00						
2 ASAT Verbal	0.60	1.00					
3 ASAT Quant.	0.67	0.62	1.00				
4 ASAT Total	0.71	0.85	0.94	1.00			
5 P. Rec. Academic	0.79	0.54	0.57	0.62	1.00		
6 P. Rec. Personal	0.78	0.48	0.49	0.53	0.83	1.00	
7 P. Rec. Overall	0.81	0.52	0.54	0.59	0.92	0.91	1.00
	1	2	3	4	5	6	7

B Of the 1759 students (Appendix 1) 1 was not given ASAT so was omitted.

TABLE 3.2

Results of Principal Components Analyses on College Variables

1977 College Year 12

1697 students

	1	Component 2	3
% Variance	72.6	15.7	6.1
Latent Vectors			
TES	-0.40	-0.09	-0.21
ASAT Verbal	-0.34	0.35	0.79
ASAT Quant.	-0.34	0.48	-0.58
ASAT Total	-0.38	0.47	-0.01
Prin. Rec. Academic	-0.40	-0.29	0.01
Prin. Rec. Personal	-0.37	-0.44	0.02
Prin. Rec. Overall	-0.40	-0.37	0.01

1978 College Year 12

1758 students

	1	Component 2	3
% Variance	72.9	15.5	5.6
Latent Vectors			
TES	-0.40	-0.11	-0.14
ASAT Verbal	-0.34	0.41	0.77
ASAT Quant.	-0.36	0.43	-0.61
ASAT Total	-0.39	0.47	-0.06
Prin. Rec. Academic	-0.39	-0.31	0.00
Prin. Rec. Personal	-0.38	-0.42	0.06
Prin. Rec. Overall	-0.40	-0.38	0.03

TABLE 3.3

Results of Principal Components Analyses on College Variables

1977 St. Clare's College Griffith

97 students

	Component		
	1	2	3
% Variance	75.6	14.2	5.2
Latent Vectors			
TES	-0.41	-0.13	0.00
ASAT Verbal	-0.37	0.25	-0.78
ASAT Quant.	-0.32	0.58	0.59
ASAT Total	-0.38	0.46	-0.07
Prin. Rec. Academic	-0.40	-0.26	0.05
Prin. Rec. Personal	-0.36	-0.45	0.10
Prin. Rec. Overall	-0.40	-0.33	0.16

1978 St. Clare's College Griffith

123 students

	Component		
	1	2	3
% Variance	78.3	12.2	4.5
Latent Vectors			
TES	-0.41	-0.10	0.05
ASAT Verbal	-0.34	0.48	0.73
ASAT Quant.	-0.37	0.34	-0.65
ASAT Total	-0.39	0.42	-0.15
Prin. Rec. Academic	-0.39	-0.22	-0.07
Prin. Rec. Personal	-0.34	-0.54	0.11
Prin. Rec. Overall	-0.39	-0.36	0.06

TABLE 3.4

Frequencies of Principal's Recommendations
awarded to College Students^A

<u>Recommendation</u>		<u>1977</u>	<u>1978</u>
All 3 Same	111	45	21
	222	113	84
	333	201	214
	444	226	238
	555	201	199
	666	147	116
Total		933 (54.9%)	872 (49.6%)
Pe 1 greater than Ac & Ov (121,232,343,454,565)		288 (16.9%)	326 (18.5%)
Pe & Ov 1 greater than Ac (122,233,344,455,566)		259 (15.2%)	295 (16.8%)
Pe 1 less than Ac & Ov (212,323,434,545,656)		50 (2.9%)	96 (5.5%)
Pe & Ov 1 less than Ac (211,322,433,544,655)		80 (4.7%)	97 (5.5%)
Pe 2 greater than Ac; Ov between (132,243,354,465)		37 (2.2%)	26 (1.5%)
Pe 2 less than Ac; Ov between (312,423,534,645)		14 (0.8%)	13 (0.7%)
Other with			
Pe greater than Ac		21	9
Pe same as Ac		13	22
Pe less than Ac		6	3
Total		40 (2.4%)	34 (1.9%)
TOTAL		1701	1759

A Recommendations are 3 digits: Academic, Personal and Overall.
Within the table these are abbreviated Ac, Pe and Ov respectively
Figures in brackets give percentage distribution for each year.

TABLE 3.5

Means, Standard Deviations and Latent Vectors adopted
for Construction of Principal Component Scores

(i) Means

<u>Variable</u>	<u>1977</u>	<u>1978</u>	<u>Adopted</u>
TES	252.66	252.33	252
ASAT Verbal	66.26	65.92	65
ASAT Quant.	65.67	67.24	65
ASAT Total	66.04	67.16	65
Prin. Rec. Academic	3.77	3.75	3.75
Prin. Rec. Personal	4.06	4.01	4.05
Prin. Rec. Overall	3.89	3.87	3.90

(ii) Standard Deviations

<u>Variable</u>	<u>1977</u>	<u>1978</u>	<u>Adopted</u>
TES	44.75	47.46	46
ASAT Verbal	14.50	14.54	15
ASAT Quant.	14.78	14.40	15
ASAT Total	14.64	14.47	15
Prin. Rec. Academic	1.29	1.23	1.275
Prin. Rec. Personal	1.32	1.25	1.275
Prin. Rec. Overall	1.31	1.25	1.275

(iii) Latent Vectors Adopted^A

<u>Variable</u>	<u>Component</u>		
	1	2	3
TES	0.40	-0.10	-0.17
ASAT Verbal	0.34	0.38	0.78
ASAT Quant.	0.35	0.45	-0.60
ASAT Total	0.38	0.47	-0.04
Prin. Rec. Academic	0.40	-0.30	0.01
Prin. Rec. Personal	0.37	-0.43	0.04
Prin. Rec. Overall	0.40	-0.37	0.02

A See Table 3.3 for Latent Vectors obtained from 1977 and 1978 data.

CHAPTER 4

PREDICTION OF MARKS IN A.N.U. UNITS

4.1 Correlations with College Variables

Although there were over 65 A.N.U. units in each year where one or more result was available, many had such small numbers that it was impossible to attempt to relate marks to the college variables. To attempt to overcome this, it had to be decided when it was valid to group units and then include all results from the group in a regression analysis. In many cases there were obviously different distributions of marks for units from different departments, and within departments there were, in some cases, different units with different degrees of difficulty e.g. 'honours' and 'pass' levels. Consequently it was decided to only group units within a department and with the same degree of difficulty. Thus the following groupings were able to be formed :

History 1 units

Geography 1 units

English 1 units (1980 only)

Linguistics 1 units

Romance languages (French and Italian)

Applied Maths A21 & A22

Applied Maths A31H & A32H

A few other groupings would have been possible but were not done because there were enough results in each separate unit e.g. Computer Science A01 & A02. Grouping over years was not considered, as preliminary analyses had shown large differences between the years in many aspects considered in this study.

Regression analyses were thus run for 29 units or groups of units on the 1978 data, for 33 on the 1979 data and for 28 on the 1980 data. Correlations between marks obtained in these units or groups of units and the seven college variables are presented in Tables 4.1, 4.2 and 4.3.

Correlations between marks and TES were positive and significant in the vast majority of cases. They were also greater than correlations with each of the other six variables in most instances. This was particularly so for the Faculty of Science units, however it was not true for some Arts units and for Law units. The lower correlations for Law units are not surprising as Law students only occupy the top end of the TES distribution (approximately $TES > 300$). The cases where the correlation was not significant generally occurred where number of students was low, instances where one or two 'peculiar' results could easily upset a pattern.

Fewer ASAT correlations were significant, and where they were the TES correlation was generally higher. Only in Law did ASAT stand out, probably because of the narrower TES range and because most Law students received Principal's Recommendations of 5 or 6, leaving little scope for prediction. ASAT verbal correlations tended to be higher

in Arts units, whereas ASAT quantitative and ASAT total correlations tended to be higher in most other areas.

The three correlations between marks and each of the Principal's Recommendations were generally of a similar size, due no doubt to the closeness of the recommendations, as discussed in chapter 3. However in very few instances, and certainly not in a consistent pattern, were these correlations greater than those of marks with TES.

4.2 Correlations with Principal Component Scores

For each of the units or groups of units in Tables 4.1, 4.2 and 4.3, correlations were also calculated between marks and the three Principal Component Scores.

The first component, which was a measure of student 'ability', was significantly positively correlated with marks obtained in many cases, however in very few of these was the correlation greater than that with TES; in 1978, 4 occurrences only with 3 in Law units; in 1979, 3 occurrences with 2 in Law units; in 1980, 9 occurrences with 2 in Law units and the other 7 in the Faculty of Economics. In the case of the Law units, usually one or more of the ASAT correlations were higher than the PC Score correlation, whereas for Economics in 1980, even though the correlations were greater the differences between them and TES correlations were small (<0.05 in all cases), so not important. Because this component is behaving essentially like TES but with 'contamination' from other variables, the correlations are not presented in detail.

Very few correlations were significant for the second principal component, a contrast between ASAT scores and Principal's Recommendations. In the three years only seven significant positive correlations and three significant negative correlations were observed. Correlations with Law units were positive and significant on four occasions, however the other cases of significance were random and of no interest. Again the correlations are not presented in detail.

For the third component, a contrast between ASAT verbal and ASAT quantitative, only nine correlations were significant, four positive and five negative, in the three years of data. These were randomly scattered and are also of no interest.

From the point of view of correlations it thus appears that the principal components, whilst having clear interpretations, are not of much use in predicting student achievement at A.N.U.

4.3 Comparison of Regressions

Many of the results in the remainder of this chapter and in chapters 5 and 6 rely upon comparison of goodness of fit of different linear regressions. I have chosen to summarise the goodness of fit of my regressions by '% variation explained'.

For a linear regression, the coefficient of determination, R^2 , is defined by

$$R^2 = \frac{\text{Regression sum of squares}}{\text{Total sum of squares}}$$

This is a good relative measure of goodness of fit for regressions on the same Y-variable, however when comparing regressions with different X-variables and Y-variables, as is commonly done in this study, the adjusted coefficient of determination should be used. It is defined by

$$\bar{R}^2 = 1 - (1-R^2) \frac{n}{n-p}$$

where n = total degrees of freedom

p = no. of parameters fitted.

Thus
$$\bar{R}^2 = 1 - \frac{\text{Residual mean square}}{\text{Total mean square}}$$

From this we then obtain $100 \bar{R}^2$, which is the % variance explained by the regression.

A good discussion of this and other measures of goodness of fit for regressions appears in Seber (1977). Kennard (1971) shows that there is a one-to-one correspondence between $\bar{R}^2$ and Mallows' C_p statistic, Haitovsky (1969) derives the relationship between $\bar{R}^2$ and the t-statistics associated with the regression coefficients, and Edwards (1969) discusses the relation between the F-test and $\bar{R}^2$. Thus it seemed reasonable to adopt $\bar{R}^2$ as a measure of goodness of fit, since it is related to most other commonly used measures.

4.4 Percent Variation Explained by College Variables

To examine percent variation explained by various combinations of independent variables, it was not feasible to do stepwise regressions in all cases due to the large number of data sets to be examined. Rather, various plausible combinations of independent variables were chosen

and regressed against marks in all cases, providing a basis for comparison between different units or groups of units as well as between variables for a given unit or group of units.

In this study, the 3 ASAT variables have been grouped and always are either included or excluded from a regression. A similar approach was adopted for the 3 Principal's Recommendation variables. Thus in Tables 4.4, 4.5 and 4.6 the % variation explained by five different combinations of college variables is presented. TES is the only single variable included, as its % variation explained is greater than that for the other variables taken singly in the vast majority of cases. Relative rankings of % variations explained for the other single variables can be obtained by referring to the correlations (Tables 4.1, 4.2 and 4.3), since for a single variable the % variation explained and correlation coefficient are alternative measures of the same thing.

For most units or groups of units some combination of variables leads to a higher % of variation being explained than for TES alone. However the numbers of students in most of these regressions are still relatively low, and unusual patterns amongst the variables for only a few students could produce a misleading regression. Thus the only true test is whether essentially the same regression was best for all 3 years i.e. we must look for general patterns. Detailed examination of the results in Tables 4.4, 4.5 and 4.6 shows that for most units where there are results for the three years the set of independent variables giving the best regression changes. For example, in Anthropology 1

the best regressions are 3 PREC in 1978, TES & 3 ASAT in 1979, and TES & 3 PREC in 1980; in Accounting 1 the best regressions are TES in 1978, TES & 3 ASAT & 3 PREC in 1979, and 3 PREC in 1980. Thus the regressions appear to be highly data specific.

Even in the few cases where similar patterns of % variation explained occur, there are differences in the signs and magnitudes of the regression coefficients which prevent any general use of these regressions for predictive purposes. In Table 4.7 the regression coefficients are given for three cases where the seven variables gave the best regression. The lack of consistency over the three years is obvious. Further, the particular way the regression relationship comes out is counter-intuitive in many instances. For example, why should ASAT verbal and quantitative have one sign and ASAT total the other, as in Statistics A03 and Contracts? Also, the relative signs of the three Principal's Recommendations vary for these three units. This provides further evidence that doing multiple regressions on individual unit marks is just an exercise in model fitting divorced from reality.

4.5 Effect of SEX

In all the regressions discussed in section 4.4, the effect of SEX was tested by adding it as an extra variable. The final columns in Tables 4.4, 4.5 and 4.6 present the % variation explained by the regression including SEX in those cases where SEX significantly improved the regression. In these tables, it is also indicated whether this effect was

due to male or female students achieving better marks.

Overall, SEX was significant in very few instances. There were, however, three cases where consistent results were obtained. In Geography 1 units, females obtained significantly better results in 1978 and 1979, and males in 1980. However numbers of students were rather low; 9 male and 4 female in 1978, 6 male and 7 female in 1979, and 4 male and 7 female in 1980. Secondly, in Statistics A03 females performed better in all three years. This could be a real effect as there were reasonable numbers in all cases; 5 female and 15 male in 1978, 7 female and 20 male in 1979, and 5 female and 18 male in 1980. Finally, in Computer Science 1 males performed better in both 1979 and 1980. In 1979 only 4 of the 29 students were female, however in 1980 there were 17 females and 39 males so the result again could be real.

Other significant SEX effects occurred only for one of the years so are probably just chance events depending on the particular students attempting the courses.

4.6 Percent Variation Explained by Principal Component Scores

As was the case for correlations, the % variation explained by Principal Component Scores did not assist in prediction of student achievement, so is not presented in detail. Percent variation explained when each component is used alone in the regression followed the same pattern as the correlation coefficients, already discussed in section 4.2, because of the equivalence of the two measures

for regressions with a single independent variable. Thus there is no need to discuss this again.

When all three PC Scores were included in the regression the % variation explained was in many cases approximately the sum of the individual percentages. This confirmed that the three components were indeed acting fairly independently. However components 2 and 3 usually contributed little to this sum, and any total percentages greater than those for TES or ASAT regressions were not consistent over the three years.

TABLE 4.1

Correlations between marks obtained in A.N.U. units and the seven college variables - 1978

A.N.U. unit or group of units	No. of students	TES	ASAT Verbal	ASAT Quant.	ASAT Total	P. Rec. Academic	P. Rec. Personal	P. Rec. Overall
History 1 units	54	0.69***	0.50***	0.21	0.34*	0.54***	0.43**	0.56***
Anthropology 1	20	0.48*	0.12	0.09	0.14	0.67**	0.54*	0.61**
Geography 1 units	13	0.59*	-0.14	0.49	0.34	0.08	0.11	-0.12
Political Science 1	31	0.56**	0.52**	0.20	0.38*	0.51**	0.56**	0.58***
Sociology 1	27	0.73***	0.59**	0.42*	0.54**	0.26	0.46*	0.32
Philosophy A1	18	0.29	0.03	-0.03	-0.02	0.17	0.19	0.22
English 1	38	0.63***	0.33*	0.28	0.35*	0.55***	0.56***	0.66***
Linguistics 1 units	12	0.82**	0.74**	0.13	0.36	0.66*	0.43	0.45
Romance languages	10	-0.28	-0.12	-0.26	-0.20	-0.21	-0.17	-0.26
Economics 1	43	0.27	0.34*	0.16	0.27	0.09	0.19	0.15
Accounting 1	20	0.37	0.40	0.28	0.36	0.30	0.37	0.27
Economic History 1	15	0.53*	0.43	0.52*	0.55*	0.45	0.10	0.09
Statistics A01/1	38	0.41*	0.20	0.23	0.27	0.29	0.12	0.16
Statistics A01/2	20	0.36	0.05	0.32	0.25	0.20	0.29	0.10
Statistics A02	31	0.43*	0.13	0.48**	0.38*	0.48**	0.35	0.34
Statistics A03	20	0.30	-0.04	0.31	0.10	-0.10	0.28	-0.02

TABLE 4.1 (cont.)

<u>A.N.U. unit or group of units</u>	<u>No. of students</u>	<u>TES</u>	<u>ASAT Verbal</u>	<u>ASAT Quant.</u>	<u>ASAT Total</u>	<u>P. Rec. Academic</u>	<u>P. Rec. Personal</u>	<u>P. Rec. Overall</u>
Legal Method	30	0.23	0.50**	0.28	0.40*	-0.25	0.05	-0.07
Constitutional Law & Civil Rights	28	0.52**	0.62***	0.65***	0.73***	0.12	0.12	0.21
Contracts	29	0.19	0.32	0.30	0.35	-0.22	0.10	-0.15
Pure Maths A03	34	0.48**	0.24	0.36*	0.37*	0.37*	0.18	0.26
Pure Maths A04	28	0.60***	0.41*	-0.05	0.26	0.51**	0.00	0.24
Applied Maths A21 & A22	38	0.70***	0.39*	0.27	0.43**	0.62***	0.31	0.51**
Applied Maths A31H & A32H	17	0.55*	0.36	0.34	0.36	0.50*	0.21	0.23
Physics A01	18	0.45	-0.10	0.34	0.09	0.37	0.01	0.09
Chemistry A01	30	0.61***	0.42*	0.24	0.38*	0.59***	0.47**	0.58***
Chemistry A02	29	0.43*	0.14	0.00	0.13	0.25	0.28	0.33
Botany A01	21	0.62**	0.29	-0.08	0.17	0.40	0.01	0.13
Zoology A01	30	0.58***	0.26	0.15	0.27	0.51**	0.34	0.51**
Psychology A01	36	0.50**	0.09	0.17	0.20	0.22	0.26	0.24

* Significant at $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$

TABLE 4.2

Correlations between marks obtained in A.N.U. units and the seven college variables - 1979

A.N.U. unit or group of units	No. of students	TES	ASAT Verbal	ASAT Quant.	ASAT Total	P. Rec. Academic	P. Rec. Personal	P. Rec. Overall
History 1 units	47	0.56***	0.30*	0.19	0.26	0.16	0.33*	0.35*
Anthropology 1	21	0.68***	0.59**	0.44*	0.54*	0.36	0.32	0.37
Geography 1 units	13	0.70**	0.16	0.30	0.27	0.50	0.61*	0.62*
Political Science 1	34	0.55***	0.33	0.22	0.29	0.40*	0.39*	0.48**
Sociology 1	28	0.72***	0.51**	0.16	0.33	0.32	0.38*	0.35
Philosophy A1	15	0.33	-0.14	0.13	0.05	0.43	0.50	0.56*
English 1	47	0.60***	0.46**	0.16	0.31*	0.47***	0.37*	0.39**
Linguistics 1 units	7	0.54	0.41	0.34	0.38	0.61	0.12	0.50
Romance Languages	20	0.14	-0.04	-0.40	-0.32	0.43	0.20	0.29
Economics 1	59	0.41**	0.29	0.43***	0.41**	0.20	0.07	0.14
Accounting 1	20	0.14	0.04	-0.16	-0.07	0.21	0.00	0.04
Economic History 1	18	0.58*	0.04	0.35	0.26	0.09	0.04	0.18
Statistics A01/1	42	0.73***	0.34*	0.42**	0.42**	0.56***	0.43**	0.54***
Statistics A01/2	38	0.34*	-0.19	0.10	-0.05	-0.05	0.02	0.03
Statistics A02	32	0.56***	0.00	0.13	0.08	0.25	0.16	0.25
Statistics A03	27	0.53**	0.18	0.56**	0.45*	0.24	0.14	0.16

TABLE 4.2 (cont.)

<u>A.N.U. unit or group of units</u>	<u>No. of students</u>	<u>TES</u>	<u>ASAT Verbal</u>	<u>ASAT Quant.</u>	<u>ASAT Total</u>	<u>P. Rec. Academic</u>	<u>P. Rec. Personal</u>	<u>P. Rec. Overall</u>
Legal Method	34	0.25	0.08	0.35*	0.35*	-0.04	0.12	0.13
Constitutional Law & Civil Rights	33	0.45**	0.12	0.43*	0.43*	0.11	0.18	0.21
Contracts	32	0.29	0.08	0.36*	0.36*	-0.10	0.16	0.19
Pure Maths A03	40	0.61***	0.13	0.35*	0.27	0.39*	0.41**	0.39*
Pure Maths A04	37	0.55***	0.11	0.10	0.11	0.39*	0.33*	0.37*
Pure Maths A05H	17	0.77***	0.42	0.71**	0.66**	0.29	0.32	0.40
Pure Maths A06H	13	0.85***	0.55	0.67*	0.73**	0.21	0.38	0.19
Applied Maths A21 & A22	15	-0.05	0.05	0.14	0.12	-0.12	-0.25	-0.36
Applied Maths A31H & A32H	28	0.77***	0.57**	0.51**	0.62***	0.43*	0.45*	0.52**
Computer Science A01	29	0.57**	0.16	0.39*	0.32	0.41*	0.36	0.30
Computer Science A02	21	0.77***	0.55**	0.67***	0.69***	0.55**	0.54*	0.55**
Physics A11	25	0.68***	0.47*	0.68***	0.71***	0.55**	0.45*	0.55**
Chemistry A01	26	0.71***	0.52**	0.65***	0.64***	0.49*	0.45*	0.50**
Chemistry A02	24	0.71***	0.26	0.25	0.32	0.23	0.33	0.35
Botany A01	17	0.73***	0.36	0.28	0.40	0.21	0.30	0.28
Zoology A01	24	0.57**	0.35	0.20	0.35	0.26	0.38	0.32
Psychology A01	35	0.49**	0.29	0.25	0.32	0.43*	0.27	0.39*

* Significant at $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$

TABLE 4.3

Correlations between marks obtained in A.N.U. units and the seven college variables - 1980

<u>A.N.U. unit or group of units</u>	<u>No. of students</u>	<u>TES</u>	<u>ASAT Verbal</u>	<u>ASAT Quant.</u>	<u>ASAT Total</u>	<u>P. Rec. Academic</u>	<u>P. Rec. Personal</u>	<u>P. Rec. Overall</u>
History 1 units	25	0.62**	0.33	0.38	0.43*	0.29	0.42*	0.34
Anthropology 1	19	0.54*	0.28	0.49*	0.47*	0.28	0.10	0.13
Geography 1 units	11	0.39	0.21	0.21	0.25	-0.04	-0.02	-0.11
Political Science 1	30	0.64***	0.52**	0.08	0.29	0.43*	0.52**	0.52**
Sociology 1	31	0.63***	0.38*	0.26	0.36*	0.28	0.19	0.20
Philosophy A1	11	0.40	0.32	0.39	0.46	0.34	-0.06	0.08
English 1 units	61	0.37**	0.50***	0.35**	0.45***	0.24	0.19	0.09
Linguistics 1 units	19	0.74***	0.61**	0.60**	0.63**	0.49*	0.32	0.62**
Romance Languages	12	0.34	-0.01	-0.13	-0.10	0.37	0.28	-0.11
Economics 1	65	0.59***	0.43***	0.36**	0.46***	0.45***	0.54***	0.52***
Accounting 1	23	0.38	0.25	-0.02	0.12	0.43*	0.58**	0.35
Economic History 1	19	0.49*	0.53*	-0.10	0.25	0.60**	0.47*	0.65**
Statistics A01/1	56	0.66***	0.39**	0.60***	0.60***	0.43***	0.57***	0.51***
Statistics A01/2	35	0.43*	0.17	0.36*	0.30	0.38*	0.30	0.43*
Statistics A02	37	0.35*	0.32	0.38*	0.44**	0.28	0.26	0.13
Statistics A03	23	0.02	-0.34	-0.30	-0.35	-0.39	0.14	-0.13

TABLE 4.3 (cont.)

<u>A.N.U. unit or group of units</u>	<u>No. of students</u>	<u>TES</u>	<u>ASAT Verbal</u>	<u>ASAT Quant.</u>	<u>ASAT Total</u>	<u>P. Rec. Academic</u>	<u>P. Rec. Personal</u>	<u>P. Rec. Overall</u>
Legal System & Torts	39	0.39*	0.22	0.24	0.30	0.38*	0.32*	0.26
Contracts	39	0.41**	0.35*	0.59***	0.60***	0.33*	0.18	0.25
Applied Maths A21 & A22	23	0.69***	0.41	0.28	0.37	0.27	0.30	0.36
Applied Maths A31H & A32H	25	0.68***	0.22	-0.04	0.13	0.58**	0.44*	0.49*
Computer Science A01	56	0.67***	0.38**	0.56***	0.53***	0.28*	0.11	0.29*
Computer Science A02	34	0.39*	0.15	0.42*	0.33	0.22	0.02	0.14
Physics A11	21	0.60**	0.23	0.24	0.28	0.42	0.22	0.34
Chemistry A01	36	0.74***	0.05	0.10	0.11	0.57***	0.42*	0.58***
Chemistry A02	25	0.51**	-0.08	0.19	0.06	0.11	0.29	0.48*
Botany A01	23	0.84***	0.38	0.71***	0.64**	0.71***	0.66***	0.81***
Zoology A01	36	0.53***	0.20	0.21	0.24	0.40*	0.14	0.38*
Psychology A01	32	0.43*	0.40*	-0.03	0.21	0.36*	0.36*	0.42*

* Significant at $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$

TABLE 4.4

% variation explained in marks obtained in A.N.U. units by regression against college variables^A - 1978

A.N.U. unit or group of units	No. of students	% variation for Independent variables						SEX B effect
		TES	TES 3 ASAT	3 PREC	TES 3 PREC	TES 3 ASAT 3 PREC		
History 1 units	54	47	48	30	48	48		
Anthropology 1	20	19	5	37	36	23		
Geography 1 units	13	28	39	6	29	12	F 63	
Political Science 1	31	28	46	28	28	39		
Sociology 1	27	51	62	11	53	64		
Philosophy A1	18	3	-	-	-	-		
English 1	38	38	35	40	45	43		
Linguistics 1 units	12	64	53	27	56	47		
Romance Languages	10	-	-	-	-	54	F 74	
Economics 1	43	5	6	-	2	6		
Accounting 1	20	9	3	-	-	-		
Economic History 1	15	23	10	27	33	16		
Statistics A01/1	38	14	11	2	13	8		
Statistics A01/2	20	8	9	-	-	-		
Statistics A02	31	16	29	15	16	23		
Statistics A03	20	4	26	12	28	29	F 40	

TABLE 4.4 (cont.)

A.N.U. unit or group of units	No. of students	% variation for Independent variables						SEX B effect
		TES	TES 3 ASAT	3 PREC	TES 3 PREC	TES 3 ASAT 3 PREC		
Legal Method	30	2	23	-	5	32		
Constitutional Law & Civil Rights	28	24	52	-	36	59		
Contracts	29	-	3	5	6	11		
Pure Maths AO3	34	21	18	7	17	12		
Pure Maths AO4	28	34	50	33	38	47		
Applied Maths A21 & A22	38	47	43	35	53	55		
Applied Maths A31H & A32H	17	25	13	38	40	30		
Physics AO1	18	15	12	25	54	49		
Chemistry AO1	30	34	31	30	34	30		
Chemistry AO2	29	16	10	-	12	4		
Botany AO1	21	35	39	10	36	45		
Zoology AO1	30	32	31	21	32	29		
Psychology AO1	36	23	18	-	21	16		

A 3 ASAT = all 3 ASAT variables used in regression

3 PREC = all 3 Principal's Recommendations used in regression

Blank entries in table indicate residual variance after regression exceeds original variance of marks obtained.

B An entry in this column indicates that adding SEX as a variable significantly increased % variation explained. M = male students performed better; F = female students performed better. Value is % variation explained in 'best' regression including SEX.

TABLE 4.5

% variation explained in marks obtained in A.N.U. units by regression against college variables^A - 1979

A.N.U. unit or group of units	No. of students	% variation for Independent variables						SEX B effect ^B
		TES	TES 3 ASAT	3 PREC	TES 3 PREC	TES 3 ASAT 3 PREC		
History 1 units	47	30	25	13	31	27		
Anthropology 1	21	44	50	1	39	43		
Geography 1 units	13	44	49	27	60	42	F 85	
Political Science 1	34	28	24	16	23	19		
Sociology 1	28	51	54	4	45	49		
Philosophy A1	15	4	1	20	12	34		
English 1	47	35	32	18	34	31		
Linguistics 1 units	7	15	-	-	-	-		
Romance Languages	20	-	9	10	5	1		
Economics 1	59	15	21	-	19	23		
Accounting 1	20	-	21	-	-	39		
Economic History 1	18	30	31	-	45	43		
Statistics A01/1	42	52	49	30	54	52	F 58	
Statistics A01/2	38	9	26	-	17	34		
Statistics A02	32	29	34	-	27	32		
Statistics A03	27	25	46	-	26	54	F 61	

TABLE 4.5 (Cont.)

A.N.U. unit or group of units	No. of students	% variation for Independent variables						SEX B effect
		TES 3 ASAT	TES 3 PREC	TES 3 PREC	TES 3 ASAT	TES 3 PREC		
Legal Method	34	3	1	-	1	6		
Constitutional Law & Civil Rights	33	18	19	-	12	15	M 24	
Contracts	32	6	8	7	15	26		
Pure Maths AO3	40	36	33	11	32	28		
Pure Maths AO4	37	28	27	7	24	24		
Pure Maths AO5H	17	56	62	-	60	75		
Pure Maths AO6H	13	70	70	-	63	94		
Applied Maths A21 & A22	15	-	-	54	52	80		
Applied Maths A31H & A32H	28	58	57	21	58	59		
Computer Science AO1	29	30	22	15	30	24	M 37	
Computer Science AO2	21	57	55	25	54	52		
Physics A11	25	44	50	24	40	52	M 60	
Chemistry AO1	26	49	48	15	43	43		
Chemistry AO2	24	49	49	6	48	47		
Botany AO1	17	50	50	-	61	51		
Zoology AO1	24	29	32	2	26	32		
Psychology AO1	35	21	27	12	24	26		

A,B See footnotes to Table 4.4

TABLE 4.6

% variation explained in marks obtained in A.N.U. units by regression against college variables^A - 1980

A.N.U. unit or group of units	No. of students	% variation for Independent variables					SEX ^B effect
		TES	TES 3 ASAT	TES 3 PREC	TES 3 PREC	TES 3 ASAT 3 PREC	
History 1 units	25	36	32	6	38	56	
Anthropology 1	19	25	16	5	41	25	
Geography 1 units	11	6	8	-	-	40	M 75
Political Science 1	30	39	36	20	34	32	
Sociology 1	31	38	32	-	45	39	
Philosophy A1	11	7	-	-	56	39	
English 1 units	61	12	24	9	16	21	F 32
Linguistics 1 units	19	52	44	29	43	33	
Romance Languages	12	3	-	28	19	-	
Economics 1	65	34	37	27	33	37	
Accounting 1	23	10	9	29	25	19	
Economic History 1	19	20	40	34	36	59	
Statistics A01/1	56	42	46	29	42	47	
Statistics A01/2	35	16	12	12	13	12	
Statistics A02	37	9	11	12	12	18	
Statistics A03	23	-	-	18	14	25	F 40

TABLE 4.6 (cont.)

A.N.U. unit or group of units	No. of students	% variation for Independent variables						SEX B effect
		TES	TES 3 ASAT	3 PREC	TES 3 PREC	TES 3 ASAT 3 PREC		
Legal System & Torts	39	13	8	11	14	8		
Contracts	39	14	35	6	20	35		
Applied Maths A21 & A22	23	45	52	5	38	54		
Applied Maths A31H & A32H	25	44	49	25	45	55		
Computer Science A01	56	44	46	10	46	46	M 49	
Computer Science A02	34	13	14	1	7	6		
Physics A11	21	32	29	5	31	27		
Chemistry A01	36	53	57	31	51	60		
Chemistry A02	25	23	25	47	58	52		
Botany A01	23	70	69	60	74	74		
Zoology A01	36	26	27	17	28	28		
Psychology A01	32	16	27	8	12	27		

A,B See footnotes to Table 4.4

TABLE 4.7

Coefficients from regressions of marks in A.N.U. units
against college variables

<u>A.N.U. unit or</u> <u>group of units</u>	<u>College</u> <u>variable</u>	<u>Coefficients for</u>		
		<u>1978</u>	<u>1979</u>	<u>1980</u>
Statistics A03	TES	0.43	0.42	-0.11
	ASAT Verbal	1.07	0.70	-3.31
	ASAT Quant.	2.43	2.76	-5.61
	ASAT Total	-3.64	-2.74	7.77
	P.Rec. Academic	-7.01	4.25	-11.29
	P.Rec. Personal	12.81	3.09	7.65
	P.Rec. Overall	-6.40	-12.69	2.03
Contracts	TES	0.00	0.04	0.14
	ASAT Verbal	-0.43	-2.46	-0.16
	ASAT Quant.	-0.92	-3.47	-0.03
	ASAT Total	1.59	5.71	0.66
	P.Rec. Academic	-3.13	-8.91	1.60
	P.Rec. Personal	7.86	0.60	-6.03
	P.Rec. Overall	-6.93	10.29	1.46
Applied Maths A21 & A22	TES	0.46	-1.15	0.51
	ASAT Verbal	0.30	-4.91	-10.65
	ASAT Quant.	1.02	4.68	-15.53
	ASAT Total	-1.17	2.77	22.84
	P.Rec. Academic	-1.25	-18.90	4.49
	P.Rec. Personal	-9.63	65.62	-5.63
	P.Rec. Overall	10.08	-39.71	-5.69

CHAPTER 5

GRADE SCORES AND THEIR PREDICTION

5.1 Grade Scores

In chapter 4 we have seen that restricting attention to individual A.N.U. units or small groups of units leads to highly variable results. Also the consequent small numbers of students in many analyses tend to produce spurious relationships not consistent from year to year. Thus some means of combining results from the wide range of units to obtain measures of achievement of students was required, so relationships between these measures and the college variables could then be investigated.

Various methods of combining results from examinations where students have selected the courses from a number of options have been discussed in the literature. Murgatroyd (1975) described an iterative procedure of additive adjustment, whereby marks in each subject are adjusted so that the subject average becomes equal to the average of overall averages of the students who took the subject. Such a procedure would be possible for certain subsets of our data, but would be difficult with the large number of units with very few students. Also, not having marks available for some failures, all withdrawals and for certain units (see section 2.3) would distort any measure of achievement based on such adjustment of marks. Cornish (1980) and Foyster (1980) discuss a range of other methods

available to adjust marks, but all of these depend upon having all, or nearly all, the raw marks available.

Consequently we defined our own measure of student achievement at A.N.U., which we have called a 'grade score'. Variation in actual marks between different units suggested that a more reliable indication of level of achievement was the grade obtained (HD,D,...,W). Also by using grades, information on all results, including failures and withdrawals, could be incorporated. Inclusion of withdrawals in the score could arouse some controversy. As justification for such inclusion, the student results were very carefully checked and only withdrawals which led to a student then attempting a lower than normal workload in first year (8 points or 4 full-year units) were included. Excluded, for example, were transfers to a lower stream, say 'honours' to 'pass' level, where the 'honours' unit appears in the student record as a withdrawal. Thus the remaining withdrawals were clearly failure of the student to complete the usual number of units, for whatever reason.

For each student, all or some of the grades obtained can be used to calculate a grade score. This score is defined as the weighted mean score over the results obtained in the group of units being considered, where

weight = point value of unit (2 or 1)

score = 4 for HD

3.5 for D, HM

3 for CR, PM

2 for P, P1

1.5 for P2

1 for N, W.

Thus, for example, if a student received the results :

Pure Maths A03 (weight 1)	:	D
Pure Maths A04 (1)	:	P
Botany A01 (2)	:	CR
Zoology A01 (2)	:	P
Chemistry A01 (2)	:	HD

his overall grade score would be 2.94, his score for Mathematical sciences would be 2.75 and his score for Empirical sciences would be 3.00.

In the study, eleven meaningful groupings of A.N.U. units were defined. Some were based on faculty and others on general subject area. For most of the groupings, numbers of students receiving a grade score were sufficient for analyses to be reasonably independent of the minor data distortions which caused problems in analysing the unit marks. The groupings used were :

All units

- | | |
|--------------------------------|--|
| Arts units | - all units offered by departments within the Faculty of Arts |
| Asian Studies units | - all units offered by departments within the Faculty of Asian Studies |
| Non-language units | - all non-language units from the faculties of Arts and Asian Studies |
| Language units | - all language units from the faculties of Arts and Asian Studies |
| Economics units | - all units offered by departments within the Faculty of Economics |
| Economics excluding Statistics | - Economics 1 & 1H, Accounting 1, Economic History 1 |

- | | |
|-----------------------|---|
| Law units | - all units offered by departments within the Faculty of Law |
| Science units | - all units offered by departments within the Faculty of Science |
| Mathematical sciences | - units in Pure Maths, Applied Maths, Statistics and Computer Science |
| Empirical sciences | - units in the Faculty of Science not in the Mathematical sciences. |

Frequencies of grades obtained in the above groupings have already been given in Tables 2.6, 2.7 and 2.8, and frequencies for each unit in Appendix 2. For the grade score to be a valid measure of student achievement across disciplines, the range of results obtained needs to be reasonably similar for all units contributing to the score. In two of the above groupings this may not be the case, hence grade scores may need to be interpreted with caution. Firstly, the grouping of all units incorporates results from some Economics units with very high failure rates and from Law units with relatively low failure rates. Thus students attempting units in those areas may be disadvantaged or advantaged in grade score merely by their choice of units. In the case of Law, this probably doesn't matter as the students were selected from the top 15% of TES for admission to A.N.U. Secondly the grouping 'Faculty of Economics' causes problems because Statistics units have much lower failure rates and much higher proportions of HD, D and CR than other Economics units. Thus more emphasis should be placed on 'Economics excluding Statistics' and 'Mathematical sciences', which includes Statistics, than

on the faculty grouping.

Mean grade scores for the eleven groupings of units and the three years of the study are presented in Tables 5.1, 5.2 and 5.3 for each 5% percentile range of TES. The general decrease in grade score as TES decreases is obvious for all groupings except Asian Studies and Language units, where numbers of students are very low. Grade scores for Economics and Economics excluding Statistics are particularly low, and grade scores for Mathematical sciences tend to be higher than those for Empirical sciences.

Many different ways of attaching a score to a grade obtained could be proposed, leading to many different grade scores. However it is clear from Tables 5.1, 5.2 and 5.3 that our grade score successfully reflects results and is probably as good as most other grade scores would be for the purposes of this study.

5.2 Correlations with College Variables

Correlations of grade scores for the eleven groupings of units with the seven college variables are presented in Tables 5.4, 5.5 and 5.6. In all groups except Law, the TES correlation is greater than the other six correlations. The highest correlation in the Law group is with ASAT Total in 1978 and 1980 and Principal's Recommendation Overall in 1979. This is consistent with observations made about Law units in chapter 4.

Groupings of units from Economics and Science show the highest correlations. TES and Principal's

Recommendations correlate highly significantly with grade scores for these five groupings in almost all instances. Additionally many ASAT correlations are highly significant, particularly in 1979 and 1980.

The groups based on the faculties of Arts and Asian Studies show much less definite results. 'Asian Studies units' and 'Language units' have low numbers of students and in only one case is a correlation significant (TES for Asian Studies in 1980). Because of these low numbers the groups 'Arts units' and 'Non-language units' have a substantial overlap and consequently have similar results. Correlations with TES are all highly significant, however other correlations are much lower and are significant in only some instances.

'All units' reflects the overall pattern with greater weight where there are more students. Consequently all its correlations are highly significant except for ASAT in 1978, where few significances were observed in any group.

Principal Component Scores were also correlated with grade scores for these eleven groups, but as was the case for marks in chapter 4 the results were disappointing. Correlations of the first PC Score with grade score were significant in many instances, but for all groups except Law units were less than the correlation with TES. Even for Law units, correlations were less than those with ASAT total in 1978 and 1980, however the 1979 correlation of 0.53 was greater than each of the correlations with the seven individual variables. Consequently the first component is generally inferior to TES, or to ASAT for Law units, so the correlations are not presented.

For the second and third PC Scores, only six correlations were significant for the three years. Correlations between the third PC Score and the Mathematical sciences grade score were significant in two of the three years; -0.27 ($P < 0.001$) in 1979 and -0.18 ($P < 0.05$) in 1980. This corresponds to students doing relatively better in ASAT quantitative than ASAT verbal and is not surprising in mathematics. However values of the correlations are too low to be of any use. The other four significant correlations occurred at random for only one year and are probably not meaningful.

5.3 Percent Variation Explained by College Variables

Procedures as discussed in section 4.4 were also applied to the eleven grade scores. Consideration was given to using the total number of points of the units each student attempted in a grouping as weights in the regression analyses. However it was decided that each student should have equal weight as individual student achievement, rather than overall level of achievement, is of major interest.

In Tables 5.7, 5.8 and 5.9 the % variation explained by six different combinations of college variables is presented. Again TES is the only single variable included, and the relative magnitudes of % variations explained can be inferred from correlations in Tables 5.4, 5.5 and 5.6.

Percent variation explained by TES alone is as great or almost as great as for any other combination of independent variables in all cases except Law units, Economics excluding Statistics in 1978 and Asian Studies

units in 1980. Excluding these three, explaining an extra 1 to 3% of variation by adding up to six extra variables is of no practical importance, and in any case the results are not consistent over the three years. For the Law units, adding 3 ASAT or 3 PREC does increase % variation explained, consistent with the pattern observed for correlation coefficients. The increase induced by 3 ASAT in 1978 in Economics excluding Statistics is confined to that year only, and the 18% explained is not high. Low numbers of students in Asian Studies mean the increase there in 1980 is probably only due to the particular 15 students involved.

It is interesting that a significant SEX effect for 'All units' was observed in all three years, based mainly on Arts and Empirical sciences in 1978, on Economics excluding Statistics and Empirical sciences in 1979, and probably on a combination of groups with effects not quite significant in themselves in 1980. Females have thus performed consistently better over the three years, however with only 1 to 4 percent of extra variation explained this is not of any practical predictive value.

Similarly to the regressions involving actual marks obtained, no useful results arose from regressions of grade scores against the three Principal Component Scores. In all cases but Law units, TES alone explained more variation than the three components together in the regression. For Law units, either adding 3 ASAT or 3 PREC explained more variation than the regression on the three PC scores.

5.4 Correlations for Marginal Students

All the preceding correlations and regression analyses have included all students, from the very top to those whose TES was only just sufficient to obtain a place at A.N.U. Naturally the A.N.U. Admissions Committee only considers in more detail those students whose TES is in the borderline area. Also the results to date suggest that many of the significant relationships may be primarily due to the high levels of achievement of the best students.

It is thus of interest to attempt to exclude the better students and see if the relationships still hold. Ideally we would like to consider only the students below the top 40% by TES, that is, those who came under closer scrutiny when admitted. However there are not enough of those to consider alone, so students with TES not too far above borderline levels must be included in such analyses.

When the top 20% or 30% by TES of students are excluded, only the grade scores for seven of the groupings provide enough data for meaningful analysis; Asian Studies units, Language units, Economics excluding Statistics and Law units cannot be considered. Accordingly, in Tables 5.10, 5.11 and 5.12 the correlation coefficients between these seven grade scores and the college variables are given when students with $TES > 291$ in 1978, and $TES > 292$ in 1979 and 1980 are excluded. Correlations of grade scores with TES are still significant in some cases for results from Economics and Science faculties, however no correlations for grade scores based on Arts and Asian Studies units are significant. ASAT correlations have virtually disappeared,

and those with Principal's Recommendations are, when significant, less than TES correlations in 1980. Only in 1978 for Empirical sciences are correlations for Principal's Recommendations significant and greater than TES correlations.

When students in the top 30% by TES are excluded (TES > 276 in 1978, TES > 277 in 1979, TES > 274 in 1980), most correlations then cease to be significant, as seen in Tables 5.13, 5.14 and 5.15. Numbers of students are still at least 40 in all but one instance so should be sufficient to detect any trends. However the few significant correlations are not consistent, occurring only for one year of the three. Thus at this level the ability of any of the college variables to predict A.N.U. achievement is dubious. If consistent relationships cannot be found for students who received TES below about 275, then it is highly unlikely that any consistent relationships would exist for the truly marginal students, those with TES between 240 and 260.

TABLE 5.1

Mean grade scores for students in each 5% percentile of TES - 1978

TES Percentile	TES Range	All units		Arts units		Asian Studies units		Non-language units		Language units	
		No.	Score	No.	Score	No.	Score	No.	Score	No.	Score
0-5	360-332	24	2.81	10	2.97	3	3.00	11	2.98	2	3.00
5-10	331-313	37	2.24	15	2.64	2	1.67	14	2.58	5	2.46
10-15	312-302	33	2.31	22	2.50	3	3.00	23	2.44	4	3.50
15-20	301-292	27	2.21	13	2.32	1	3.25	13	2.38	2	2.25
20-25	291-284	25	1.95	12	2.43	1	1.00	12	2.40	3	1.83
25-30	283-277	21	1.90	12	1.95	0	-	11	2.00	1	1.00
30-35	276-270	19	2.16	13	2.36	4	2.50	12	2.19	5	3.00
35-40	269-265	20	1.88	15	2.00	3	2.50	16	1.97	4	2.50
40-45	264-259	16	1.82	10	1.98	1	1.00	10	1.88	2	2.25
45-50	258-253	11	1.73	5	2.13	0	-	4	1.89	2	2.83
>50	<253	6	1.55	5	1.54	0	-	5	1.54	0	-
OVERALL		239	2.15	132	2.30	18	2.45	131	2.27	30	2.68

A. 'No.' is number of students who attempted one or more units in the grouping.

TABLE 5.1 (cont.)

Mean grade scores for students in each 5% percentile of TES - 1978

<u>TES</u> <u>Percentile</u>	<u>TES</u> <u>Range</u>	<u>Economics</u> <u>units</u>		<u>Economics</u> <u>excluding</u> <u>Statistics</u>		<u>Law</u> <u>units</u>		<u>Science</u> <u>units</u>		<u>Mathematical</u> <u>sciences</u>		<u>Empirical</u> <u>sciences</u>	
		<u>No.</u>	<u>Score</u>	<u>No.</u>	<u>Score</u>	<u>No.</u>	<u>Score</u>	<u>No.</u>	<u>Score</u>	<u>No.</u>	<u>Score</u>	<u>No.</u>	<u>Score</u>
0-5	360-332	4	2.88	3	2.70	9	2.57	17	2.81	15	3.02	15	2.67
5-10	331-313	11	2.06	10	1.75	11	2.04	22	2.16	25	2.43	18	2.03
10-15	312-302	7	2.02	5	1.63	11	2.30	14	2.06	12	2.42	11	1.94
15-20	301-292	11	2.19	6	1.82	0	-	20	2.10	19	2.36	15	2.05
20-25	291-284	13	1.88	10	1.72	0	-	14	1.65	16	1.93	12	1.67
25-30	283-277	11	1.79	7	1.44	0	-	16	1.95	16	2.12	13	2.00
30-35	276-270	5	1.70	3	1.60	0	-	10	2.05	10	1.98	9	2.03
35-40	269-265	8	1.60	5	1.70	0	-	12	1.71	9	1.62	11	1.66
40-45	264-259	6	1.91	4	1.71	0	-	9	1.62	7	2.00	8	1.60
45-50	258-253	3	1.53	2	1.50	0	-	8	1.58	6	1.56	8	1.58
>50	<253	0	-	0	-	0	-	2	1.57	2	1.67	2	1.50
OVERALL		79	1.93	55	1.71	31	2.29	144	2.06	137	2.29	122	1.96

TABLE 5.2

Mean grade scores for students in each 5% percentile of TES - 1972

TES Percentile	TES Range	All units		Arts units		Asian Studies units		Non-language units		Language units	
		No.	Score	No.	Score	No.	Score	No.	Score	No.	Score
0-5	412-334	37	3.06	15	3.14	1	4.00	14	3.16	6	3.19
5-10	333-316	30	2.57	8	2.85	0	-	8	2.85	0	-
10-15	315-302	38	2.27	21	2.51	1	4.00	21	2.57	4	2.38
15-20	301-293	22	2.26	14	2.49	2	1.58	14	2.34	7	2.43
20-25	292-285	23	2.17	8	2.53	1	4.00	7	2.37	4	3.07
25-30	284-278	24	1.99	15	2.18	3	2.00	15	2.16	3	2.29
30-35	277-271	25	1.86	13	2.14	0	-	12	2.04	2	3.50
35-40	270-264	21	1.74	8	2.14	1	3.50	8	2.13	2	2.50
40-45	263-258	15	1.82	10	1.96	3	2.38	11	2.12	3	1.44
45-50	257-253	17	1.81	9	1.96	4	2.63	10	1.88	3	3.13
750	<253	6	1.59	2	2.00	1	1.50	1	1.50	2	2.00
OVERALL		258	2.23	123	2.41	17	2.35	121	2.36	36	2.61

A. 'No.' is number of students who attempted one or more units in the grouping.

TABLE 5.2 (cont.)

Mean grade scores for students in each 5% percentile of TES - 1979

TES Percentile	TES Range	Economics units		Economics excluding Statistics		Law units		Science units		Mathematical sciences		Empirical sciences	
		No.	Score	No.	Score	No.	Score	No.	Score	No.	Score	No.	Score
0-5	412-334	11	2.81	9	2.54	10	2.50	20	3.24	24	3.41	15	3.05
5-10	333-316	11	2.43	7	1.88	8	2.42	18	2.57	23	2.85	17	2.35
10-15	315-302	13	2.08	12	1.83	14	2.01	14	2.20	18	2.39	12	2.05
15-20	301-293	5	2.11	4	1.88	3	1.75	11	2.27	9	2.61	11	2.09
20-25	292-285	11	1.88	5	1.63	0	-	19	2.07	16	2.09	16	2.06
25-30	284-278	11	1.89	6	1.60	0	-	12	1.70	13	2.16	10	1.62
30-35	277-271	11	1.93	10	1.76	0	-	16	1.57	17	2.04	13	1.48
35-40	270-264	10	1.50	8	1.36	0	-	12	1.61	14	1.76	9	1.55
40-45	263-258	10	1.49	7	1.42	0	-	5	1.82	8	1.57	3	1.93
45-50	257-253	9	1.49	7	1.31	0	-	7	1.79	9	1.89	5	1.78
>50	<253	4	1.38	2	1.40	0	-	4	1.69	6	1.75	3	1.42
OVERALL		106	1.91	77	1.68	35	2.21	138	2.24	157	2.45	114	2.05

TABLE 5.3

Mean grade scores for students in each 5% percentile of TES - 1980

TES Percentile	TES Range	All units		Arts units		Asian Studies units		Non-language units		Language units	
		No. ^A	Score	No.	Score	No.	Score	No.	Score	No.	Score
0-5	384-336	34	2.82	5	3.08	1	3.75	5	3.09	2	3.50
5-10	335-316	35	2.48	11	2.54	0	-	10	2.64	3	1.83
10-15	315-303	32	2.26	12	2.38	2	1.83	11	2.32	7	2.35
15-20	302-293	27	2.13	13	2.26	1	3.00	13	2.26	5	2.41
20-25	292-283	29	2.08	13	2.14	4	2.25	12	2.03	5	2.90
25-30	282-275	24	2.04	11	2.13	1	1.00	10	2.08	2	2.11
30-35	274-268	23	1.83	10	1.93	0	-	9	1.74	3	3.00
35-40	267-261	21	1.71	12	1.97	1	1.00	11	1.89	2	2.25
40-45	260-256	21	1.89	9	2.17	1	1.00	9	2.08	3	2.30
45-50	255-250	19	1.74	9	2.12	3	1.75	9	2.05	3	2.14
>50	<250	7	1.38	4	1.68	1	1.00	4	1.68	1	1.00
OVERALL		272	2.15	109	2.21	15	1.98	103	2.14	36	2.42

A. 'No.' is number of students who attempted one or more units in the grouping.

TABLE 5.3 (cont.)

Mean grade scores for students in each 5% percentile of TES - 1980

<u>TES</u> <u>Percentile</u>	<u>TES</u> <u>Range</u>	<u>Economics</u> <u>units</u>		<u>Economics</u> <u>excluding</u> <u>Statistics</u>		<u>Law</u> <u>units</u>		<u>Science</u> <u>units</u>		<u>Mathematical</u> <u>sciences</u>		<u>Empirical</u> <u>sciences</u>	
		<u>No.</u>	<u>Score</u>	<u>No.</u>	<u>Score</u>	<u>No.</u>	<u>Score</u>	<u>No.</u>	<u>Score</u>	<u>No.</u>	<u>Score</u>	<u>No.</u>	<u>Score</u>
0-5	384-336	16	2.50	12	2.20	12	2.50	21	3.00	28	3.05	14	2.88
5-10	335-316	13	2.24	9	1.83	12	2.00	20	2.72	23	2.87	18	2.57
10-15	315-303	13	2.42	9	2.09	10	1.85	17	2.31	21	2.56	13	2.19
15-20	302-293	8	1.83	7	1.60	10	1.74	15	2.41	15	2.44	12	2.22
20-25	292-283	14	1.83	11	1.67	0	-	18	2.21	19	2.28	12	2.11
25-30	282-275	13	1.78	9	1.63	0	-	14	2.20	14	2.18	11	2.15
30-35	274-268	13	1.59	9	1.43	0	-	15	1.99	17	2.01	12	1.96
35-40	267-261	8	1.34	5	1.25	0	-	9	1.64	11	1.45	8	1.68
40-45	260-256	8	1.50	6	1.40	0	-	10	1.88	10	1.78	9	1.93
45-50	255-250	10	1.54	7	1.25	0	-	13	1.57	12	1.91	11	1.54
>50	<250	4	1.26	4	1.14	0	-	4	1.00	4	1.38	2	1.00
OVERALL		120	1.86	88	1.62	44	2.04	156	2.30	174	2.45	122	2.14

TABLE 5.4

Correlations between A.N.U. grade scores and the seven college variables - 1978

<u>Group of A.N.U. units</u>	<u>No. of students</u>	<u>TES</u>	<u>ASAT Verbal</u>	<u>ASAT Quant.</u>	<u>ASAT Total</u>	<u>P. Rec. Academic</u>	<u>P. Rec. Personal</u>	<u>P. Rec. Overall</u>
All units	237	0.42***	0.19**	0.09	0.15*	0.36***	0.32***	0.34***
Arts units	131	0.38***	0.18*	0.12	0.16	0.27**	0.27**	0.29***
Asian Studies units	18	0.25	0.10	0.15	0.15	0.28	0.12	0.18
Non-language units	130	0.42***	0.23**	0.17	0.22*	0.32***	0.33***	0.33***
Language units	30	0.11	0.02	-0.08	-0.06	0.09	0.08	0.05
Economics units	79	0.40***	0.11	0.26*	0.25*	0.32**	0.31**	0.30**
Economics excluding Statistics	55	0.33*	0.32*	0.11	0.24	0.21	0.25	0.24
Law units	31	0.17	0.31	0.30	0.35	-0.05	0.19	0.08
Science units	142	0.40***	0.04	0.08	0.08	0.34***	0.28***	0.27**
Mathematical sciences	136	0.48***	0.15	0.24**	0.23**	0.40***	0.33***	0.33***
Empirical sciences	120	0.34***	0.10	0.07	0.10	0.33***	0.25**	0.25**

* Significant at $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$

TABLE 5.5

Correlations between A.N.U. grade scores and the seven college variables - 1979

Group of A.N.U. units	No. of students	TES	ASAT Verbal	ASAT Quant.	ASAT Total	P. Rec. Academic	P. Rec. Personal	P. Rec. Overall
All units	258	0.57***	0.27***	0.28***	0.33***	0.31***	0.31***	0.35***
Arts units	123	0.48***	0.23*	0.22*	0.26**	0.21*	0.25**	0.31***
Asian Studies units	17	0.33	0.12	0.12	0.12	0.01	0.03	0.13
Non-language units	121	0.54***	0.31***	0.28**	0.34***	0.23*	0.29**	0.34***
Language units	36	0.25	-0.03	0.05	0.02	-0.10	-0.05	-0.06
Economics units	106	0.56***	0.21*	0.43***	0.38***	0.28**	0.29**	0.33***
Economics excluding Statistics	77	0.52***	0.23*	0.42***	0.38***	0.29*	0.20	0.26*
Law units	35	0.43*	0.26	0.36*	0.42*	0.20	0.34*	0.47**
Science units	138	0.61***	0.25**	0.37***	0.39***	0.44***	0.34***	0.41***
Mathematical sciences	157	0.65***	0.23**	0.48***	0.42***	0.34***	0.31***	0.35***
Empirical sciences	114	0.55***	0.32***	0.30**	0.38***	0.37***	0.26**	0.35***

* Significant at $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$

TABLE 5.6

Correlations between A.N.U. grade scores and the seven college variables - 1980

<u>Group of A.N.U. units</u>	<u>No. of students</u>	<u>TES</u>	<u>ASAT Verbal</u>	<u>ASAT Quant.</u>	<u>ASAT Total</u>	<u>P. Rec. Academic</u>	<u>P. Rec. Personal</u>	<u>P. Rec. Overall</u>
All units	272	0.53***	0.28***	0.29***	0.33***	0.35***	0.35***	0.36***
Arts units	109	0.36***	0.13	0.10	0.13	0.19*	0.21*	0.14
Asian Studies units	15	0.62*	0.08	0.36	0.31	0.28	0.45	0.35
Non-language units	103	0.39***	0.20*	0.18	0.22*	0.23*	0.26**	0.22*
Language units	36	0.14	-0.11	-0.05	-0.08	-0.03	-0.19	-0.21
Economics units	120	0.64***	0.32***	0.41***	0.42***	0.43***	0.52***	0.50***
Economics excluding Statistics	88	0.56***	0.36***	0.37***	0.43***	0.39***	0.45***	0.41***
Law units	44	0.49***	0.36*	0.59***	0.62***	0.16	0.09	0.18
Science units	156	0.53***	0.22**	0.23**	0.27***	0.34***	0.37**	0.38***
Mathematical sciences	174	0.62***	0.29***	0.43***	0.42***	0.36***	0.39***	0.39***
Empirical sciences	122	0.46***	0.19*	0.09	0.15	0.29**	0.40***	0.37***

* Significant at $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$

TABLE 5.7

% variation explained in A.N.U. grade scores by regression against college variables^A - 1978

Group of A.N.U. units	No. of students	TES	% variation for Independent variables						SEX effect ^B
			3 ASAT	TES	3 ASAT	3 PREC	TES	3 PREC	
All units	237	17	2	18	13	18	18	18	F 22
Arts units	131	14	1	13	7	12	11	11	F 19
Asian Studies units	18	1	-	-	-	-	-	-	
Non-language units	130	17	4	16	11	16	15	15	F 20
Language units	30	-	-	-	-	-	-	-	
Economics units	79	15	5	14	8	13	12	12	
Economics excluding Statistics	55	9	10	18	1	6	15	15	
Law units	31	-	7	4	-	-	2	2	
Science units	142	16	-	17	11	16	18	18	
Mathematical sciences	136	23	4	22	15	22	22	22	
Empirical sciences	120	11	-	11	10	12	12	12	F 17

A 3 ASAT = all 3 ASAT variables used in regression

3 PREC = all 3 Principal's Recommendations used in regression

Blank entries in table indicate residual variance after regression exceeds original variance of grade scores.

B An entry in this column indicates that SEX as a variable significantly increased % variation explained. M = male students performed better; F = female students performed better. Value is % variation explained by 'best' regression including SEX.

TABLE 5.8

% variation explained in A.N.U. grade scores by regression against college variables^A - 1979

Group of A.N.U. units	No. of students	% variation for Independent variables						SEX effect ^B
		TES	3 ASAT	TES	3 PREC	TES	3 ASAT	
All units	258	32	10	32	11	33	32	F 35
Arts units	123	23	5	21	8	25	23	
Asian Studies units	17	5	-	-	-	-	-	
Non-language units	121	28	10	27	10	29	28	
Language units	36	4	-	2	-	6	3	
Economics units	106	31	17	33	8	30	32	
Economics excluding Statistics	77	26	15	28	5	27	30	F 32
Law units	35	16	15	19	22	27	40	
Science units	138	37	14	36	17	38	37	
Mathematical sciences	157	42	21	43	11	44	44	
Empirical sciences	114	29	13	30	12	29	32	F 34

A,B See footnotes to Table 5.7

TABLE 5.9

% variation explained in A.N.U. grade scores by regression against college variables^A - 1980

Group of A.N.U. units	No. of students	% variation for Independent variables						SEX effect ^B
		TES	3 ASAT	TES	3 ASAT	TES	3 ASAT	
All units	272	28	11	29	13	27	28	F 30
Arts units	109	12	-	9	4	12	10	
Asian Studies units	15	34	5	44	-	17	39	F 59
Non-language units	103	14	3	12	5	13	10	
Language units	36	-	-	-	-	8	11	
Economics units	120	40	17	41	26	40	40	
Economics excluding Statistics	88	30	16	33	18	29	32	
Law units	44	23	36	40	1	30	43	
Science units	156	28	8	28	14	28	28	
Mathematical sciences	174	38	18	38	15	37	37	
Empirical sciences	122	21	6	24	14	22	25	

A,B See footnotes to Table 5.7

TABLE 5.10

Correlations between A.N.U. grade scores and the seven college variables - 1978

Students in top 20% by TES excluded

<u>Group of A.N.U. units</u>	<u>No. of students</u>	<u>TES</u>	<u>ASAT Verbal</u>	<u>ASAT Quant.</u>	<u>ASAT Total</u>	<u>P. Rec. Academic</u>	<u>P. Rec. Personal</u>	<u>P. Rec. Overall</u>
All units	116	0.13	0.01	-0.06	-0.04	0.23*	0.17	0.18
Arts units	71	0.18	0.03	-0.02	-0.01	0.13	0.08	0.12
Non-language units	69	0.20	0.08	0.07	0.09	0.15	0.16	0.16
Economics units	46	0.20	-0.12	0.30*	0.15	0.10	-0.01	0.07
Science units	69	0.14	-0.10	-0.05	-0.09	0.27*	0.25*	0.22
Mathematical sciences	65	0.21	-0.10	0.11	0.01	0.13	0.11	0.08
Empirical sciences	61	0.14	0.00	-0.05	-0.04	0.31*	0.26*	0.24

* Significant at $P < 0.05$

TABLE 5.11

Correlations between A.N.U. grade scores and the seven college variables - 1979

Students in top 20% by TES excluded

<u>Group of A.N.U. units</u>	<u>No. of students</u>	<u>TES</u>	<u>ASAT Verbal</u>	<u>ASAT Quant.</u>	<u>ASAT Total</u>	<u>P. Rec. Academic</u>	<u>P. Rec. Personal</u>	<u>P. Rec. Overall</u>
All units	131	0.25**	0.02	-0.02	-0.01	-0.04	-0.06	-0.01
Arts units	65	0.21	0.03	0.06	0.06	-0.12	-0.03	0.05
Non-language units	64	0.20	0.13	0.17	0.18	-0.12	-0.01	0.04
Economics units	66	0.42***	-0.02	0.13	0.06	0.03	0.12	0.08
Science units	75	0.16	-0.08	-0.05	-0.09	-0.01	-0.11	0.02
Mathematical sciences	83	0.25*	-0.14	0.06	-0.05	-0.08	-0.06	-0.05
Empirical sciences	59	0.14	0.02	-0.05	-0.04	-0.13	-0.23	-0.07

* Significant at $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$

TABLE 5.12

Correlations between A.N.U. grade scores and the seven college variables - 1980

Students in top 20% by TES excluded

<u>Group of A.N.U. units</u>	<u>No. of students</u>	<u>TES</u>	<u>ASAT Verbal</u>	<u>ASAT Quant.</u>	<u>ASAT Total</u>	<u>P. Rec. Academic</u>	<u>P. Rec. Personal</u>	<u>P. Rec. Overall</u>
All units	144	0.25**	0.12	-0.08	0.01	0.12	0.17*	0.10
Arts units	68	0.10	0.02	-0.05	-0.03	-0.05	0.00	-0.13
Non-language units	64	0.10	0.08	-0.05	0.00	0.00	0.05	-0.02
Economics units	70	0.39***	0.09	-0.01	0.04	0.14	0.38**	0.28*
Science units	83	0.39***	0.14	-0.17	-0.04	0.22*	0.29**	0.23*
Mathematical sciences	87	0.29**	0.08	0.04	0.07	0.05	0.19	0.07
Empirical sciences	65	0.37**	0.14	-0.27*	-0.11	0.14	0.28*	0.16

* Significant at $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$

TABLE 5.13

Correlations between A.N.U. grade scores and the seven college variables - 1978

Students in top 30% by TES excluded

Group of A.N.U. units	No. of students	TES	ASAT Verbal	ASAT Quant.	ASAT Total	P. Rec. Academic	P. Rec. Personal	P. Rec. Overall
All units	72	0.23*	0.03	-0.10	-0.05	0.18	0.19	0.20
Arts units	48	0.14	0.11	-0.07	0.01	0.09	0.04	0.09
Non-language units	47	0.10	0.20	0.07	0.16	0.10	0.06	0.08
Economics units	22	0.00	0.03	-0.02	0.01	-0.19	0.02	0.03
Science units	41	0.23	-0.16	-0.22	-0.23	0.12	0.39*	0.23
Mathematical Sciences	34	0.23	-0.11	-0.07	-0.11	0.05	0.23	0.11
Empirical Sciences	38	0.19	-0.01	-0.16	-0.13	0.18	0.41**	0.29

* Significant at $P < 0.05$; ** $P < 0.01$

TABLE 5.14

Correlations between A.N.U. grade scores and the seven college variables - 1979

Students in top 30% by TES excluded

<u>Group of A.N.U. units</u>	<u>No. of students</u>	<u>TES</u>	<u>ASAT Verbal</u>	<u>ASAT Quant.</u>	<u>ASAT Total</u>	<u>P. Rec. Academic</u>	<u>P. Rec. Personal</u>	<u>P. Rec. Overall</u>
All units	84	0.11	-0.06	-0.17	-0.16	-0.16	-0.11	-0.09
Arts units	42	0.15	-0.01	-0.10	-0.08	-0.26	-0.09	0.01
Non-language units	42	0.13	0.15	0.01	0.07	-0.24	-0.09	0.01
Economics units	44	0.33*	-0.16	0.06	-0.05	-0.12	-0.02	-0.10
Science units	44	-0.07	-0.06	-0.17	-0.17	-0.10	-0.18	0.01
Mathematical Sciences	54	0.15	-0.24	-0.03	-0.16	-0.16	-0.13	-0.15
Empirical Sciences	33	-0.14	-0.01	-0.29	-0.24	-0.25	-0.35*	-0.15

* Significant at $P < 0.05$

TABLE 5.15

Correlations between A.N.U. grade scores and the seven college variables - 1980

Students in top 30% by TES excluded

Group of A.N.U. units	No. of students	TES	ASAT Verbal	ASAT Quant.	ASAT Total	P. Rec. Academic	P. Rec. Personal	P. Rec. Overall
All units	91	0.10	0.05	-0.17	-0.09	0.08	0.06	-0.01
Arts units	44	-0.08	-0.04	-0.13	-0.12	0.01	-0.05	-0.14
Non-language units	42	-0.23	-0.02	-0.15	-0.12	-0.03	-0.09	-0.10
Economics units	43	0.21	0.08	0.02	0.06	0.12	0.33*	0.22
Science units	51	0.41**	-0.02	-0.33*	-0.23	0.14	0.18	0.13
Mathematical Sciences	54	0.13	0.12	0.08	0.11	-0.04	0.06	-0.05
Empirical Sciences	42	0.35*	-0.13	-0.43**	-0.34*	0.06	0.20	0.06

* Significant at $P < 0.05$; ** $P < 0.01$

CHAPTER 6

COMPARISONS BETWEEN A.C.T. COLLEGES

6.1 Grade Scores and Pass Rates

During the three years of the study, students from twelve A.C.T. colleges were admitted to A.N.U. on the basis of TES and the associated information. These colleges were

- BR - Braddon Catholic High (female students only)
- CO - Copland College
- DA - Daramalan College (male students only)
- DK - Dickson College
- ED - St. Edmund's College (male students only)
- GG - Canberra Girls Grammar (female students only)
- GR - St. Clare's College Griffith (female students only)
- HK - Hawker College
- MA - Marist College (male students only)
- NB - Narrabundah College
- PH - Phillip College
- ST - Stirling College

Students first entered A.N.U. from Stirling College in 1979, the second year of the study, and from Copland College in 1980, the third year of the study.

With 10 to 12 colleges and only about 250 students entering A.N.U. in each year, comparison of results of students from different colleges was only possible for relatively large groupings of students, where reasonable representation from each college could be guaranteed.

No individual unit or group of units within an A.N.U. department provided enough data for college comparisons using actual marks obtained. Thus all college comparisons were based on grade scores, defined in chapter 5. Even using grade scores, only the seven groupings with larger numbers of students could be used; these are the same seven groupings as used to obtain correlations for marginal students in section 5.4.

Basic information on results obtained by students from each college for these seven groupings is provided in Table 6.1. For each college for each of the three years of the study the following are given :

Number of students entering A.N.U. from that college
% pass

Mean of student grade scores for the grouping of units where % pass is the ratio of total number of grades P2 or better achieved by the students to total number of units attempted by the students (including W), converted to a percentage.

In all seven groupings, substantial differences between colleges in both % pass and mean grade score are apparent. However these are based on students with a wide range of abilities, so some adjustment to allow for this must take place before it can be determined whether college differences are significant.

6.2 Regression Analyses

To investigate the effect of college on grade scores, a regression analysis approach was adopted where COLLEGE was fitted as an extra variable in four of the grade score regressions already discussed in section 5.3. COLLEGE is a categorical variable with 10 to 12 levels, depending on year, so what in effect occurs in the regression analyses is 9, 10 or 11 dummy variables are fitted, each variable being associated with a particular college. These dummy variables take a value 1 if the student is from that college, and 0 otherwise. There is one less dummy variable than number of colleges otherwise linear dependence of the variables would result. The coefficient for the college omitted is set to zero. In this approach an extra 9, 10 or 11 degrees of freedom are used up, so a substantial improvement in the regression is required to cause the adjusted coefficient of determination, $\bar{R}^2$, to significantly increase.

In Tables 6.2, 6.3 and 6.4 the % variation explained by COLLEGE in conjunction with the four sets of other independent variables is presented and compared with the 'best' regression without COLLEGE as a variable. Here 'best' was simply the regression with the highest % variation explained. The particular four sets of variables chosen to regress with COLLEGE added were intended to be representative of all possible sets of variables. The reasoning behind this has already been discussed in section 4.4.

Addition of COLLEGE as a variable significantly increased % variation explained in four groups of units

in 1978; Arts units, Non-language units, Economics units and Empirical sciences. The increase for Arts and Non-language units was substantial. In 1979 significant and substantial increases occurred in five groups of units; All units, Economics units, Science units, Mathematical sciences and Empirical sciences. However in 1980 no significant increases occurred.

As in chapter 5, SEX was added as an extra variable to all regressions. Some SEX effects were observed, as indicated by the final columns in Tables 6.2, 6.3 and 6.4. However once COLLEGE is introduced as a variable, there is a problem interpreting effects of SEX. Since three colleges are male only and three are female only, it cannot be certain whether an observed increase in % variation explained is due to colleges or to the sex of the students. For example, if the three male only colleges all had poorer results than other colleges, adding either SEX or COLLEGE would increase the % variation explained.

Despite these problems, some conclusions can be drawn. In the case of Arts units in 1978, both SEX and COLLEGE had an effect, since adding COLLEGE increased % variation explained, and adding SEX both when COLLEGE was present and absent increased % variation explained. Secondly, for Empirical sciences in 1978, the SEX effect was the dominant one, but adding COLLEGE in the absence of the SEX variable did cause some increase in % variation explained. This was no doubt due to results differing for students from the male only to those from the female only colleges. The third type of effect identifiable is where SEX accounts for only a part of the increase of % variation

explained due to COLLEGE. In this case the true differences are probably due to colleges, but SEX can appear significant because of the single sex colleges. Examples of this are Non-language units in 1978, All units in 1979 and Empirical sciences in 1979.

For the remainder of this chapter we concentrate on COLLEGE effects ignoring SEX, as only in the case of Empirical sciences in 1978 was there any suggestion that SEX may be more important than COLLEGE. The implicit assumption in doing this is that if college differences are detected one of the possible explanations may be sex of the students. Of course that could be easily tested using only the six mixed colleges, but hasn't been attempted in the present study.

6.3 Representation of Relative Achievement.

Having established significant differences between A.C.T. colleges in student achievement at A.N.U., it is important to obtain ways of representing the relative levels of achievement for each college. Any such representation would at least have to allow for the effect of TES, the most important predictive variable.

In the regression analyses where COLLEGE was significant, the regression with only TES and COLLEGE accounted for almost all the extra % variation explained; addition of other variables further increased % variation explained significantly only for Empirical sciences in 1979. Thus the coefficients for the variables representing each college can be taken from these

regressions as a representation of the college effects. In Tables 6.5 and 6.6 the coefficients for each college are given in all cases where the college effect was significant. Within each regression analysis the coefficient of the first mentioned college, in our case BR, was set to zero and the other coefficients were fitted relative to that. However for presentation the coefficients have been additively adjusted so that their weighted sum is zero, where the weight used was the number of students from the college. This would then only alter the constant term in the fitted regression equation. After adjustment, coefficients with positive sign indicate that students from that college performed above the average level, and coefficients with negative sign indicate that students performed below the average level.

In the two years where significant differences were obtained, students from some colleges clearly stand out as being superior or inferior to other colleges. In 1978 (Table 6.5) particularly high coefficients were obtained by BR in Economics units and Empirical sciences, and by GR in Arts units, Non-language units and Empirical sciences; low coefficients were obtained by ED in Arts units, Non-language units and Economics units, by GG in Economics units, by MA in Arts units, Non-language units and Empirical sciences, and by PH in Arts units and Non-language units. In 1979 (Table 6.6) particularly high coefficients were obtained by BR in some groups of units, GG in all groups, GR in some groups, and NB in Economics units; low coefficients were obtained by DA in some groups, ED in some groups, MA in all groups, NB in Empirical

sciences and ST in some groups. There is some consistency in these results, for example students from BR and GR have good performances in some groups of units in both years and students from ED and MA have bad performances in some groups in both years. However as there were no significant differences at all in 1980, it is difficult to generalise about a student's expected performance at A.N.U. based on the college that student attended.

It should be noted in interpreting Tables 6.5 and 6.6 that because of the nature of the categorical variables representing COLLEGE the coefficients translate directly to grade scores. Thus, for example, in Arts units in 1978 students from GR obtained on average a grade score 0.50 above what would have been expected after allowing for TES, whereas students from MA obtained a grade score 0.62 below what would have been expected after allowing for TES.

Finally these college differences can also be represented graphically. If mean grade score for students from each college is plotted against mean TES of the students, the expected relationship is a slight increase in grade score as TES increases. Departures from such a pattern indicate instances where students from particular colleges have performed better or worse than expected. Graphs of mean grade score against mean TES are presented for two of the significant groups of units in 1978 in Figures 6.1 and 6.2, and for two of the significant groups of units in 1979 in Figures 6.3 and 6.4. In Figure 6.1, the positions of ED, MA and PH well below a 'slight' trend are clear; these three colleges had high negative coefficients for Arts units in Table 6.5. NB, although lower than the

remainder, also had low mean TES so is not conspicuous (coefficient was 0.13). Similarly the location of BR, ED and GG in Figure 6.2 is consistent with the coefficients for Economics units in Table 6.5. In figure 6.3 there is clearly no linear trend, and the four colleges with lowest grade score, DA, ED, MA and ST, also had lowest coefficients for Mathematical sciences in Table 6.6. Comparison of Figure 6.4 and the coefficients for Empirical sciences in Table 6.6 yields a similar result, with high coefficients and grade scores for GG and GR, and low coefficients and grade scores for ED, MA and NB. Note that even though PH appears satisfactory on Figure 6.4, its coefficient is -0.21, indicating that the students performed below expectation given their high TES values.

To contrast with the above results, the graphical representation of two of the 1980 groups, where significance was not achieved but where a slight increase occurred in % variation explained, is presented in Figures 6.5 and 6.6. In both these figures the points conform more to a generally slightly increasing trend. Clearly some differences appear as if they could be meaningful, but they have failed to be detected in the regression analyses.

Thus the graphs provide a useful indication of whether there are likely to be differences between colleges, but the regression analyses test for significance and quantify any differences.

TABLE 6.1

Results obtained by students from each college of origin^A

All units

<u>College^B</u>	<u>1978</u>			<u>1979</u>			<u>1980</u>		
	<u>No</u>	<u>% pass</u>	<u>Score</u>	<u>No</u>	<u>% pass</u>	<u>Score</u>	<u>No</u>	<u>% pass</u>	<u>Score</u>
BR	12	91	2.43	8	79	2.51	5	76	2.65
CO	-	-	-	-	-	-	28	64	1.85
DA	21	82	2.18	18	69	1.93	4	74	2.11
DK	32	78	2.25	39	87	2.37	30	87	2.37
ED	14	82	1.99	9	70	2.09	8	61	1.80
GG	15	75	2.38	15	96	2.45	23	73	2.12
GR	16	96	2.53	15	88	2.43	17	79	2.21
HK	43	79	2.14	50	85	2.41	39	82	2.16
MA	14	71	1.97	13	60	1.68	10	85	2.03
NB	18	82	2.12	20	71	2.10	22	69	1.86
PH	54	72	1.93	35	85	2.40	57	83	2.25
ST	-	-	-	36	67	1.83	29	78	2.23

A 'No' is number of students, '% pass' is the percentage passed of all units attempted and 'Score' is mean grade score for those students

B College abbreviations are given in the text in section 6.1.

Students first entered A.N.U. from Stirling College in 1979, and from Copland College in 1980.

TABLE 6.1 (cont.)

Arts units

<u>College</u>	<u>1978</u>			<u>1979</u>			<u>1980</u>		
	<u>No</u>	<u>% pass</u>	<u>Score</u>	<u>No</u>	<u>% pass</u>	<u>Score</u>	<u>No</u>	<u>% pass</u>	<u>Score</u>
BR	9	88	2.48	7	77	2.49	3	88	3.07
CO	-	-	-	-	-	-	9	62	1.91
DA	9	89	2.50	7	79	2.18	2	100	2.50
DK	17	84	2.43	15	88	2.53	15	85	2.33
ED	5	57	1.57	2	67	2.40	1	100	3.00
GG	12	82	2.52	10	96	2.48	11	74	2.29
GR	9	97	2.69	7	87	2.57	7	71	1.95
HK	20	93	2.60	25	82	2.45	17	82	2.25
MA	7	60	1.80	3	100	2.20	1	50	1.50
NB	17	80	2.18	13	71	2.27	10	84	1.96
PH	27	54	1.81	18	85	2.44	20	82	2.25
ST	-	-	-	16	90	2.28	13	67	2.16

Non-language units

<u>College</u>	<u>1978</u>			<u>1979</u>			<u>1980</u>		
	<u>No</u>	<u>% pass</u>	<u>Score</u>	<u>No</u>	<u>% pass</u>	<u>Score</u>	<u>No</u>	<u>% pass</u>	<u>Score</u>
BR	10	88	2.50	6	71	2.29	3	88	3.07
CO	-	-	-	-	-	-	8	65	1.93
DA	10	79	2.45	7	79	2.18	2	100	2.50
DK	18	87	2.45	15	88	2.52	15	80	2.21
ED	4	67	1.67	2	100	2.75	1	100	3.00
GG	12	81	2.50	10	96	2.54	10	71	2.20
GR	9	100	2.55	7	92	2.42	7	67	2.03
HK	20	91	2.57	24	89	2.52	15	87	2.30
MA	7	60	1.80	4	100	2.17	1	100	2.00
NB	15	80	2.15	11	69	2.15	10	78	1.89
PH	26	53	1.78	17	81	2.31	20	76	2.12
ST	-	-	-	18	88	2.21	11	58	1.94

TABLE 6.1 (cont.)

Economics units

<u>College</u>	<u>1978</u>			<u>1979</u>			<u>1980</u>		
	<u>No</u>	<u>% pass</u>	<u>Score</u>	<u>No</u>	<u>% pass</u>	<u>Score</u>	<u>No</u>	<u>% pass</u>	<u>Score</u>
BR	3	100	2.50	2	100	2.75	1	100	3.13
CO	-	-	-	-	-	-	14	63	1.78
DA	9	65	1.91	13	59	1.70	1	0	1.00
DK	14	69	2.04	15	79	1.93	11	88	2.24
ED	5	53	1.45	5	67	2.09	6	60	1.58
GG	2	50	1.67	4	86	1.90	8	58	1.75
GR	2	86	2.35	11	85	2.33	6	59	1.62
HK	15	71	2.01	15	78	2.00	12	67	1.76
MA	8	78	2.00	9	42	1.44	7	88	2.10
NB	3	67	1.77	6	90	2.33	12	56	1.72
PH	18	75	1.90	13	81	2.22	29	72	1.91
ST	-	-	-	13	48	1.38	13	74	1.95

Science units

<u>College</u>	<u>1978</u>			<u>1979</u>			<u>1980</u>		
	<u>No</u>	<u>% pass</u>	<u>Score</u>	<u>No</u>	<u>% pass</u>	<u>Score</u>	<u>No</u>	<u>% pass</u>	<u>Score</u>
BR	5	92	2.43	3	67	2.00	1	100	4.00
CO	-	-	-	-	-	-	17	71	1.99
DA	8	93	2.19	10	77	2.02	2	50	1.86
DK	16	74	2.11	26	87	2.37	16	93	2.57
ED	11	98	2.30	7	60	1.88	5	59	1.92
GG	10	61	2.10	9	100	2.58	14	73	2.06
GR	11	97	2.41	8	89	2.46	9	88	2.45
HK	28	73	1.86	25	89	2.66	26	87	2.26
MA	6	69	2.03	8	63	1.71	5	75	1.93
NB	7	93	1.96	8	52	1.59	10	74	2.03
PH	42	76	1.94	17	86	2.54	34	91	2.49
ST	-	-	-	17	64	1.70	17	88	2.51

TABLE 6.1 (cont.)

Mathematical sciences

<u>College</u>	<u>1978</u>			<u>1979</u>			<u>1980</u>		
	<u>No</u>	<u>% pass</u>	<u>Score</u>	<u>No</u>	<u>% pass</u>	<u>Score</u>	<u>No</u>	<u>% pass</u>	<u>Score</u>
BR	4	86	2.14	2	100	2.75	1	100	3.25
CO	-	-	-	-	-	-	20	74	2.14
DA	12	78	2.30	14	72	1.95	2	80	2.90
DK	21	82	2.39	28	86	2.47	18	94	2.62
ED	12	95	2.31	9	71	2.19	7	53	1.67
GG	3	67	2.33	7	100	2.66	12	70	2.12
GR	7	94	2.56	9	88	2.40	10	80	2.24
HK	27	76	2.09	24	94	3.03	23	88	2.53
MA	10	86	2.57	11	62	1.88	9	94	2.42
NB	4	100	2.44	11	81	2.38	15	78	2.31
PH	37	82	2.26	19	92	2.87	41	92	2.60
ST	-	-	-	23	75	1.90	16	90	2.68

Empirical sciences

<u>College</u>	<u>1978</u>			<u>1979</u>			<u>1980</u>		
	<u>No</u>	<u>% pass</u>	<u>Score</u>	<u>No</u>	<u>% pass</u>	<u>Score</u>	<u>No</u>	<u>% pass</u>	<u>Score</u>
BR	4	100	2.56	3	67	2.00	1	100	4.00
CO	-	-	-	-	-	-	13	70	1.96
DA	7	88	2.03	8	88	2.19	1	0	1.00
DK	14	65	2.00	21	84	2.21	13	92	2.52
ED	9	95	2.18	2	33	1.67	3	75	2.06
GG	10	56	2.03	9	100	2.52	11	70	1.96
GR	10	100	2.40	6	89	2.56	7	93	2.50
HK	22	71	1.80	23	79	2.24	25	79	2.01
MA	6	50	1.67	6	64	1.59	1	0	1.00
NB	6	90	1.90	7	23	1.19	7	71	1.91
PH	34	70	1.79	14	77	2.23	27	86	2.30
ST	-	-	-	15	50	1.53	13	84	2.21

TABLE 6.2

% variation explained in A.N.U. grade scores by differences between colleges^A - 1978

Group of A.N.U. units	No. of students	% variation for Independent variables					SEX ^C effect
		'Best' regression without COLLEGE	TES COLLEGE	TES 3 ASAT COLLEGE	TES 3 PREC COLLEGE	TES 3 ASAT 3 PREC COLLEGE	
All units	237	18 (F 22)	21	21	20	20	
Arts units	131	14 (F 19)	22	20	22	20	F 25
Non-language units	130	17 (F 20)	25	23	25	23	
Economics units	79	15	17	18	14	17	
Science units	142	18	16	19	16	19	
Mathematical sciences	136	23	24	23	23	22	
Empirical sciences	120	12 (F 17)	15	15	14	15	F 17

A 3 ASAT = all 3 ASAT variables used in regression.

3 PREC = all 3 Principal's Recommendations used in regression.

COLLEGE = COLLEGE was a variable in regression - 9 d.f. for the 10 colleges.

B Obtained from Table 5.7. If SEX was significant, the SEX effect is in brackets.

C An entry in this column indicates that SEX as a variable significantly increased % variation explained, even after COLLEGE effects were fitted. M = male students performed better; F = female students performed better. Value is % variation explained by 'best' regression including COLLEGE and SEX.

TABLE 6.3
% variation explained in A.N.U. grade scores by differences between colleges^A - 1979

Group of A.N.U. units	No. of students	% variation for Independent variables					SEX effect ^C		
		'Best' regression without COLLEGE	TES COLLEGE	TES 3 COLLEGE	TES ASAT COLLEGE	TES 3 PREC COLLEGE	TES 3 ASAT 3 PREC COLLEGE		
All units	258	33 (F 35)	39	39	39	39	39		
Arts units	123	25	20	18	22	20	20		
Non-language units	121	29	30	28	30	29	29		
Economics units	106	33	37	39	40	40	40		
Science units	138	38	47	46	49	49	49		
Mathematical sciences	157	44	49	50	50	50	50		
Empirical sciences	114	32 (F 34)	40	40	42	43	43		

A See footnote A to Table 6.2, but with 10 d.f. for 11 colleges.
 B Obtained from Table 5.8. If SEX was significant, the SEX effect is in brackets.
 C See footnote C to Table 6.2.

TABLE 6.4

% variation explained in A.N.U. grade scores by differences between colleges^A - 1980

Group of A.N.U. units	No. of students	% variation for Independent variables					SEX C effect
		'Best' regression without COLLEGE	TES COLLEGE	TES 3 ASAT COLLEGE	TES 3 PREC COLLEGE	TES 3 ASAT 3 PREC COLLEGE	
All units	272	29 (F 30)	28	29	28	28	F 30
Arts units	109	12	12	9	12	9	
Non-language units	103	14	12	9	10	7	
Economics units	120	41	42	43	41	41	F 46
Science units	156	28	28	29	27	28	
Mathematical sciences	174	38	40	40	39	39	F 41
Empirical sciences	122	25	19	23	20	23	

A See footnote A to Table 6.2, but with 11 d.f. for 12 colleges.

B Obtained from Table 5.9. If SEX was significant, the SEX effect is in brackets.

C See footnote C to Table 6.2.

TABLE 6.5

Regression coefficients for colleges
in grade score regressions^A - 1978

<u>College</u>	<u>Arts</u> <u>units</u>	<u>Non-language</u> <u>units</u>	<u>Economics</u> <u>units</u>	<u>Empirical</u> <u>sciences</u>
BR	0.12	0.22	0.68 ^B	0.58 ^B
DA	0.13	0.11	0.03	-0.11
DK	0.17	0.23	-0.02	0.22
ED	-0.57	-0.40 ^B	-0.47	0.02
GG	0.12	0.09	-0.81 ^B	-0.06
GR	0.50	0.51	0.27 ^B	0.41
HK	0.13	0.05	-0.02	-0.10
MA	-0.62	-0.62	0.08	-0.44
NB	0.13	0.08	0.28 ^B	0.02
PH	-0.32	-0.36	0.01	-0.11

A Coefficients are given only for unit groups where COLLEGE significantly increased % variation explained (see Table 6.2). For all 4 groups, coefficients are from the regression on TES and COLLEGE only, as other variables did not significantly increase % variation explained.

B These values are based on less than 5 students so should be interpreted with caution.

TABLE 6.6

Regression coefficients for colleges
in grade score regressions^A - 1979

<u>College</u>	<u>All units</u>	<u>Economics</u> <u>units</u>	<u>Science</u> <u>units</u>	<u>Math.</u> <u>sciences</u>	<u>Empirical</u> <u>sciences</u>
BR	0.32	0.95 ^B	0.02 ^B	0.70 ^B	0.11 ^B
DA	-0.33	-0.12	-0.38	-0.42	-0.05
DK	0.16	-0.01	0.12	0.10	0.08
ED	-0.24	0.10	-0.31	-0.45	-0.50 ^B
GG	0.46	0.37 ^B	0.63	0.35	0.69
GR	0.12	0.16	0.36	0.18	0.48
HK	0.10	-0.14	0.25	0.32	0.14
MA	-0.50	-0.32	-0.48	-0.35	-0.47
NB	0.03	0.57	-0.27	-0.02	-0.63
PH	-0.04	0.13	-0.12	0.19	-0.21
ST	-0.19	-0.32	-0.23	-0.25	-0.18

A Coefficients are given only for unit groups where COLLEGE significantly increased % variation explained (see Table 6.3). For all 5 groups, coefficients are from the regression on TES and COLLEGE only; addition of other variables significantly increased % variation explained for Empirical Sciences only.

B These values are based on less than 5 students so should be interpreted with caution.

FIGURES 6.1-6.6

In these figures, mean grade score of students from each college is plotted against mean TES of the students. The meanings of the college abbreviations are given in the text in section 6.1. College abbreviations in brackets indicate that there were only 2, 3 or 4 students from that college in that group of units, so those points are to be interpreted cautiously; colleges with only one student in a group were omitted.

Figure 6.1 Arts units - 1978

Figure 6.2 Economics units - 1978

Figure 6.3 Mathematical sciences - 1979

Figure 6.4 Empirical sciences - 1979

Figure 6.5 Economics units - 1980

Only one student from each of BR and DA, so these colleges were omitted.

Figure 6.6 Mathematical sciences - 1980

Only one student from BR, so this college was omitted.

FIGURE 6.1

ARTS UNITS - 1978

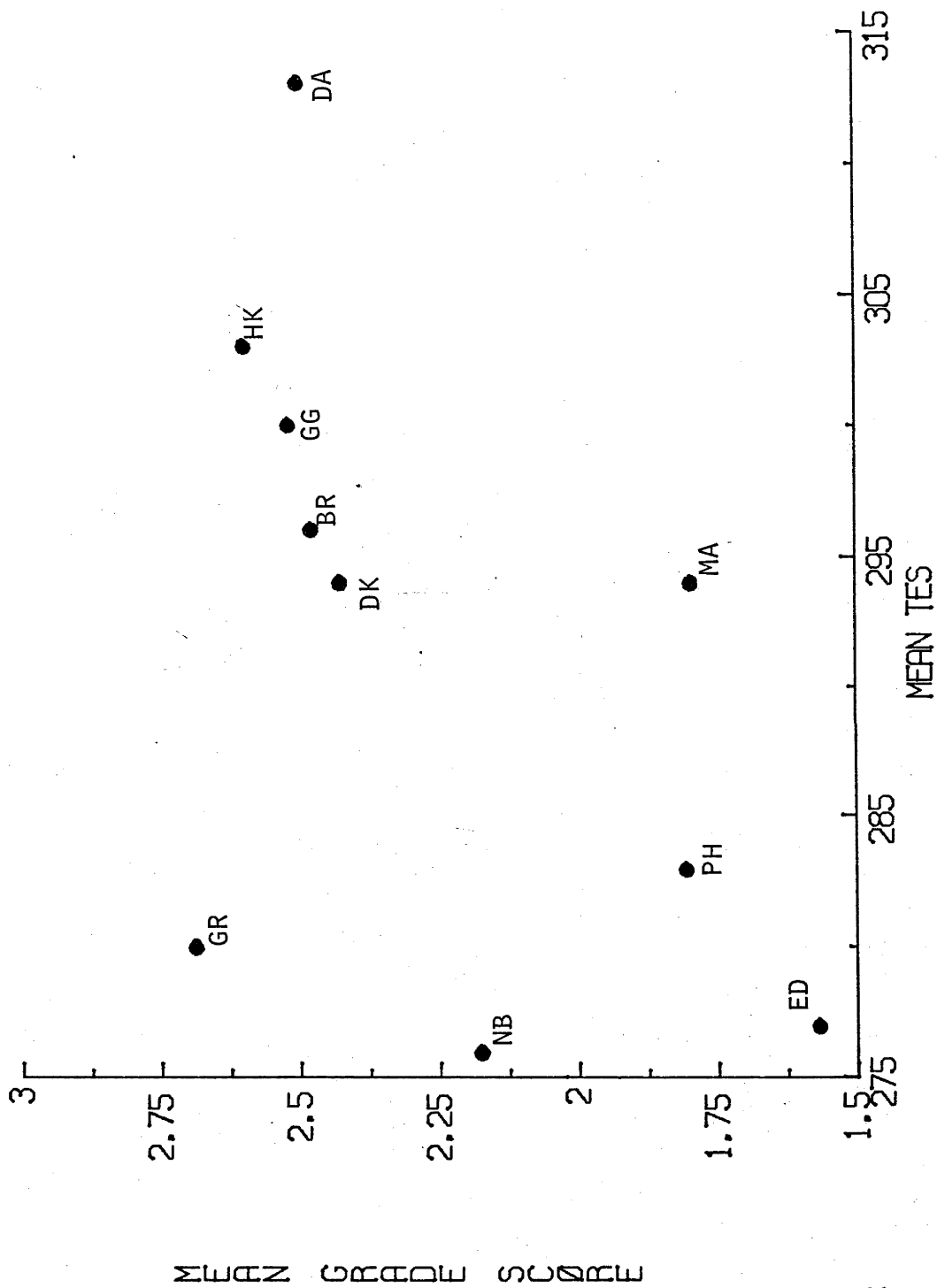


FIGURE 6.2

ECONOMICS UNITS - 1978

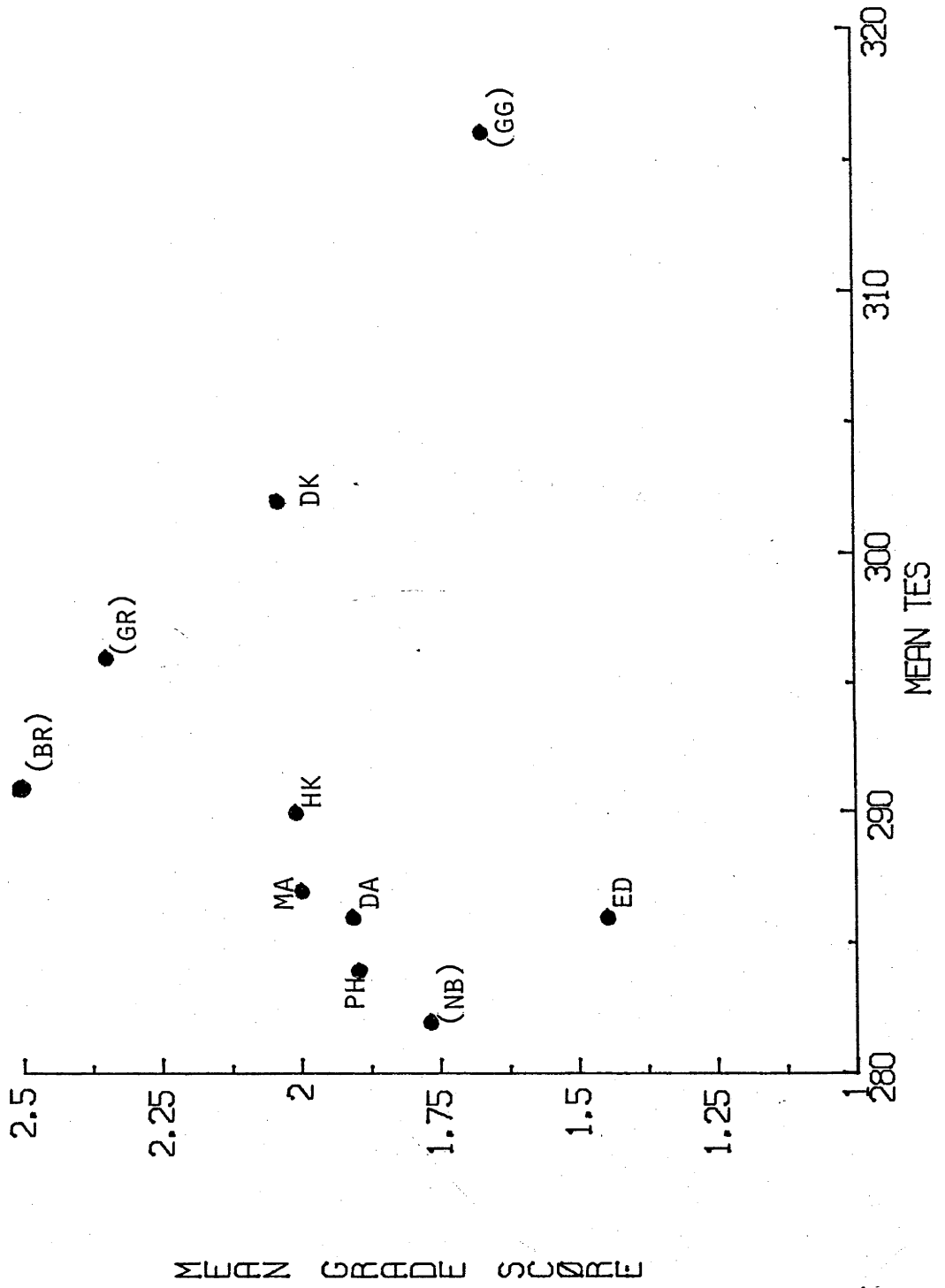


FIGURE 6.3

MATHEMATICAL SCIENCES - 1979

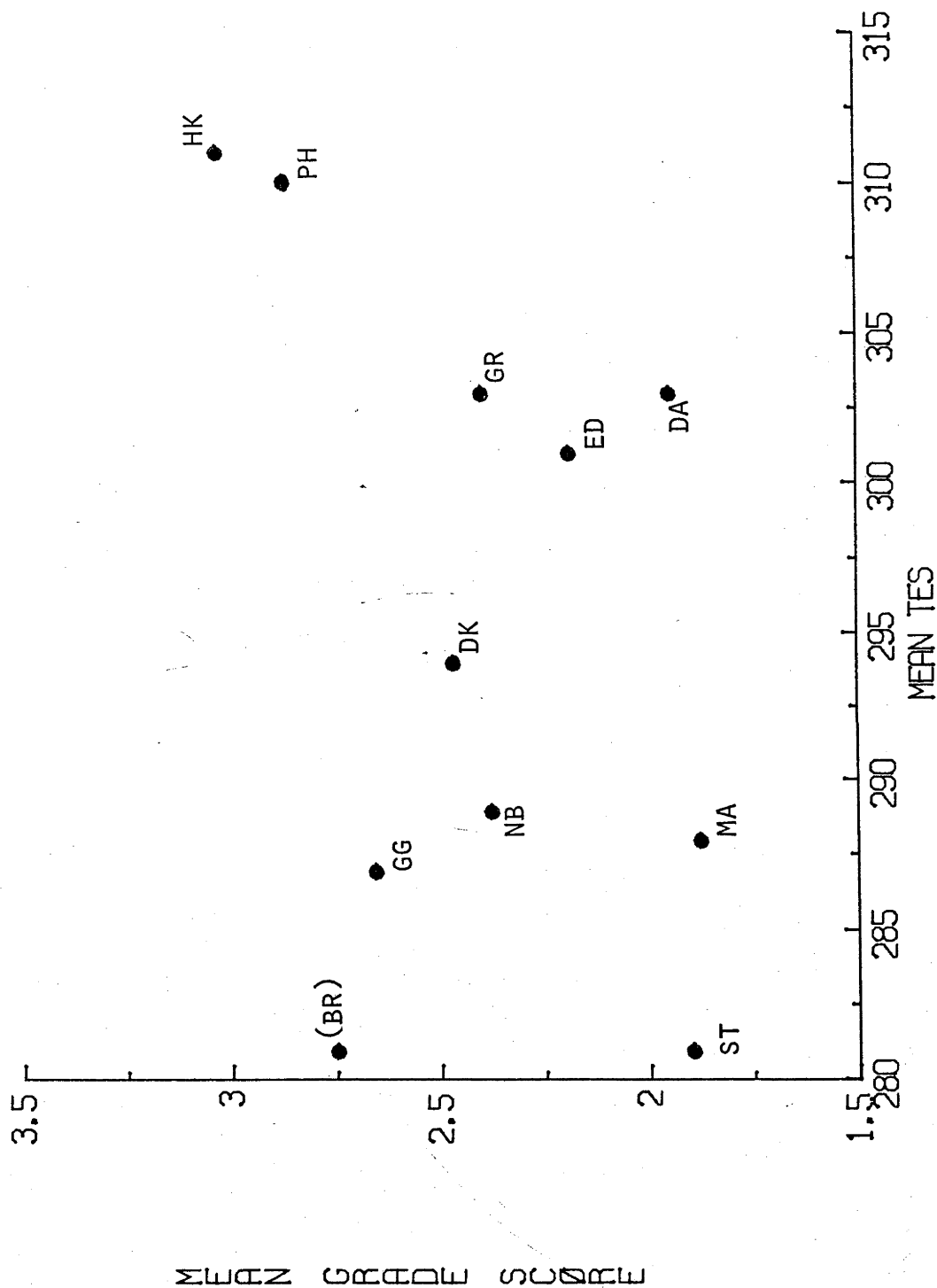


FIGURE 6.4

EMPIRICAL SCIENCES - 1979

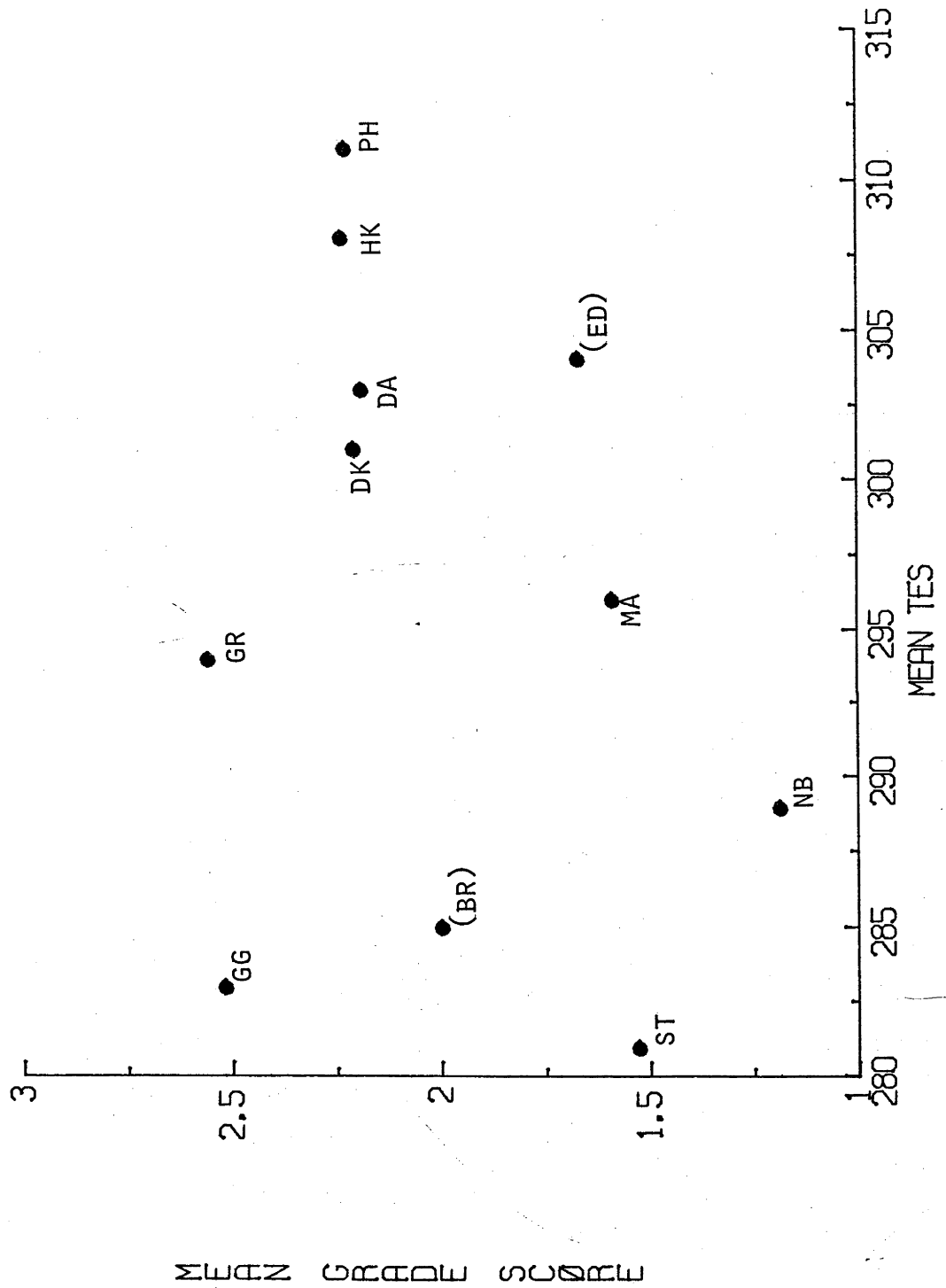


FIGURE 6.5

ECONOMICS UNITS - 1980

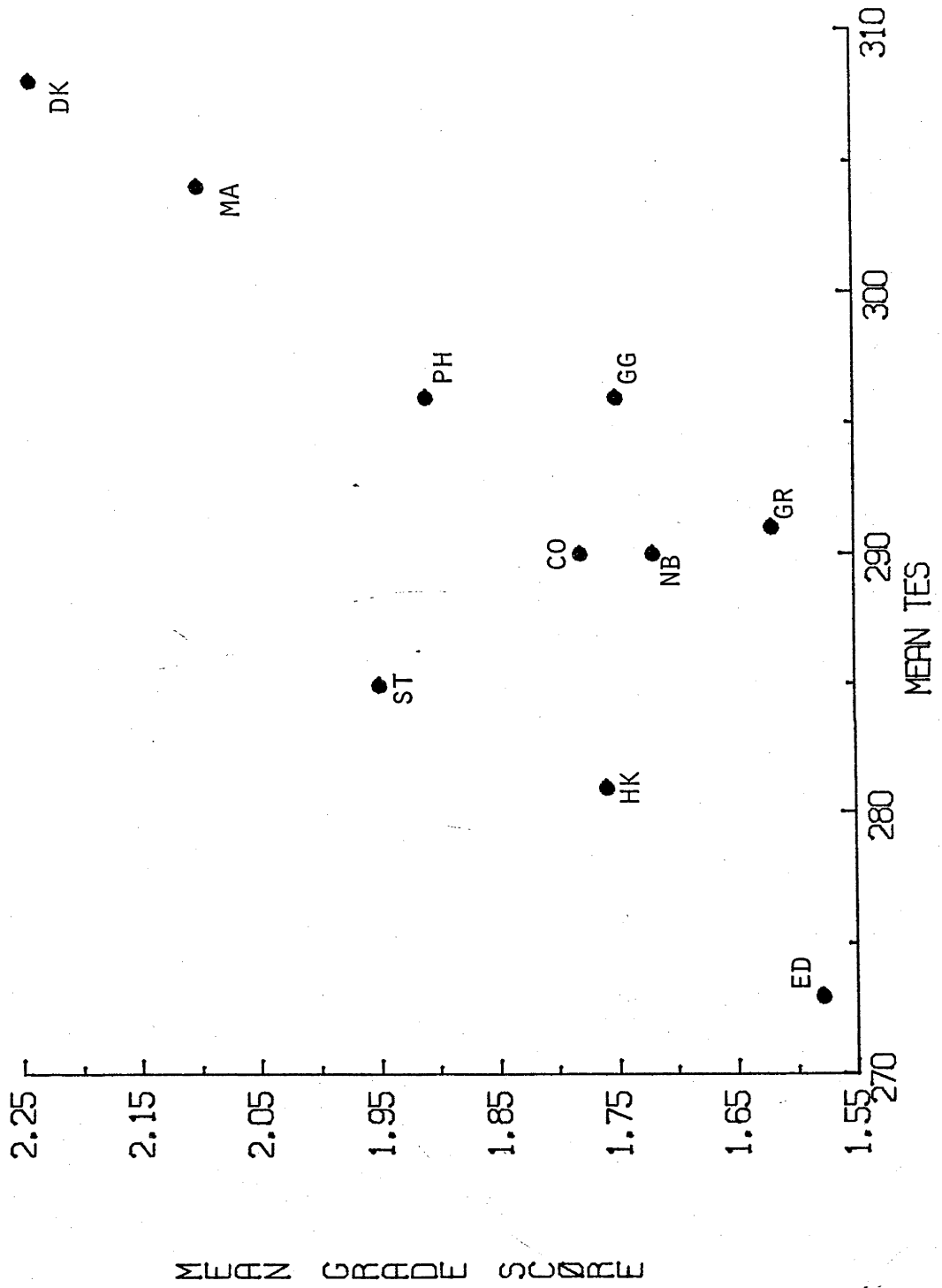
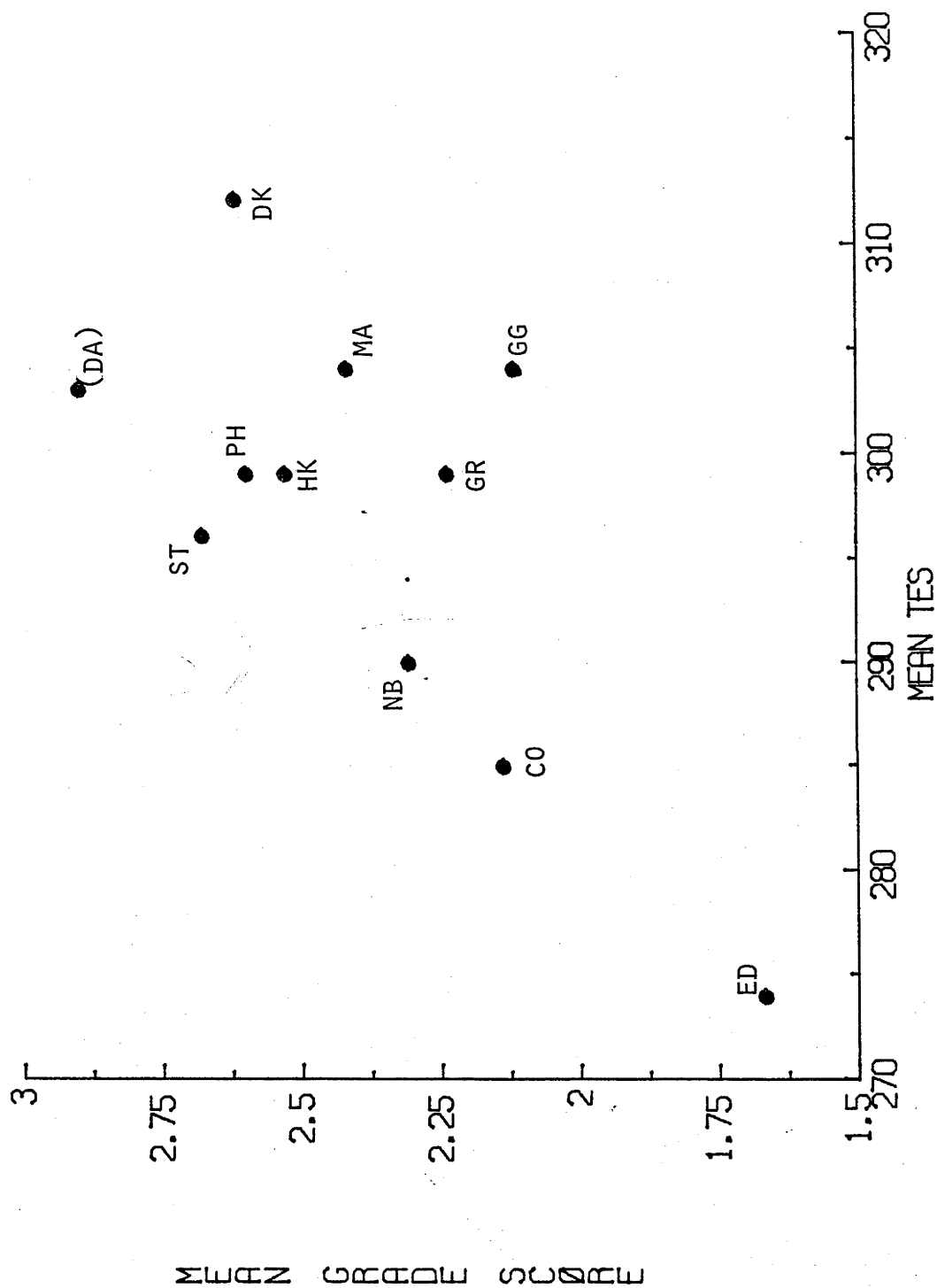


FIGURE 6.6

MATHEMATICAL SCIENCES - 1980



CHAPTER 7

DISCUSSION AND RECOMMENDATIONS

7.1 Discussion

In all faculties but Law, it is clear from all aspects of this study that TES is the best predictor of student achievement in first year A.N.U. units. The addition of other variables in regressions did improve relationships for some units or groups of units in some years, but none of these improved relationships would be any use for predictive purposes as they were not consistent over the three years. Sutherland (1973) found that TEEP and ASAT were less successful than HSC (N.S.W. Higher School Certificate) examination scores in predicting results in first year A.N.U., except for the Faculty of Arts where predictions were equally as good. The results of the present study are consistent with this earlier study.

The Faculty of Law was the special case in this study, with ASAT clearly being the best predictor of achievement in 1978 and 1980, and all three types of college variable, TES, ASAT and Principal's Recommendations, being moderately good predictors in 1979. Thus overall one would have to recommend ASAT as the best predictor. In the TERTIARY EDUCATION ENTRANCE PROJECT (1975) the relationship of HSC aggregate and TEEP scores with first year Law results in 1971-1973 was examined. Neither TEEP nor HSC were considered to be good predictors of success in A.N.U. first

year Law. This is in partial agreement with the present study in that the admission of only top students to Law using a score such as HSC or TES then rules out that score as a useful predictor for those students admitted.

Many other studies have findings in general agreement with those of the present study. Campbell (1972) considered in his report the predictive validity of examinations. He referred to Swedish studies which had shown that secondary school marks were the best predictors of success in further education, certainly better than tests of aptitude. McGaw (1977b) compared aggregate standardized marks and aggregate grades from external examination, rescaled teacher assessments and ASAT in attempting to predict a Tertiary Grade Point Average in Queensland. He found that the three examination and teacher measures, with correlations for university students in the range 0.38 to 0.68, were clearly superior to ASAT, with correlations 0.16 to 0.29. O'Connor (1974) obtained a similar result for University of Queensland Engineering students, with teacher assessments (rescaled or moderated) correlating 0.54 to 0.63 with results whereas ASAT correlations were only 0.13 to 0.16. Otto (1976), relating results of Arts and Science students at the University of Adelaide to South Australian public examination results and ASAT, obtained relationships generally very similar in nature to this study. He even found some sex effects and developed multiple regressions involving ASAT and sex which, although superior to examination scores alone, were not consistent over time. In a Victorian study, Smurthwaite (1973) found that the Victorian HSC score correlated better with

performance in Science faculties than in Arts. Similar observations were made in the present study in chapter 5, where Economics and Science-based groupings of units showed higher correlations than those based on Arts and Asian Studies. Finally Sutherland (1973) found for University of W.A. students that TEEP and ASAT were inferior predictors to Leaving Certificate scores.

The relative merit of external assessment systems against internal assessment systems is a considerable source of controversy. Some of the abovementioned references give comparative data, in particular McGaw (1977a, 1977b) and O'Connor (1974). Campbell (1972) discusses the issue at some length. The present study cannot present any direct evidence to resolve this issue because no 'external' measurements were available as predictors. Nevertheless the results have some bearing. The differences found between colleges in some of the years could suggest that students from particular colleges in particular years were better or worse prepared for tertiary study than students from other colleges. However the inconsistency of the effect of college means that no adjustment for college can be made for future predictions, i.e. the effect of college is only known 'after the damage is done'. Some might argue that this provides good evidence for some form of external examination, but on the other hand Campbell (1972), McGaw (1977a) and others provide sound educational reasons why external examinations should be abandoned.

Other than the analysis of three years of data to examine the effectiveness of college variables as predictors

of A.N.U. achievement, this study has produced a suite of programs which can be easily used to investigate many aspects of student results at A.N.U. The major programs are listed in Appendices 3 and 4. Obtaining these programs was not so much just a by-product as a partial aim of the study. In the light of the three years of results obtained, further work can be done on present or future data files using those methods which have proved useful. This would involve direct use, minor amendment or major simplification of the programs. Such possible further work is discussed in section 7.3.

Fundamental to the results obtained were the grade scores. They gave better, and much more consistent, results than the actual marks obtained and enabled effects such as college to be tested. The grade scores need not, of course, be defined in precisely the way they were in this study. Each person would have his own subjective ideas on values of various grades and could redefine grade scores accordingly. Some definitions could probably be found where slightly better linear relationships between grade score and TES would result. However as in most instances this relationship is fairly variable, it is doubtful whether substantial improvement could be made. Also, such a redefinition would be very unlikely to alter the general conclusions reached in the study.

As an alternative to correlation and least squares regression, other statistical techniques could be used which may also improve relationships obtained. Procedures of adjustment of marks, rather than defining grade scores, are discussed in section 5.1. Cornish (1980) and Foyster (1980)

refer to a number of such techniques. Such adjustment of the dependent variable could then lead to other ways of relating it to the independent variables. However it is doubtful whether any of these techniques could be applied to anything but small subsets of the full data in our circumstances. A quite different approach is described by Rubin (1980). His study applied empirical Bayes techniques in law school validity studies in U.S.A. The Bayes techniques gave rise to admitting equations which gave better predictions of student performance than least squares admitting equations, and which were more stable in time.

7.2 Implications for A.N.U. Admission Procedures

Within the earlier chapters there are no doubt many results given and discussed briefly which could be of interest or use in particular circumstances. However the motivation for this study was in relation to admission of A.C.T. students to A.N.U., so the following recommendations are given, based on the results :

- (1) For all but the Faculty of Law, TES should continue to be used as the primary admission criterion.
- (2) For all but the Faculty of Law, no account should be taken of ASAT results.
- (3) For the Faculty of Law, TES and ASAT Total should both be considered.

(4) Whilst Principal's Recommendations are awarded under the present guidelines, no account should be taken of them, even for marginal students.

If the above recommendations were adopted, the admission of students to all faculties except Law would be done by setting a TES borderline, admitting all those above or equal to it and rejecting those below it. There is some natural justification in this, in that the whole Year 11 and 12 assessment procedure is firmly based and students could be regarded as competing for tertiary places in a sort of academic 'race'. The rules of the 'race' are clear and as in any race the winners would be those doing better. The statistical justification for such a simplified procedure lies in the results of the present study, in that there is no evidence suggesting that anything else other than TES should be used in admitting students. Naturally special cases could still be argued by students below the cutoff, but these should be rarer and the reasons would need to be special.

Law admission is a problem in that it is difficult to make a specific recommendation based on the results of the present study. The probable reason that ASAT is a better predictor than TES is that the present admission procedure considerably restricts the range of TES for Law students. It is quite likely that if ASAT was adopted as the primary admission criterion, then TES would be a better predictor than ASAT. Thus a composite procedure needs to be worked out. For example, marginal

ranges of values could be set for Law students in both TES and ASAT, then any student above the marginal area in either or both would be admitted, and others considered more closely. However further study of the Law students data is essential before any new procedure is firmly proposed or adopted.

The recommendation (4) on Principal's Recommendations is not likely to be well received but it is firmly based on the results. The present Principal's Recommendations are only in effect a single recommendation and generally are of less predictive value than TES. If A.N.U. admission is their only use, then it may be pointless to continue giving them. Conversely, renewed attempts could be made to devise meaningful new recommendations which overcome the obvious problems which emerged in the detailed analysis in chapter 3. Such new recommendations would need to be at least genuinely two-dimensional to hope to add to information contained in TES.

7.3 Possible Further Studies

The following projects could be undertaken to further study the prediction of student achievement in first year at A.N.U.

(1) A fourth year of data is now available; Year 12 college 1980, first year A.N.U. 1981. This could be analysed in essentially the same way as the first three years to provide further confirmation of, or contrasts with, the results already obtained.

(2) Each year, a subset of the analyses done in this study could be run. The programs given in Appendices 3 and 4 form the basis of such a procedure. It would probably be worthwhile to obtain all the basic tabulations of % pass, grade score etc. and the correlations with the college variables. However to substantially reduce the workload the following could be omitted

- (i) Principal Component Analyses and all use of Principal Component Scores
- (ii) All analyses of marks in individual units i.e. use grade scores only.
- (iii) All multiple regressions involving ASAT or Principal's Recommendations. However multiple regressions involving COLLEGE and SEX should still be done.

If these were adopted the programs would still allow extra information to be obtained in response to specific requests, e.g. regressions on unit marks if a particular department requested them.

(3) The relationship between college subject scores (standardised and scaled) and A.N.U. results could be investigated. The data are already available from this study for such an investigation. If this is undertaken, the relative predictive values of such subject scores only need to be compared to TES, as ASAT and Principal's Recommendations are known to be inferior.

(4) A.N.U. results obtained by A.C.T. students admitted on the basis of TES could be compared with the results of other groups e.g. N.S.W. Higher School Certificate, mature age etc. In such a study TES is a sufficient indicator of 'ability' of A.C.T. students. Many of the programs developed in this study could be easily adapted for other groups, considerably decreasing the software development work needed; data preparation would then be the main task.

REFERENCES

A.C.T. SCHOOLS ACCREDITING AGENCY. 1978.

Calculating, standardising and scaling course scores:
procedures - 1978.

A.C.T. SCHOOLS ACCREDITING AGENCY. 1980.

Senior secondary education A.C.T.

CAMPBELL, R.J. 1972. Secondary education for Canberra -
Report of the working committee on college proposals
for the Australian Capital Territory. Australian
Government Publishing Service, Canberra.

COONEY, G.H. 1974. Studies related to student performance
at tertiary level. Education Research and
Perspectives, 1, 3-13.

COONEY, G.H. 1975. Standardization procedures involving
moderator variables : some theoretical considerations.
Australian Journal of Education, 19, 50-63.

CORNISH, G. 1980. A problem of aggregate comparability.
Paper presented at the 5th Australian Statistical
Conference, University of N.S.W., August 1980.

EDWARDS, J.B. 1969. The relation between the F-test and
 $\bar{R}^2$. The American Statistician, 23, No.5, 28.

FOYSTER, J. 1980. Why are we weighting? Paper presented
at the 5th Australian Statistical Conference,
University of N.S.W., August 1980.

HAITOVSKY, Y. 1969. A note on the maximization of $\bar{R}^2$.
The American Statistician, 23, No.1, 20-21.

- KEEVES, J.P., McBRYDE, B., and BENNETT, L.A. 1977. The validity of alternative methods of scaling school assessments at the HSC level for the colleges and high schools of the Australian Capital Territory. Paper presented at the annual conference of the Australian Association for Research in Education, Canberra, 1977.
- KEEVES, J.P. 1980. Reference tests : their use in the scaling of school assessment scores. Paper presented at the 5th Australian Statistical Conference, University of N.S.W., August 1980.
- KENNARD, R.W. 1971. A note on the C_p statistic. Technometrics, 13, 899-900.
- KNIGHT, I. 1981. Course scores : procedures and calculations. A.C.T. Schools Authority, Canberra.
- LEES, L. 1979. Research relating to the Australian Scholastic Aptitude Test : a selected annotated bibliography. Australian Council for Educational Research, Hawthorn, Victoria.
- McGAW, B. 1977a. Ought secondary exit to serve tertiary entrance? Victorian Institute of Educational Research Bulletin, 39, 2-24.
- McGAW, B. 1977b. The use of rescaled teacher assessments in the admission of students to tertiary study. Australian Journal of Education, 21, 209-225.
- MORGAN, D.E. 1978. Tertiary entrance score study : number one. A.C.T. Schools Authority, Canberra.

- MORGAN, D.E. 1981a. Tertiary entrance score study :
number four. A.C.T. Schools Authority, Canberra.
- MORGAN, D.E. 1981b. Tertiary entrance score study :
number five. A.C.T. Schools Authority, Canberra.
- MURGATROYD, P.N. 1975. An adjustment procedure for
examination marks in optional subjects. International
Journal of Mathematical Education in Science and
Technology, 6, 435-444.
- O'CONNOR, C. 1974. Correlation of senior and university
performance (Engineering semester 1, 1974). Faculty
of Engineering, University of Queensland, St. Lucia,
Queensland.
- OTTO, E.P. 1976. ASAT and other factors related to
academic achievement. Educational Research and
Perspectives, 3, 34-43.
- RESEARCH PAPERS RELATING TO THE AUSTRALIAN SCHOLASTIC
APTITUDE TEST. 1978. Australian Council for
Educational Research : papers presented at the 1978
annual conference.
- RUBIN, D.B. 1980. Using empirical Bayes techniques in the
law school validity studies. Journal of the American
Statistical Association, 75, 801-827.
- RUST, K. 1980. The statistical treatment of some problems
in a system of scaled school assessments. Paper
presented at the 5th Australian Statistical Conference,
University of N.S.W., August 1980.
- SEBER, G.A.F. 1977. Linear regression analysis.
Wiley, New York.

SMURTHWAITE, A. 1973. Final year secondary school examination results and scholastic aptitude tests as a basis for selection for entrance to university. Higher Education Research Unit, Monash University, Clayton, Victoria.

SUTHERLAND, J.E.N. 1973. Prediction of academic performance at two Australian universities. Australian University, 11, 122-170.

TERTIARY EDUCATION ENTRANCE PROJECT. 1975. Evaluation of TEEP as a predictor of success in first year law studies at the Australian National University, 1971-1973. Department of Education, Woden, A.C.T.

THOMSON, P.P. 1974. Assessment for Australian Capital Territory secondary schools. Australian Council for Educational Research, Hawthorn, Victoria.

APPENDIX 1

TES PERCENTILE FREQUENCIES FOR A.C.T. COLLEGES

The following tables give numbers of students from each A.C.T. college in each 5% percentile band of TES. The information was obtained by detailed tabulation from listings of A.C.T. Year 12 results supplied by the A.C.T. Schools Authority. The data are an accurate reflection of the listings, but differ very slightly in total student numbers from summary tabulations provided with the listings. Only data from the first two years of the study were analysed in detail in this manner. College abbreviations are listed in section 6.1 (page 82).

1977 COLLEGE YEAR 12 (1978 A.N.U. FIRST YEAR)

<u>TES</u> <u>Percentile</u>	<u>TES</u> <u>Range</u>	<u>BR</u>	<u>DA</u>	<u>DK</u>	<u>ED</u>	<u>GG</u>	<u>GR</u>	<u>HK</u>	<u>MA</u>	<u>NB</u>	<u>PH</u>	<u>ALL</u> <u>Colleges</u>
0-5	360-332	1	12	8	4	15	1	18	10	5	9	83
5-10	331-313	5	8	23	8	5	3	14	3	2	16	87
10-15	312-302	8	4	18	4	6	7	12	3	4	12	78
15-20	301-292	1	4	12	2	12	6	18	3	8	20	86
20-25	291-284	3	2	19	4	7	3	17	4	7	22	88
25-30	283-277	4	5	10	6	2	5	14	7	3	30	86
30-35	276-270	4	4	14	2	5	6	11	5	8	23	82
35-40	269-265	1	4	18	1	5	3	6	4	7	32	81
40-45	264-259	4	3	15	2	5	3	21	3	7	30	93
45-50	258-253	2	1	17	2	8	4	13	4	8	16	75
50-55	252-246	1	3	19	2	7	5	12	4	8	33	94
55-60	245-240	6	4	15	2	5	4	18	2	16	19	91
60-65	239-234	6	1	13	2	5	1	16	2	12	20	78
65-70	233-227	3	5	25	4	5	10	8	4	10	20	94
70-75	226-221	3	4	17	4	2	7	21	3	12	13	86
75-80	220-214	6	7	7	7	4	4	14	2	6	26	83
80-85	213-205	6	4	13	6	2	3	17	5	12	17	85
85-90	204-196	7	8	12	4	4	10	17	1	10	12	85
90-95	195-178	3	5	15	9	3	7	19	1	7	17	86
95-100	177-123	7	4	8	9	6	5	9	2	10	20	80
OVERALL		81	92	298	84	113	97	295	72	162	407	1701

1978 COLLEGE YEAR 12 (1979 A.N.U. FIRST YEAR)

<u>TES</u> <u>Percentile</u>	<u>TES</u> <u>Range</u>	<u>BR</u>	<u>DA</u>	<u>DK</u>	<u>ED</u>	<u>GG</u>	<u>GR</u>	<u>HK</u>	<u>MA</u>	<u>NB</u>	<u>PH</u>	<u>ST</u>	<u>ALL</u> <u>Colleges</u>
0-5	412-334	3	10	6	4	5	6	17	2	5	20	11	89
5-10	333-316	1	7	12	2	2	7	25	7	7	5	9	84
10-15	315-302	2	6	18	2	3	5	22	2	4	12	12	88
15-20	301-293	3	7	22	3	7	9	14	2	6	10	12	95
20-25	292-285	3	6	19	4	7	6	9	3	4	12	10	83
25-30	284-278	5	4	13	2	6	3	16	4	7	11	10	81
30-35	277-271	3	6	13	4	5	4	15	3	9	16	13	91
35-40	270-264	3	7	17	2	9	7	13	4	9	10	14	95
40-45	263-258	1	8	16	4	3	3	18	7	4	5	14	83
45-50	257-253	1	4	10	0	9	8	16	3	5	12	20	88
50-55	252-247	7	9	22	1	2	3	18	3	7	5	15	92
55-60	246-241	5	8	11	2	5	6	17	5	6	6	10	81
60-65	240-234	5	3	16	5	8	4	19	4	9	11	14	98
65-70	233-227	6	3	13	5	1	8	17	3	9	9	15	89
70-75	226-220	5	4	14	1	1	5	14	1	8	4	15	72
75-80	219-212	10	7	14	5	5	5	14	2	14	4	15	95
80-85	211-204	4	12	12	4	4	4	15	0	9	5	16	85
85-90	203-195	5	7	12	4	1	8	15	3	15	10	10	90
90-95	194-177	5	2	13	8	3	10	21	1	9	1	14	87
95-100	176-77	12	4	6	11	2	12	17	2	10	3	14	93
OVERALL		89	124	279	73	88	123	332	61	156	171	263	1759

APPENDIX 2

FREQUENCIES OF GRADES IN INDIVIDUAL UNITS

The following tables present the distribution of the A.N.U. grades obtained by students from A.C.T. Colleges in each unit available.

Not all units were available in all years, mainly due to restructuring of courses. Those known to be unavailable in a particular year are marked * .

The grades awarded were:

HD	-	High Distinction
D	-	Distinction
HM	-	Pass with High Merit (Faculty of Economics only)
CR	-	Credit
PM	-	Pass with Merit (Faculty of Economics only)
P	-	Pass
P1	-	Pass 1 (Faculty of Science only)
P2	-	Pass 2 (Faculty of Science only)
N	-	Failure
W	-	Withdrawal

1978

[illegible]

1978 (cont.)

<u>UNIT</u>	<u>HD</u>	<u>D</u>	<u>HM</u>	<u>CR</u>	<u>PM</u>	<u>P</u>	<u>P1</u>	<u>P2</u>	<u>N</u>	<u>W</u>	<u>TOTAL</u>
Economics 1	0	0	0	0	3	28	0	0	14	4	49
Economics 1H	0	1	0	1	0	0	0	0	1	0	3
Accounting 1	0	0	0	1	0	12	0	0	10	7	30
Economic History 1	0	0	0	4	0	9	0	0	3	0	16
Statistics A01/1	3	5	0	7	0	19	0	0	5	2	41
Statistics A01/2	0	2	0	8	0	9	0	0	5	3	27
Statistics A02	3	1	0	12	0	13	0	0	2	2	33
Statistics A03	1	2	0	3	0	8	0	0	6	0	20
Legal Method	0	1	0	6	0	23	0	0	0	1	31
Constitutional Law & Civil Rights	1	1	0	12	0	14	0	0	0	1	29
Legal System & Torts*	0	0	0	0	0	0	0	0	0	0	0
Contracts	0	0	0	11	0	16	0	0	2	2	31
Criminal Law & Procedure	0	0	0	0	0	0	0	0	0	0	0
Pure Maths A01	0	0	0	5	0	2	10	0	3	4	24
Pure Maths A02	1	0	0	3	0	0	4	0	0	0	8
Pure Maths A03	0	2	0	10	0	6	15	0	2	4	39
Pure Maths A04	0	1	0	5	0	0	19	1	4	1	31
Pure Maths A05H	3	6	0	9	0	0	0	0	1	1	20
Pure Maths A06H	0	1	0	4	0	0	7	0	0	1	13
Pure Maths B05H	0	0	0	0	0	0	0	0	0	0	0
Pure Maths B06H	0	0	0	0	0	0	0	0	0	0	0
Applied Maths A12	0	1	0	2	0	0	7	0	0	1	11
Applied Maths A21	0	1	0	4	0	0	10	1	5	2	23
Applied Maths A22	1	0	0	8	0	0	9	0	2	0	20
Applied Maths A31H	1	2	0	5	0	0	3	1	0	0	12
Applied Maths A32H	0	2	0	1	0	0	2	0	0	0	5
Computer Science A01*	0	0	0	0	0	0	0	0	0	0	0
Computer Science A02*	0	0	0	0	0	0	0	0	0	0	0
Physics A01	1	1	0	1	0	0	11	1	5	5	25
Physics A02	0	0	0	0	0	0	6	1	4	1	12
Physics A11*	0	0	0	0	0	0	0	0	0	0	0
Physics A12*	0	0	0	0	0	0	0	0	0	0	0
Physics B06	0	0	0	0	0	0	0	0	0	0	0
Geology A01	0	0	0	1	0	0	3	0	1	2	7
Chemistry A01	0	2	0	6	0	0	18	2	3	4	35
Chemistry A02	1	0	0	3	0	0	23	2	0	8	37
Botany A01	1	1	0	4	0	0	12	3	2	5	28
Zoology A01	1	1	0	10	0	0	14	4	0	7	37
Human Biology A02	0	0	0	5	0	0	4	0	2	1	12
Psychology A01	0	0	0	11	0	0	25	1	0	9	46

1979

<u>UNIT</u>	<u>HD</u>	<u>D</u>	<u>HM</u>	<u>CR</u>	<u>PM</u>	<u>P</u>	<u>P1</u>	<u>P2</u>	<u>N</u>	<u>W</u>	<u>TOTAL</u>
History 1A	0	2	0	1	0	5	0	0	1	2	11
History 1B	0	1	0	3	0	5	0	0	1	0	10
History 1C	1	0	0	2	0	8	0	0	1	2	14
History 1E	0	2	0	5	0	3	0	0	0	1	11
History 1F	0	0	0	0	0	0	0	0	0	0	0
History 1G	0	0	0	2	0	4	0	0	0	1	7
Roman Civilisation*	0	0	0	0	0	0	0	0	0	0	0
Greek Civilisation	0	1	0	1	0	3	0	0	0	0	5
Prehistory 1	0	4	0	3	0	4	0	0	1	1	13
Anthropology 1	0	4	0	13	0	4	0	0	1	1	23
Medieval Studies 1	0	2	0	2	0	2	0	0	0	1	7
Geography 1A	0	0	0	4	0	5	0	0	0	2	11
Geography 1B	0	1	0	1	0	1	0	0	1	0	4
Political Science 1	0	0	0	13	0	21	0	0	1	5	40
Sociology 1	3	3	0	12	0	10	0	0	0	4	32
Philosophy A1	0	1	0	8	0	6	0	0	2	2	19
Philosophy A2	1	0	0	0	0	0	0	0	0	1	2
Fine Art 1	0	2	0	2	0	0	0	0	0	0	4
English 1	0	7	0	10	0	27	0	0	3	3	50
English A1*	0	0	0	0	0	0	0	0	0	0	0
English A2*	0	0	0	0	0	0	0	0	0	0	0
English A3*	0	0	0	0	0	0	0	0	0	0	0
English A4*	0	0	0	0	0	0	0	0	0	0	0
Latin 1A	1	0	0	1	0	1	0	0	1	0	4
Latin 1B	0	0	0	0	0	0	0	0	0	1	1
Greek 1A	0	0	0	0	0	0	0	0	0	1	1
Linguistics A1	0	1	0	1	0	1	0	0	0	1	4
Linguistics A2	0	1	0	2	0	1	0	0	1	0	5
Linguistics A3	0	0	0	0	0	0	0	0	0	0	0
Linguistics A4	0	0	0	0	0	0	0	0	0	0	0
Introductory French	2	0	0	1	0	0	0	0	0	0	3
French Language & Literature 1	2	3	0	2	0	3	0	0	0	2	12
Italian 1	0	3	0	2	0	1	0	0	0	2	8
Italian 2	1	0	0	0	0	0	0	0	0	0	1
German Literature 1	1	0	0	2	0	1	0	0	0	1	5
German Language 1	2	1	0	0	0	1	0	0	0	1	5
Russian 1	0	1	0	0	0	1	0	0	0	1	3
Polish 1	0	0	0	0	0	0	0	0	0	0	0
Swedish 1A	0	0	0	0	0	0	0	0	0	0	0
Intro.South Asia S1	0	1	0	0	0	0	0	0	0	0	1
Intro.S.E.Asia SE1	0	0	0	1	0	4	0	0	0	2	7
East Asian History E1	0	0	0	0	0	1	0	0	0	1	2
Contemporary Japan	0	1	0	0	0	0	0	0	0	0	1
Japanese 1	0	1	0	0	0	1	0	0	0	0	2
Modern Chinese 1	0	0	0	0	0	0	0	0	0	0	0
Modern Chinese 2	1	0	0	0	0	0	0	0	0	0	1
Thai 1	0	0	0	0	0	0	0	0	0	1	1
Bahasa Indo.Malay 1	2	1	0	1	0	0	0	0	0	3	7
Literary Arabic 1	0	0	0	1	0	0	0	0	0	0	1

1979 (cont.)

<u>UNIT</u>	<u>HD</u>	<u>D</u>	<u>HM</u>	<u>CR</u>	<u>PM</u>	<u>P</u>	<u>P1</u>	<u>P2</u>	<u>N</u>	<u>W</u>	<u>TOTAL</u>
Economics 1	0	0	2	0	5	28	0	0	24	12	71
Economics 1H	0	0	0	2	0	0	0	0	0	0	2
Accounting 1	0	0	0	4	0	13	0	0	5	8	30
Economic History 1	0	1	0	1	0	11	0	0	5	1	19
Statistics A01/1	2	6	0	8	0	20	0	0	7	3	46
Statistics A01/2	1	3	0	10	0	18	0	0	7	0	39
Statistics A02	1	3	0	8	0	20	0	0	1	1	34
Statistics A03	1	5	0	7	0	11	0	0	5	1	30
Legal Method	0	4	0	7	0	23	0	0	1	0	35
Constitutional Law & Civil Rights	1	1	0	9	0	19	0	0	3	0	33
Legal System & Torts*	0	0	0	0	0	0	0	0	0	0	0
Contracts	1	1	0	4	0	23	0	0	3	1	33
Criminal Law & Procedure	0	0	0	0	0	0	0	0	0	0	0
Pure Maths A01	0	0	0	4	0	0	11	0	5	8	28
Pure Maths A02	0	2	0	2	0	0	3	0	4	4	15
Pure Maths A03	3	6	0	9	0	0	21	0	2	0	41
Pure Maths A04	4	7	0	9	0	0	11	2	4	0	37
Pure Maths A05H	4	3	0	5	0	0	5	0	0	0	17
Pure Maths A06H	4	2	0	1	0	0	7	0	1	0	15
Pure Maths B05H	1	0	0	0	0	0	0	0	0	0	1
Pure Maths B06H	1	0	0	0	0	0	0	0	0	0	1
Applied Maths A12	0	1	0	1	0	0	4	1	0	0	7
Applied Maths A21	0	3	0	1	0	0	2	0	1	1	8
Applied Maths A22	1	1	0	3	0	0	2	0	1	0	8
Applied Maths A31H	3	7	0	4	0	0	2	0	0	0	16
Applied Maths A32H	2	3	0	4	0	0	2	2	0	0	13
Computer Science A01	8	3	0	7	0	0	7	1	5	3	34
Computer Science A02	4	6	0	3	0	0	7	1	1	2	24
Physics A01*	0	0	0	0	0	0	0	0	0	0	0
Physics A02	0	0	0	0	0	0	0	0	0	0	0
Physics A11	1	3	0	5	0	0	8	4	7	8	36
Physics A12	1	1	0	2	0	0	1	0	0	0	5
Physics B06	1	0	0	0	0	0	0	0	0	0	1
Geology A01	2	0	0	2	0	0	1	3	1	1	10
Chemistry A01	2	3	0	4	0	0	10	3	6	4	32
Chemistry A02	3	3	0	3	0	0	13	1	2	5	30
Botany A01	0	2	0	2	0	0	7	4	2	5	22
Zoology A01	0	2	0	3	0	0	14	1	4	7	31
Human Biology A02	0	0	0	2	0	3	3	0	0	1	9
Psychology A01	0	2	0	11	0	17	4	1	0	5	40

1980

[illegible]

1980 (cont.)

<u>UNIT</u>	<u>HD</u>	<u>D</u>	<u>HM</u>	<u>CR</u>	<u>PM</u>	<u>P</u>	<u>P1</u>	<u>P2</u>	<u>N</u>	<u>W</u>	<u>TOTAL</u>
Economics 1	0	0	0	0	4	37	0	0	25	13	79
Economics 1H	0	0	0	2	0	0	0	0	0	0	2
Accounting 1	0	1	0	3	0	15	0	0	7	16	42
Economic History 1	0	0	0	0	0	16	0	0	3	0	19
Statistics A01/1	3	7	0	10	0	28	0	0	8	5	61
Statistics A01/2	1	7	0	7	0	13	0	0	7	2	37
Statistics A02	2	4	0	11	0	20	0	0	1	3	41
Statistics A03	0	1	0	9	0	12	0	0	5	1	28
Legal Method*	0	0	0	0	0	0	0	0	0	0	0
Constitutional Law & Civil Rights	0	0	0	0	0	0	0	0	0	0	0
Legal System & Torts	0	1	0	8	0	27	0	0	4	4	44
Contracts	0	4	0	5	0	27	0	0	4	4	44
Criminal Law & Procedure	0	0	0	0	0	0	0	0	0	1	1
Pure Maths A01	0	0	0	3	0	0	10	0	1	3	17
Pure Maths A02	0	2	0	12	0	0	7	1	3	1	26
Pure Maths A03	4	11	0	18	0	0	7	0	2	3	45
Pure Maths A04	3	14	0	10	0	0	11	3	0	2	43
Pure Maths A05H	2	3	0	4	0	0	8	0	0	1	18
Pure Maths A06H	2	0	0	4	0	0	4	0	0	2	12
Pure Maths B05H	0	0	0	0	0	0	0	0	0	0	0
Pure Maths B06H	0	0	0	0	0	0	0	0	0	0	0
Applied Maths A12	0	0	0	0	0	0	2	0	0	0	2
Applied Maths A21	1	5	0	2	0	0	4	0	1	1	14
Applied Maths A22	0	4	0	1	0	0	5	1	1	0	12
Applied Maths A31H	2	2	0	7	0	0	2	0	1	0	14
Applied Maths A32H	2	1	0	2	0	0	6	1	1	0	13
Computer Science A01	5	7	0	14	0	0	15	6	11	2	60
Computer Science A02	1	6	0	14	0	0	11	3	1	2	38
Physics A01*	0	0	0	0	0	0	0	0	0	0	0
Physics A02*	0	0	0	0	0	0	0	0	0	0	0
Physics A11	4	3	0	3	0	0	7	2	2	7	28
Physics A12	0	0	0	2	0	0	1	1	0	0	4
Physics B06	0	0	0	0	0	0	0	0	0	0	0
Geology A01	0	1	0	0	0	0	3	0	1	1	6
Chemistry A01	3	2	0	4	0	0	18	3	6	6	42
Chemistry A02	0	4	0	4	0	0	15	1	1	6	31
Botany A01	0	2	0	6	0	0	15	0	0	4	27
Zoology A01	0	4	0	10	0	0	19	2	2	6	43
Human Biology A02	0	1	0	3	0	0	5	2	0	0	11
Psychology A01	1	2	0	11	0	0	18	0	0	8	40

APPENDIX 3

FORTRAN PROGRAMS

The following programs were used mainly for data checking, manipulation and tabulation. They were written in FORTRAN 4 and run on the CSIRO Division of Computing Research Cyber 76 computer. In all instances only the program for the first year of data (College Year 12 1977, A.N.U. first year 1978) is given; programs for the other two years are obtained by obvious minor amendments.

There were four files from which these programs read the data :

- ZCP77 : Full data for all 1977 Year 12 college students, as listed on page 6. There were 1701 records.
- ZC771 : Data relating to college variables for the students who were admitted to A.N.U. (241 records in 1977).
- ZA781 : A.N.U. first year results in 1978 achieved by all students who came from A.C.T. colleges. (241 records).
- ZA782 : A second record of A.N.U. results where there was insufficient space on the record in ZA781.

PROGRAM 1 - DETAILED CHECKING OF COLLEGE DATA

- ZCCHK77 : Checks data in file ZC771 for inconsistencies and lists all student records in descending order of TES.

PROGRAM 2 - DETAILED CHECKING OF A.N.U. DATA

- ZACHK78 : Checks data in files ZA781 and ZA782 for inconsistencies.

PROGRAM 3 - TABULATIONS FOR FULL COLLEGE DATA

ZXNEC77 : Tabulates number of students from each college obtaining each TES, and summarises this by 5% percentiles. Tables 2.1 - 2.5 and Appendix 1 are based on this program.

PROGRAM 4 - GRADE FREQUENCIES IN A.N.U. UNITS

ZANO78 : Gives number of students receiving each grade in each A.N.U. unit available. Tables 2.6 - 2.8 and Appendix 2 are based on this program.

PROGRAM 5 - DATA AVAILABLE FOR INDIVIDUAL A.N.U. UNITS

ZEXA78 : Extracts from all data files and prints out the college variables and A.N.U. information for students attempting any specified A.N.U. unit. Information for more than one unit can be obtained in each run.

PROGRAM 6 - SUMMARY TABULATIONS FOR A.N.U. UNITS

ZIANUG8 : Tabulates for any specified A.N.U. unit or group of units, both overall and for each 5% percentile, frequencies of results and mean grade scores. Tables 5.1 - 5.3 are based on this program.

PROGRAM 7 - SUMMARY TABULATIONS FOR COLLEGES

ZICOLL8 : Tabulates for any specified A.N.U. unit or group of units, both overall and for each 5% percentile, some summary statistics for each college and for all colleges. Table 6.1 is based on this program.

PROGRAM 8 - DATA FILE FOR REGRESSIONS BASED ON MARKS.

ZEMK78 : Produces a data file for a specified A.N.U. unit or group of units containing all information necessary for the regression analyses on marks (chapter 4). This is then the input file for ZR78A (see Appendix 4).

PROGRAM 9 - DATA FILE FOR GRADE SCORE REGRESSIONS

ZEGS78 : Produces a data file for a specified group of A.N.U. units containing all information necessary for grade score regression analyses (chapter 5). This is then the input file for ZS78A (see Appendix 4). Data for all groupings are given, but only the appropriate part should be included when the program is run. Trivial amendment to this program enables students with TES above a specified level to be excluded from the output file.

PROGRAM 1 - DETAILED CHECKING OF COLLEGE DATA.

ZCCHK77.

ATTACH,TAPE1,ZC771,ID=CMSXWM.

ATTACH,TAPE2,ZC772,ID=CMSXWM.

FTN,SL.

LGO.

```

      PROGRAM CCHECK7(TAPE1,TAPE2,OUTPUT,TAPE61=OUTPUT)
      DIMENSION NANU1(270),ACOLL1A(270),ACOLL1B(270),NCOLL1(270),
+      ITES(270),IAV(270),IAQ(270),IAT(270),IPR1(270),IPR2(270),
+      IPR3(270),RANK12(270),RANKAGE(270),NCOURSE(8),NSUBC(8),
+      NSUBA(8)
      WRITE(61,5)
      5 FORMAT(1H1,/)
      I=0
      10 I=I+1
      READ(1,15)NANU1(I),ACOLL1A(I),ACOLL1B(I),NCOLL1(I),NCARD,
+      ITES(I),IAV(I),IAQ(I),IAT(I),IPR1(I),IPR2(I),IPR3(I),
+      RANK12(I),RANKAGE(I),(NCOURSE(J),NSUBC(J),J=1,3)
      15 FORMAT(I6,1X,2A1,I6,1X,I1,I4,3I3,1X,3I1,2F5.1,
+      +3(1X,I4,1X,I3,3X))
      IF(EOF(1))100,20
      20 IF(NCARD.EQ.1)GOTO 29
      READ(2,25)NANU2,ACOLL2A,ACOLL2B,NCOLL2,
+      (NCOURSE(J),NSUBC(J),J=4,8)
      25 FORMAT(I6,1X,2A1,I6,3X,5(1X,I4,1X,I3,3X))
      C   WRITE OUT BASIC INFORMATION FROM CARD 1.
      29 WRITE(61,30)NANU1(I),ACOLL1A(I),ACOLL1B(I),NCOLL1(I),ITES(I),
+      IAV(I),IAQ(I),IAT(I),IPR1(I),IPR2(I),IPR3(I),RANK12(I),
+      RANKAGE(I)
      30 FORMAT(5X,I6,4X,2A1,I6,I5,5X,3I4,3X,3I1,2F8.1)
      C   CHECK ANU STUDENT NUMBERS.
      IF(NCARD.EQ.1)GOTO 40
      IF(NANU1(I).EQ.NANU2)40,35
      35 WRITE(61,36)
      36 FORMAT(10X,*ANU STUDENT NUMBERS DIFFER ON TWO CARDS*)
      C   CHECK COLLEGE STUDENT NUMBERS.
      40 IF(NCARD.EQ.1)GOTO 50
      IF(ACOLL1A(I).EQ.ACOLL2A)41,45
      41 IF(ACOLL1B(I).EQ.ACOLL2B)42,45
      42 IF(NCOLL1(I).EQ.NCOLL2)50,45
      45 WRITE(61,46)
      46 FORMAT(10X,*COLLEGE STUDENT NUMBERS DIFFER ON TWO CARDS*)
      C   CHECK ASAT RANGE.
      50 IF(IAV(I).LE.100)51,53
      51 IF(IAV(I).GE.0)55,53
      53 WRITE(61,54)
      54 FORMAT(10X,*ASAT VERBAL OUTSIDE RANGE*)
      55 IF(IAQ(I).LE.100)56,58
      56 IF(IAQ(I).GE.0)60,58
      58 WRITE(61,59)
      59 FORMAT(10X,*ASAT QUANTITATIVE OUTSIDE RANGE*)
      60 IF(IAT(I).LE.100)61,63
      61 IF(IAT(I).GE.0)70,63
      63 WRITE(61,64)
      64 FORMAT(10X,*ASAT TOTAL OUTSIDE RANGE*)
      C   CHECK PRINCIPAL'S RECOMMENDATION.

```

```
70 IF(IPR1(I).GE.1)71,77
71 IF(IPR1(I).LE.6)72,77
72 IF(IPR2(I).GE.1)73,77
73 IF(IPR2(I).LE.6)74,77
74 IF(IPR3(I).GE.1)75,77
75 IF(IPR3(I).LE.6)80,77
77 WRITE(61,78)
78 FORMAT(10X,*PRINCIPAL'S RECOMMENDATION OUTSIDE RANGE*)
C CHECK COLLEGE UNIT MARKS.
80 DO 90 J=1,8
  IF(J.GT.3.AND.NCARD.EQ.1)GOTO 90
  IF(NCOURSE(J).LT.1)90,81
81 IF(NSUBC(J).LE.100)82,85
82 IF(NSUBC(J).GE.0)90,85
85 WRITE(61,87)J
87 FORMAT(10X,*COLLEGE MARK FOR SUBJECT*,I3,* IS OUTSIDE RANGE*)
90 CONTINUE
  GOTO 10
100 NUNITS=I-1
  WRITE(61,101)
101 FORMAT(1H1,///,20X,*LISTING OF STUDENTS IN DESCENDING TES
+SCORE ORDER*,//)
  DO 120 IT=1,128
    KTES=377-IT
    DO 110 J=1,NUNITS
      IF(ITES(J).EQ.KTES)105,110
105 WRITE(61,30)NANU1(J),ACOLL1A(J),ACOLL1B(J),NCOLL1(J),ITES(J),
+IAV(J),IAQ(J),IAT(J),IPR1(J),IPR2(J),IPR3(J),RANK12(J),
+RANKAGE(J)
110 CONTINUE
120 CONTINUE
  DO 130 J=1,NUNITS
    IF(ITES(J).LT.249)125,130
125 WRITE(61,30)NANU1(J),ACOLL1A(J),ACOLL1B(J),NCOLL1(J),ITES(J),
+IAV(J),IAQ(J),IAT(J),IPR1(J),IPR2(J),IPR3(J),RANK12(J),
+RANKAGE(J)
130 CONTINUE
  END
```

PROGRAM 2 - DETAILED CHECKING OF A.N.U. DATA.

ZACHK78.
GETSET,CMS8736.
ATTACH,TAPE1,ZC771,ID=CMSXWM,SN=CMS8736.
ATTACH,TAPE2,ZA781,ID=CMSXWM.
ATTACH,TAPE3,ZA782,ID=CMSXWM.
FTN,SL,R=1.
LGO.

```
PROGRAM ACHECK8(TAPE1,TAPE2,TAPE3,INPUT,OUTPUT,TAPE60=INPUT,  
+TAPE61=OUTPUT)  
  DIMENSION NUNIT(8),WT(8),GRADE(8),MARK(8),NVALID(107),  
+GVALID(10)  
  DATA(GVALID=2HHD,2HD,2HCR,2HHM,2HPM,2HP1,2HP2,2HP,2HW,2HN)  
  READ(60,3)(NVALID(I),I=1,107)  
  3 FORMAT(10I6)  
  WRITE(61,5)  
  5 FORMAT(1H1,/) )  
  10 READ(1,15)NANUC  
  15 FORMAT(I6)  
  IF(EOF(1))200,19  
  19 READ(2,20)NANU1,NCARDS1,N1,NCOURSE,FULPAR,SEX,  
+ (NUNIT(J),WT(J),GRADE(J),MARK(J),J=1,4)  
  20 FORMAT(I6,1X,2I1,1X,I2,1X,A1,1X,A1,4(I6,F4.1,1X,A2,I3))  
  IF(NCARDS1.EQ.1)GOTO 30  
  READ(3,25)NANU2,NCARDS2,N2,(NUNIT(J),WT(J),GRADE(J),MARK(J),  
+J=5,8)  
  25 FORMAT(I6,1X,2I1,4(I6,F4.1,1X,A2,I3))  
  30 WRITE(61,31)  
  31 FORMAT( )  
  WRITE(61,33)NANU1,NCARDS1,N1,NCOURSE,FULPAR,SEX,  
+ (NUNIT(J),WT(J),GRADE(J),MARK(J),J=1,4)  
  33 FORMAT(5X,I6,1X,2I1,1X,I2,1X,A1,1X,A1,4(I6,F4.1,1X,A2,I3))  
  IF(NCARDS1.NE.1)WRITE(61,35)NANU2,NCARDS2,N2,  
+ (NUNIT(J),WT(J),GRADE(J),MARK(J),J=5,8)  
  35 FORMAT(28X,I6,1X,2I1,4(I6,F4.1,1X,A2,I3))  
C  CHECK ANU STUDENT NUMBERS.  
  IF(NANU1.EQ.NANUC)40,37  
  37 WRITE(61,38)  
  38 FORMAT(10X,*CARD 1 ANU STUDENT NUMBER DIFFERS FROM COLLEGE  
+FILE ANU STUDENT NUMBER*)  
  40 IF(NCARDS1.EQ.1)GOTO 45  
  IF(NANU2.EQ.NANUC)45,42  
  42 WRITE(61,43)  
  43 FORMAT(10X,*CARD 2 ANU STUDENT NUMBER DIFFERS FROM COLLEGE  
+FILE ANU STUDENT NUMBER*)  
C  CHECK CARD NUMBERS.  
  45 IF(NCARDS1.EQ.1)47,46  
  46 IF(NCARDS1.EQ.2)47,50  
  47 IF(N1.NE.1)GOTO 50  
  IF(NCARDS1.EQ.1)GOTO 55  
  IF(N2.NE.2)GOTO 50  
  IF(NCARDS2.NE.2)GOTO 50  
  GOTO 55  
  50 WRITE(61,52)  
  52 FORMAT(10X,*PROBLEMS WITH CARD NUMBERS.*)
```

```
C      CHECK COURSE IN RANGE 1 TO 13.
55  IF(NCOURSE.LT.1)GOTO 56
    IF(NCOURSE.GT.13)GOTO 56
    GOTO 60
56  WRITE(61,57)
57  FORMAT(10X,*COURSE NUMBER NOT BETWEEN 1 AND 13*)
C      CHECK FULL- OR PART-TIME.
60  IF(FULPAR.EQ.1HF)GOTO 65
    IF(FULPAR.EQ.1HP) GOTO 65
    WRITE(61,62)
62  FORMAT(10X,*COURSE NOT DESIGNATED 'F' OR 'P'.*)
C      CHECK SEX.
65  IF(SEX.EQ.1HM)GOTO 67
    IF(SEX.EQ.1HF)GOTO 67
    WRITE(61,66)
66  FORMAT(10X,*SEX NOT 'M' OR 'F'.*)
C      CHECK ALL UNIT INFORMATION FOR ERRORS.
67  IF(NCARDS1.GT.1)GOTO 69
    DO 68 J=5,8
68  NUNIT(J)=0
69  DO 120 J=1,8
    IF(NUNIT(J).LT.1) GOTO 120
    DO 70 K=1,107
    IF(NUNIT(J).EQ.NVALID(K))GOTO 75
70  CONTINUE
    WRITE(61,72)NUNIT(J),J
72  FORMAT(10X,*THE UNIT NUMBER*,I6,* FOR UNIT*,I3,* IS NOT A
+VALID NUMBER*)
75  IF(J.EQ.1)GOTO 85
    L=J-1
    DO 84 I=1,L
    IF(NUNIT(I).NE.NUNIT(J))GOTO 84
    WRITE(61,82)NUNIT(J),J
82  FORMAT(10X,*THE UNIT NUMBER*,I6,* FOR UNIT*,I3,* IS THE SAME
+AS ANOTHER UNIT NUMBER*)
84  CONTINUE
85  IF(ABS(WT(J)-1.0).LT.0.01)GOTO 90
    IF(ABS(WT(J)-2.0).LT.0.01)GOTO 90
    WRITE(61,87)J
87  FORMAT(10X,*WEIGHT OF UNIT*,I3,* IS NOT 1.0 OR 2.0*)
90  DO 95 K=1,10
    IF(GRADE(J).EQ.GVALID(K))GOTO 100
95  CONTINUE
    WRITE(61,97)J
97  FORMAT(10X,*GRADE FOR UNIT*,I3,* IS NOT VALID.*)
100 IF(MARK(J).LT.-1)GOTO 105
    IF(MARK(J).GT.100)GOTO 105
    GOTO 120
105 WRITE(61,107)J
107 FORMAT(10X,*MARK FOR UNIT*,I3,* IS OUTSIDE RANGE.*)
120 CONTINUE
    GOTO 10
200 STOP
    END
```

10065	10106	10214	10366	10407	10504	10667	10902	11039	11448
11482	11556	11631	12081	12092	12166	12207	12713	12906	12951
13088	13754	13787	13862	14193	14546	14847	15082	15372	15480
15565	15576	15673	15781	15844	15866	15877	16056	16108	16249
16358	16465	16766	16959	16960	17428	18254	18555	18856	18953
20138	20291	20406	20417	20439	20569	20837	20934	30182	30234
30621	30706	30814	40017	40233	40277	40318	40501	40653	40954
40976	41241	42011	43494	43795	44004	44015	44048	44156	44305
44316	44327	44349	44457	44532	44628	44703	44714	44918	44929
50005	50362	50384	50395	50511	50618	50685	50704	50878	50931
51057	51121	51239	51499	51518	51842	52902			

PROGRAM 3 - TABULATIONS FOR FULL COLLEGE DATA.

ZXNEC77.
GETSET,CMS8736.
ATTACH,TAPE1,ZCP77,ID=CMSXWM,SN=CMS8736.
FTN,SL,R=1.
LGO.

```
      PROGRAM NEC77(INPUT,OUTPUT,TAPE1,TAPE60=INPUT,TAPE61=OUTPUT)
      DIMENSION NTESL(20),NTESH(20),NCOLL(420,12),NALL(420),
+NTCOLL(12),NPERC(20,12),NPALL(20),NTPERC(12),NAMCOLL(12),
+NSTES(12),XNSTES(12)
      DATA(NAMCOLL=2HBR,2HDA,2HDK,2HED,2HGG,2HGR,2HHK,2HMA,2HNB,
+2HPPH,2HST,2HSW)
      READ(60,2)NYEAR
      2 FORMAT(I5)
      READ(60,5)(NTESL(I),I=1,20)
      5 FORMAT(10I5)
      READ(60,5)(NTESH(I),I=1,20)
C      INITIALISE ALL COUNTING ARRAYS.
      DO 10 I=1,420
      NALL(I)=0
      DO 10 J=1,12
      10 NCOLL(I,J)=0
      DO 15 I=1,12
      NSTES(I)=0
      NTCOLL(I)=0
      15 NTPERC(I)=0
      DO 20 I=1,20
      NPALL(I)=0
      DO 20 J=1,12
      20 NPERC(I,J)=0
      NTALL=0
      NPTALL=0
      NSTALL=0
C      READ IN DATA AND INCREMENT ARRAYS.
      25 READ(1,30)ICOLL,AMAT,ITES
      30 FORMAT(3X,A2,4X,A1,I5)
      IF(EOF(1))100,35
      35 DO 40 I=1,12
      IF(ICOLL.EQ.NAMCOLL(I))GOTO 41
      40 CONTINUE
      41 ICOLL=I
C      INCREMENTS FOR MAIN TABLE.
      NCOLL(ITES,ICOLL)=NCOLL(ITES,ICOLL)+1
      NALL(ITES)=NALL(ITES)+1
      NTCOLL(ICOLL)=NTCOLL(ICOLL)+1
      NTALL=NTALL+1
      NSTES(ICOLL)=NSTES(ICOLL)+ITES
      NSTALL=NSTALL+ITES
C      INCREMENTS FOR PERCENTILE TABLE.
      DO 50 I=1,20
      IF(ITES.GE.NTESL(I))45,50
      45 IF(ITES.LE.NTESH(I))51,50
      50 CONTINUE
      51 IPERC=I
      NPERC(IPERC,ICOLL)=NPERC(IPERC,ICOLL)+1
      NPALL(IPERC)=NPALL(IPERC)+1
```

```

      NTPERC(ICOLL)=NTPERC(ICOLL)+1
      NPTALL=NPTALL+1
      GOTO 25
C     PRINT OUT FULL TES TABLE.
100  NPAGE=0
      KTES=420
101  NPAGE=NPAGE+1
      LCOUNT=0
      WRITE(61,105)NYEAR,NPAGE
105  FORMAT(1H1,/,10X,*NUMBERS OF STUDENTS FROM EACH A.C.T.
+COLLEGE RECEIVING EACH POSSIBLE TES - *,I6,* - PAGE*,I3,///)
      WRITE(61,110)(NAMCOLL(I),I=1,12)
110  FORMAT(10X,3HTES,7X,19HINDIVIDUAL COLLEGES,58X,3HALL,/,94X
+8HCOLLEGES,/,20X,12(A2,4X),/)
120  IF(NALL(KTES).LT.1)GOTO 130
      WRITE(61,125)KTES,(NCOLL(KTES,J),J=1,12),NALL(KTES)
125  FORMAT(10X,I3,3X,12I6,6X,I6)
      LCOUNT=LCOUNT+1
130  KTES=KTES-1
      IF(KTES.LT.1)GOTO 150
      IF(LCOUNT.LT.50)120,101
150  WRITE(61,160)(NTCOLL(J),J=1,12),NTALL
160  FORMAT(/,10X,6HTOTAL,12I6,6X,I6)
      DO 165 J=1,12
      IF(NTCOLL(J).LT.1)GOTO 163
      XNSTES(J)=FLOAT(NSTES(J))/FLOAT(NTCOLL(J))
      GOTO 165
163  XNSTES(J)=0.0
165  CONTINUE
      XNSTALL=FLOAT(NSTALL)/FLOAT(NTALL)
      WRITE(61,170)(XNSTES(J),J=1,12),XNSTALL
170  FORMAT(/,8X,8HMEAN TES,12F6.1,6X,F6.1)
C     PRINT OUT PERCENTAGE TABLE.
      WRITE(61,175)NYEAR
175  FORMAT(1H1,/,10X,*NUMBERS OF STUDENTS FROM EACH A.C.T.
+COLLEGE FALLING IN EACH 5% PERCENTILE BAND OF THE TES -*,
+I6,///)
      WRITE(61,180)(NAMCOLL(J),J=1,12)
180  FORMAT(10X,10HPERCENTILE,6X9HTES RANGE,5X19HINDIVIDUAL
+COLLEGES,58X3HALL,/,114X8HCOLLEGES,/,40X,12(A2,4X),/)
      XL=-5.00
      XH=-0.01
      DO 200 I=1,20
      XL=XL+5.0
      XH=XH+5.0
      WRITE(61,190)XL,XH,NTESL(I),NTESH(I),(NPERC(I,J),J=1,12),
+NPALL(I)
190  FORMAT(/,10X,F5.2,3H - ,F5.2,3X,I3,3H - ,I3,1X,12I6,6X,I6)
200  CONTINUE
      WRITE(61,205)(NTPERC(J),J=1,12),NPTALL
205  FORMAT(/,10X,7HOVERALL,19X,12I6,6X,I6)
      WRITE(61,210)
210  FORMAT(1H1)
      END

```

1977

332	313	302	292	284	277	270	265	259	253
246	240	234	227	221	214	205	196	178	123
360	331	312	301	291	283	276	269	264	258
252	245	239	233	226	220	213	204	195	177

PROGRAM 4 - GRADE FREQUENCIES IN A.N.U. UNITS.

ZAN078.

GETSET,CMS8736.

ATTACH,TAPE1,ZA781,ID=CMSXWM,SN=CMS8736.

ATTACH,TAPE2,ZA782,ID=CMSXWM,SN=CMS8736.

FTN,SL.

LGO.

```
      PROGRAM NUMANUS(TAPE1,TAPE2,INPUT,OUTPUT,TAPE60=INPUT,
+TAPE61=OUTPUT)
      DIMENSION N(122),NAME1(122),NAME2(122),NTOT(122),NHD(122),
+ND(122),NCR(122),NHM(122),NPM(122),NP1(122),NP2(122),NP(122),
+NW(122),NN(122),NUNIT(8),GRADE(8),MARK(8),NMARK(122),
+NBLANK(122),NMISS(122)
C      READ IN UNIT INFORMATION.
      READ(60,5)NYEAR,NAU
      5 FORMAT(2I5)
      DO 15 I=1,NAU
      READ(60,10)N(I),NAME1(I),NAME2(I)
      10 FORMAT(10X,I5,5X,2A10)
      15 CONTINUE
C      INITIALISE COUNTING ARRAYS.
      NAU2=NAU+2
      DO 20 I=1,NAU2
      NTOT(I)=0
      NHD(I)=0
      ND(I)=0
      NCR(I)=0
      NHM(I)=0
      NPM(I)=0
      NP1(I)=0
      NP2(I)=0
      NP(I)=0
      NW(I)=0
      NN(I)=0
      NMARK(I)=0
      NBLANK(I)=0
      20 NMISS(I)=0
      WRITE(61,22)
      22 FORMAT(1H1,/)
C      READ IN STUDENT INFORMATION, ONE STUDENT AT A TIME, AND
C      INCREMENT APPROPRIATE VARIABLES.
      KOUNT=0
      25 KOUNT=KOUNT+1
      READ(1,30)NANU1,NCARDS,(NUNIT(J),GRADE(J),MARK(J),J=1,4)
      30 FORMAT(I6,1X,I1,8X,4(I6,5X,A2,I3))
      IF(EOF(1))100,35
      35 IF(NCARDS.GT.1)36,44
      36 READ(2,40)NANU2,(NUNIT(J),GRADE(J),MARK(J),J=5,8)
      40 FORMAT(I6,3X,4(I6,5X,A2,I3))
      IF(NANU1.NE.NANU2)42,49
      42 WRITE(61,43)KOUNT
      43 FORMAT(10X,*STUDENT NUMBERS DO NOT AGREE FOR STUDENT*,I4)
      GOTO 49
      44 DO 45 J=5,8
      45 NUNIT(J)=0
```

```

C      +++++ LOOP TO INCREMENT COUNTS +++++
49 DO 60 J=1,8
    IF(NUNIT(J).LT.1)GOTO 60
    DO 50 I=1,NAU
    IF(NUNIT(J).EQ.N(I))GOTO 51
50 CONTINUE
    K=NAU+1
    GOTO 52
51 K=I
52 NTOT(K)=NTOT(K)+1
    NTOT(NAU2)=NTOT(NAU2)+1
    IF(GRADE(J).EQ.2HHD)NHD(K)=NHD(K)+1
    IF(GRADE(J).EQ.2HHD)NHD(NAU2)=NHD(NAU2)+1
    IF(GRADE(J).EQ.2HD )ND(K)=ND(K)+1
    IF(GRADE(J).EQ.2HD )ND(NAU2)=ND(NAU2)+1
    IF(GRADE(J).EQ.2HCR)NCR(K)=NCR(K)+1
    IF(GRADE(J).EQ.2HCR)NCR(NAU2)=NCR(NAU2)+1
    IF(GRADE(J).EQ.2HHM)NHM(K)=NHM(K)+1
    IF(GRADE(J).EQ.2HHM)NHM(NAU2)=NHM(NAU2)+1
    IF(GRADE(J).EQ.2HPM)NPM(K)=NPM(K)+1
    IF(GRADE(J).EQ.2HPM)NPM(NAU2)=NPM(NAU2)+1
    IF(GRADE(J).EQ.2HP1)NP1(K)=NP1(K)+1
    IF(GRADE(J).EQ.2HP1)NP1(NAU2)=NP1(NAU2)+1
    IF(GRADE(J).EQ.2HP2)NP2(K)=NP2(K)+1
    IF(GRADE(J).EQ.2HP2)NP2(NAU2)=NP2(NAU2)+1
    IF(GRADE(J).EQ.2HP )NP(K)=NP(K)+1
    IF(GRADE(J).EQ.2HP )NP(NAU2)=NP(NAU2)+1
    IF(GRADE(J).EQ.2HN )NN(K)=NN(K)+1
    IF(GRADE(J).EQ.2HN )NN(NAU2)=NN(NAU2)+1
    IF(GRADE(J).EQ.2HW )NW(K)=NW(K)+1
    IF(GRADE(J).EQ.2HW )NW(NAU2)=NW(NAU2)+1
    IF(MARK(J).GT.0)NMARK(K)=NMARK(K)+1
    IF(MARK(J).GT.0)NMARK(NAU2)=NMARK(NAU2)+1
    IF(MARK(J).EQ.0)NBLANK(K)=NBLANK(K)+1
    IF(MARK(J).EQ.0)NBLANK(NAU2)=NBLANK(NAU2)+1
    IF(MARK(J).EQ.-1)NMISS(K)=NMISS(K)+1
    IF(MARK(J).EQ.-1)NMISS(NAU2)=NMISS(NAU2)+1
60 CONTINUE
    GOTO 25
C      PRINT OUT FINAL TABLES.
100 NPAGE=1
    WRITE(61,105)NYEAR,NPAGE
105 FORMAT(1H1,/,20X,*NUMBER OF RESULTS AVAILABLE IN*,I5,
    +* ANU FIRST YEAR UNITS - PAGE*,I3)
    WRITE(61,106)
106 FORMAT(/,5X4HUNIT,6X9HUNIT NAME,12X9HTOTAL NO.,5X22HNO.
    +RESULTS WITH GRADE,33X,21HNO. RESULTS WITH MARK,/,4X6HNUMBER,
    +28X7HRESULTS,5X50H  HD      D   CR   HM   PM   P1   P2   P
    +N      W,8X5H1-100,3X5HBLANK,1X7HMISSING,/)
    DO 110 I=1,50
    WRITE(61,108)N(I),NAME1(I),NAME2(I),NTOT(I),NHD(I),ND(I),
    +NCR(I),NHM(I),NPM(I),NP1(I),NP2(I),NP(I),NN(I),NW(I),
    +NMARK(I),NBLANK(I),NMISS(I)
108 FORMAT(5X,I5,5X,2A10,5X,I5,5X,10I5,5X,3I8)
110 CONTINUE
    NPAGE=2
    WRITE(61,105)NYEAR,NPAGE
    WRITE(61,106)
    DO 115 I=51,100

```

```

WRITE(61,108)N(I),NAME1(I),NAME2(I),NTOT(I),NHD(I),ND(I),
+NCR(I),NHM(I),NPM(I),NP1(I),NP2(I),NP(I),NN(I),NW(I),
+NMARK(I),NBLANK(I),NMISS(I)
115 CONTINUE
NPAGE=3
WRITE(61,105)NYEAR,NPAGE
WRITE(61,106)
DO 120 I=101,NAU
WRITE(61,108)N(I),NAME1(I),NAME2(I),NTOT(I),NHD(I),ND(I),
+NCR(I),NHM(I),NPM(I),NP1(I),NP2(I),NP(I),NN(I),NW(I),
+NMARK(I),NBLANK(I),NMISS(I)
120 CONTINUE
NAU1=NAU+1
WRITE(61,122)NTOT(NAU1),NHD(NAU1),ND(NAU1),NCR(NAU1),
+NHM(NAU1),NPM(NAU1),NP1(NAU1),NP2(NAU1),NP(NAU1),NN(NAU1),
+NW(NAU1),NMARK(NAU1),NBLANK(NAU1),NMISS(NAU1)
122 FORMAT(/,15X,11HOTHER UNITS,14X,I5,5X,10I5,5X,3I8)
WRITE(61,125)NTOT(NAU2),NHD(NAU2),ND(NAU2),NCR(NAU2),
+NHM(NAU2),NPM(NAU2),NP1(NAU2),NP2(NAU2),NP(NAU2),NN(NAU2),
+NW(NAU2),NMARK(NAU2),NBLANK(NAU2),NMISS(NAU2)
125 FORMAT(/,15X,9HALL UNITS,16X,I5,5X,10I5,5X,3I8)
END

1978 107
2 10065 2 HISTORY 1A
3 10106 2 LATIN 1A
4 10214 2 GREEK 1A
5 10366 2 HISTORY 1B
6 10407 2 LATIN 1B
7 10504 2 ROMAN CIVILISATION
9 10667 2 HISTORY 1C
10 10902 2 GREEK CIVILISATION
11 11039 1 LINGUISTICS A2
12 11448 1 LINGUISTICS A4
13 11482 2 FRENCH LANG + LIT 1
14 11556 2 POLITICAL SCIENCE 1
15 11631 1 LINGUISTICS A1
17 12081 2 ITALIAN 1
18 12092 2 INTRODUCTORY FRENCH
19 12166 2 PREHISTORY 1
20 12207 1 GERMAN LITERATURE 1
21 12713 2 RUSSIAN 1
22 12906 1 GERMAN LANGUAGE 1
23 12951 1 LINGUISTICS A3
24 13088 2 HISTORY 1F
26 13754 2 ANTHROPOLOGY 1
27 13787 2 HISTORY 1E
28 13862 2 MEDIEVAL STUDIES 1
29 14193 2 GEOGRAPHY 1B
30 14546 2 ITALIAN 2
31 14847 2 POLISH 1
33 15082 2 HISTORY 1G
37 15372 1 SWEDISH 1A
38 15480 1 DUTCH 1A
39 15565 1 ELEMENTARY GERMAN A
40 15576 1 ICELANDIC 1A
41 15673 1 SWEDISH 1B
42 15781 1 DUTCH 1B
43 15844 2 GEOGRAPHY 1A

```

44	15866	1	ELEMENTARY GERMAN B	
45	15877	1	ICELANDIC 1B	
46	16056	1	ELEM. GERMAN B(F)	
47	16108	2	SOCIOLOGY 1	
50	16249	2	ENGLISH 1	
52	16358	1	ELEM. GERMAN A(F)	
54	16465	2	PHILOSOPHY A1	
58	16766	2	PHILOSOPHY A2	
60	16959	1	GERMAN LANG. 1(F)	
61	16960	1	GERMAN LIT. 1(F)	
62	17428	2	FINE ART 1	
63	18254	1	ENGLISH A2	
64	18555	1	ENGLISH A3	
65	18856	1	ENGLISH A4	
66	18953	1	ENGLISH A1	
69	20138	1	STATISTICS A02	
70	20291	1	STATISTICS A01/2	
71	20406	2	ECONOMICS 1H	
72	20417	2	ECONOMICS 1	
73	20439	1	STATISTICS A01/1	
74	20569	2	ACCOUNTING 1	
75	20837	1	STATISTICS A03	
76	20934	2	ECONOMIC HISTORY 1	
78	30182	2	LEGAL SYSTEM + TORTS	
79	30234	2	CRIMINAL LAW + PROC.	
80	30621	1	CONST. LAW + CIV RTS	
81	30706	1	LEGAL METHOD	
82	30814	2	CONTRACTS	
83	40017	2	CHEMISTRY A01	(NORMAL)
85	40233	2	GEOLOGY A01	
86	40277	2	ZOOLOGY A01	
87	40318	2	CHEMISTRY A02	(GENERAL)
88	40501	2	BOTANY A01	
89	40653	2	PHYSICS A01	(NORMAL)
90	40954	2	PHYSICS A02	(BASIC)
91	40976	2	HUMAN BIOLOGY A02	
92	41241	2	PSYCHOLOGY A01	
93	42011	1	PHYSICS B06	
94	43494	1	APPLIED MATHS A21	(SM. 1 - NORMAL)
95	43795	1	APPLIED MATHS A31H	(SM. 1 - ADVANCED)
96	44004	1	APPLIED MATHS A22	(SM. 2 - NORMAL)
97	44015	1	PURE MATHS A03	(SM. 1 - NORMAL)
98	44048	1	COMPUTER SCIENCE A01	
99	44156	2	PHYSICS A11	(NORMAL)
100	44305	1	APPLIED MATHS A32H	(SM. 2 - ADVANCED)
101	44316	1	PURE MATHS A05H	(SM. 1 - ADVANCED)
102	44327	1	PURE MATHS A02	(SM. 2 - BASIC)
103	44349	1	COMPUTER SCIENCE A02	
104	44457	2	PHYSICS A12	(ADVANCED)
105	44532	1	PURE MATHS B06H	
106	44628	1	PURE MATHS A04	(SM. 2 - NORMAL)
107	44703	1	APPLIED MATHS A12	(SM. 2 - BASIC)
108	44714	1	PURE MATHS A01	(SM. 1 - BASIC)
109	44918	1	PURE MATHS B05H	
110	44929	1	PURE MATHS A06H	(SM. 2 - ADVANCED)

111	50005	2	MODERN CHINESE 2
112	50362	2	ISLAMIC CIVILISATION
113	50384	2	LITERARY PERSIAN 1
114	50395	2	THAI 1
116	50511	2	CLASSICAL CHINESE 1
117	50618	2	JAPANESE 1
118	50685	2	HINDI 1
119	50704	2	MODERN CHINESE 1
120	50878	2	SANSKRIT 1
121	50931	2	BAHASA INDO MALAY 1
122	51057	2	INTRO SOUTH ASIA S1
123	51121	2	LITERARY ARABIC 1
126	51239	2	E-ASIAN HISTORY E1
128	51499	2	JAVANESE A
129	51518	2	CONTEMPORARY JAPAN
130	51842	2	INTRO S.E. ASIA SE1
134	52902	2	RELIGIOUS STUDIES A

PROGRAM 5 - DATA AVAILABLE FOR INDIVIDUAL A.N.U. UNITS.

ZEXA78.

GETSET,CMS8736.

ATTACH,TAPE1,ZA781,ID=CMSXWM.

ATTACH,TAPE2,ZA782,ID=CMSXWM.

ATTACH,TAPE3,ZC771,ID=CMSXWM,SN=CMS8736.

FTN,SL,R=1.

LG0.

```

      PROGRAM EXTR78(TAPE1,TAPE2,TAPE3,INPUT,OUTPUT,TAPE60=INPUT,
+TAPE61=OUTPUT)
      DIMENSION NANU(100),COLL(100),SEX(100),TYPE(100),NAREA(100),
+NTES(100),NASATV(100),NASATQ(100),NASATT(100),NPREC(100),
+NUNIT(100),WT(100),GRADE(100),MARK(100),IUNIT(8),AWT(8),
+AGRADE(8),IMARK(8)
C      READ IN UNIT INFORMATION.
      READ(60,1)NYEAR,NLIST,NORDER
      1 FORMAT(3I5)
      5 READ(60,6)N,NAME1,NAME2
      6 FORMAT(10X,I5,5X,2A10)
      IF(EOF(60))200,7
C      READ IN UNIT INFORMATION FOR EACH STUDENT.
      7 KOUNT=0
      K=0
      10 KOUNT=KOUNT+1
      READ(1,15)NANU1,NCARDS,IAREA,ATYPE,ASEX,
+ (IUNIT(J),AWT(J),AGRADE(J),IMARK(J),J=1,4)
      15 FORMAT(I6,1X,I1,2X,I2,1X,A1,1X,A1,4(I6,F4.1,1X,A2,I3))
      IF(EOF(1))100,20
      20 IF(NCARDS.GT.1)21,30
      21 READ(2,22)NANU2,(IUNIT(J),AWT(J),AGRADE(J),IMARK(J),J=5,8)
      22 FORMAT(I6,3X,4(I6,F4.1,1X,A2,I3))
      IF(NANU1.NE.NANU2)24,34
      24 WRITE(61,26)KOUNT
      26 FORMAT(10X,*STUDENT NUMBERS ON 2 ANU CARDS DO NOT AGREE FOR
+STUDENT*,I4)
      GOTO 34
      30 DO 32 J=5,8
      32 IUNIT(J)=0
      34 READ(3,35)NANU3,ACOLL,ITES,IAV,IAQ,IAT,IPREC
      35 FORMAT(I6,1X,A2,8X,I4,3I3,1X,I3)
      IF(NANU1.NE.NANU3)36,40
      36 WRITE(61,37)KOUNT
      37 FORMAT(10X,*STUDENT NUMBERS ON FIRST COLLEGE AND FIRST ANU
+CARDS DO NOT AGREE FOR STUDENT*,I4)
C      SEARCH FOR RELEVANT INFORMATION AND PUT IN ARRAYS.
      40 DO 50 J=1,8
      IF(N.EQ.IUNIT(J))42,50
      42 K=K+1
      NANU(K)=NANU1
      COLL(K)=ACOLL
      SEX(K)=ASEX
      TYPE(K)=ATYPE
      NAREA(K)=IAREA
      NTES(K)=ITES
      NASATV(K)=IAV
      NASATQ(K)=IAQ

```

```

      NASATT(K)=IAT
      NPREC(K)=IPREC
      NUNIT(K)=IUNIT(J)
      WT(K)=AWT(J)
      GRADE(K)=AGRADE(J)
      MARK(K)=IMARK(J)
50  CONTINUE
      GOTO 10
C    UNORDERED LIST OF UNIT INFORMATION.
100  NDATA=K
      IF(NLIST.EQ.0)GOTO 125
      WRITE(61,105)NYEAR,N,NAME1,NAME2
105  FORMAT(1H1,/,/,10X,I5,10X,*RESULTS AVAILABLE (UNORDERED) FOR
      +UNIT NO.*I10,3H  :,5X,2A10,/)
      WRITE(61,110)
110  FORMAT(6X3HANU,3X7HCOLLEGE,2X3HSEX,3X6HCOURSE,4X6HCOURSE,
      +4X3HTES,5X4HASAT,5X4HASAT,4X4HASAT,4X5HPRINC,6X4HUNIT,
      +6X4HUNIT,6X4HUNIT,4X4HUNIT,/,5X6HNUMBER,17X4HTYPE,6X4HAREA,
      +12X6HVERBAL,3X5HQUANT,3X5HTOTAL,5X4HREC.,5X6HNUMBER,
      +4X6HWEIGHT,4X5HGRADE,4X4HMARK,/).
      DO 120 I=1,NDATA
        WRITE(61,115)NANU(I),COLL(I),SEX(I),TYPE(I),NAREA(I),NTES(I),
      +NASATV(I),NASATQ(I),NASATT(I),NPREC(I),NUNIT(I),WT(I),
      +GRADE(I),MARK(I)
115  FORMAT(5X,I6,4X,A2,5X,A1,7X,A1,8X,I2,6X,I3,5X,I4,5X,I4,4X,
      +I4,5X,I4,5X,I6,4X,F5.1,7X,A2,5X,I4)
120  CONTINUE
      WRITE(61,122)NDATA
122  FORMAT(/,70X,*NUMBER OF STUDENTS WHO ATTEMPTED UNIT :*,I8)
C    ORDERED LIST OF UNIT INFORMATION.
125  IF(NORDER.EQ.0)GOTO 160
      IF(NDATA.LE.20.AND.NLIST.EQ.1)GOTO 132
      WRITE(61,130)NYEAR,N,NAME1,NAME2
130  FORMAT(1H1,/,/,10X,I5,10X,*RESULTS AVAILABLE ORDERED BY
      +DESCENDING MARKS FOR UNIT NO. *,I10,3H  :,5X,2A10,/)
      GOTO 134
132  WRITE(61,133)NYEAR,N,NAME1,NAME2
133  FORMAT(/////10X,I5,10X,*RESULTS AVAILABLE ORDERED BY
      +DESCENDING MARKS FOR UNIT NO.*,I10,3H  :,5X,2A10,/)
134  WRITE(61,110)
135  DO 150 I=1,102
      M=101-I
      DO 145 J=1,NDATA
        IF(MARK(J).EQ.M)140,145
140  WRITE(61,115)NANU(J),COLL(J),SEX(J),TYPE(J),NAREA(J),NTES(J),
      +NASATV(J),NASATQ(J),NASATT(J),NPREC(J),NUNIT(J),WT(J),
      +GRADE(J),MARK(J)
145  CONTINUE
150  CONTINUE
      WRITE(61,122)NDATA
160  REWIND 1
      REWIND 2
      REWIND 3
      GOTO 5
200  STOP
      END

```

```

1978      1      1
          2      10065      2      HISTORY 1A
          3      10106      2      LATIN 1A

```

REMAINDER OF DATA AS FOR PROGRAM 4.

PROGRAM 6 - SUMMARY TABULATIONS FOR A.N.U. UNITS.

ZIANUG8.

GETSET,CMS8736.

ATTACH,TAPE1,ZA781,ID=CMSXWM,SN=CMS8736.

ATTACH,TAPE2,ZA782,ID=CMSXWM,SN=CMS8736.

ATTACH,TAPE3,ZC771,ID=CMSXWM,SN=CMS8736.

FTN,SL,R=1.

LGO.

```

      PROGRAM ANUG78(TAPE1,TAPE2,TAPE3,INPUT,OUTPUT,TAPE60=INPUT,
+TAPE61=OUTPUT)
      DIMENSION NUNIT(8),GRADE(8),HEAD(3),NTESL(11),NTESH(11),
+NS(12),NR(12),NGRP(12,10),PCD(12),PCCR(12),PCF(12),GNAME(10),
+TPCN1(11),TPCN2(11),NWT(12),TSCORE(12),GRSCORE(12),WT(8),
+GVAL(10),NGPUNIT(100)
      DATA(GNAME=2HHD,2HD,2HCR,2HHM,2HPM,2HP1,2HP2,2HP,2HN,2HW)
      DATA(TPCN1=10H 0.00 - 4,10H 5.00 - 9,10H10.00 - 14,
+10H15.00 - 19,10H20.00 - 24,10H25.00 - 29,10H30.00 - 34,
+10H35.00 - 39,10H40.00 - 44,10H45.00 - 49,10H50.00 + AB)
      DATA(TPCN2=3H.99,3H.99,3H.99,3H.99,3H.99,3H.99,3H.99,3H.99,
+3H.99,3H.99,3H.99,3H.99)
      DATA(GVAL=4.0,3.5,3.0,3.5,3.0,2.0,1.5,2.0,1.0,1.0)
C      READ IN BASIC INFORMATION.
      READ(60,5)NYEAR
      5 FORMAT(I5)
      READ(60,10)(NTESL(I),I=1,11)
      10 FORMAT(11I5)
      READ(60,10)(NTESH(I),I=1,11)
      20 READ(60,25)NINGRP,(HEAD(I),I=1,3)
      25 FORMAT(I5,5X,3A10)
      IF(EOF(60))200,26
      26 READ(60,28)(NGPUNIT(J),J=1,NINGRP)
      28 FORMAT(10I6)
C      HEADINGS FOR GROUP OF INDIVIDUAL UNITS.
      WRITE(61,32)NYEAR
      32 FORMAT(1H1,///,7X,*DISTRIBUTION OF A.N.U. GRADES OBTAINED BY
+TES PERCENTILE - *,5X,I5)
      WRITE(61,33)(HEAD(I),I=1,3)
      33 FORMAT(//,7X,3A10,/)
C      INITIALISE COUNTING ARRAYS.
      DO 40 I=1,12
      NS(I)=0
      NR(I)=0
      NWT(I)=0
      TSCORE(I)=0.0
      DO 40 L=1,10
      NGRP(I,L)=0
      40 CONTINUE
      KSTUD=0
C      READ IN STUDENT INFORMATION, ONE STUDENT AT A TIME,
C      AND INCREMENT APPROPRIATE VALUES.
      50 READ(1,55)NANU1,NCARDS,(NUNIT(J),WT(J),GRADE(J),J=1,4)
      55 FORMAT(I6,1X,I1,8X,4(I6,F4.1,1X,A2,3X))
      IF(EOF(1))150,60
      60 KSTUD=KSTUD+1
      IF(NCARDS.GT.1)62,70
      62 READ(2,65)NANU2,(NUNIT(J),WT(J),GRADE(J),J=5,8)

```

```

65 FORMAT(I6,3X,4(I6,F4.1,1X,A2,3X))
   IF(NANU1.NE.NANU2)67,75
67 WRITE(61,68)KSTUD
68 FORMAT(10X,*STUDENT NUMBERS DO NOT AGREE FOR STUDENT*,I4)
   GOTO 75
70 DO 72 J=5,8
72 NUNIT(J)=0
C   +++++ READ IN STUDENT TES VALUE. +++++
75 READ(3,80)NANU3,NTES
80 FORMAT(I6,11X,I4)
   IF(NANU1.NE.NANU3)82,90
82 WRITE(61,85)KSTUD
85 FORMAT(10X,*STUDENT NUMBERS ON FIRST COLLEGE AND FIRST ANU
+CARDS DO NOT AGREE FOR STUDENT*,I4)
90 DO 95 I=1,11
   IF(NTES.GE.NTESL(I))92,95
92 IF(NTES.LE.NTESH(I))100,95
95 CONTINUE
   WRITE(61,97)KSTUD,NANU1
97 FORMAT(10X,*STUDENT NUMBER*,I5,* , WITH ANU STUDENT NUMBER*,
+I8,* DOES NOT HAVE TES IN RANGE SO IS IGNORED IN TABLE
+BELOW.*)
   GOTO 50
100 KTES=I
C   +++++ LOOP TO INCREMENT COUNTS. +++++
   NSINC=0
   DO 120 J=1,8
   DO 102 K=1,NINGRP
   IF(NUNIT(J).EQ.NGPUNIT(K))GOTO 104
102 CONTINUE
   GOTO 120
104 NSINC=NSINC+1
   IF(NSINC.GT.1)GOTO 105
   NS(KTES)=NS(KTES)+1
   NS(12)=NS(12)+1
105 NR(KTES)=NR(KTES)+1
   NWT(KTES)=NWT(KTES)+IFIX(WT(J)+0.1)
   NR(12)=NR(12)+1
   NWT(12)=NWT(12)+IFIX(WT(J)+0.1)
   DO 110 LGR=1,10
   IF(GRADE(J).EQ.GNAME(LGR))GOTO 115
110 CONTINUE
115 NGRP(KTES,LGR)=NGRP(KTES,LGR)+1
   TSCORE(KTES)=TSCORE(KTES)+WT(J)*GVAL(LGR)
   NGRP(12,LGR)=NGRP(12,LGR)+1
   TSCORE(12)=TSCORE(12)+WT(J)*GVAL(LGR)
120 CONTINUE
   GOTO 50
C   CALCULATE PERCENTAGES TO ACHIEVE VARIOUS LEVELS.
150 DO 160 K=1,12
   IF(NR(K).LT.1)GOTO 160
   PCD(K)=100.0*FLOAT(NGRP(K,1)+NGRP(K,2)+NGRP(K,4))/FLOAT(NR(K))
   PCCR(K)=100.0*FLOAT(NGRP(K,1)+NGRP(K,2)+NGRP(K,3)+NGRP(K,4)
+NGRP(K,5))/FLOAT(NR(K))
   PCF(K)=100.0*FLOAT(NGRP(K,9)+NGRP(K,10))/FLOAT(NR(K))
   GRSCORE(K)=TSCORE(K)/FLOAT(NWT(K))
160 CONTINUE
C   PRINT OUT TABLE OF RESULTS.
   WRITE(61,162)

```


27 NON-LANGUAGE STUDIES
10065 10366 10504 10667 10902 11556 12166 13088 13754 13787
13862 14193 15082 15844 16108 16249 16465 16766 17428 18254
18555 18856 18953 51057 51239 51518 51842
8 FACULTY OF ECONOMICS
20138 20291 20406 20417 20439 20569 20837 20934
4 ECONOMICS EXCLUDING STATISTICS
20406 20417 20569 20934
5 FACULTY OF LAW
30182 30234 30621 30706 30814
27 FACULTY OF SCIENCE
40017 40233 40277 40318 40501 40653 40954 40976 41241 42011
43494 43795 44004 44015 44048 44156 44305 44316 44327 44349
44457 44532 44628 44703 44714 44918 44929
19 MATHEMATICAL SCIENCES
20138 20291 20439 20837 43494 43795 44004 44015 44048 44305
44316 44327 44349 44532 44628 44703 44714 44918 44929
12 EMPIRICAL SCIENCES
40017 40233 40277 40318 40501 40653 40954 40976 41241 42011
44156 44457

PROGRAM 7 - SUMMARY TABULATIONS FOR COLLEGES.

ZICOLL8.

GETSET,CMS8736.

ATTACH,TAPE1,ZA781,ID=CMSXWM,SN=CMS8736.

ATTACH,TAPE2,ZA782,ID=CMSXWM,SN=CMS8736.

ATTACH,TAPE3,ZC771,ID=CMSXWM,SN=CMS8736.

FTN,SL,R=1.

LGO.

```

      PROGRAM COLL78(TAPE1,TAPE2,TAPE3,INPUT,OUTPUT,TAPE60=INPUT,
+TAPE61=OUTPUT)
      DIMENSION NUNIT(8),GRADE(8),WT(8),HEAD(3),NTESL(11),
+NTESH(11),NS(12,13),NR(12,13),NWT(12,13),NFAIL(12,13),
+TSCORE(12,13),GRSCORE(12,13),GVAL(10),NAMCOLL(12),TTES(13),
+TMNTES(13),TPCN1(11),TPCN2(11),GNAME(10),NGPUNIT(100)
      DATA(GNAME=2HHD,2HD,2HCR,2HIM,2HPM,2HP1,2HP2,2HP,2HN,2HW)
      DATA(TPCN1=10H 0.00 - 4,10H 5.00 - 9,10H10.00 - 14,
+10H15.00 - 19,10H20.00 - 24,10H25.00 - 29,10H30.00 - 34,
+10H35.00 - 39,10H40.00 - 44,10H45.00 - 49,10H50.00 + AB)
      DATA(TPCN2=3H.99,3H.99,3H.99,3H.99,3H.99,3H.99,3H.99,3H.99,
+3H.99,3H.99,3H.99,3H.99)
      DATA(GVAL=4.0,3.5,3.0,3.5,3.0,2.0,1.5,2.0,1.0,1.0)
      DATA(NAMCOLL=2HBR,2HCO,2HDA,2HDK,2HED,2HGG,2HGR,2HHK,2HMA,
+2HNB,2HPH,2HST)
C      READ IN BASIC INFORMATION.
      READ(60,5)NYEAR
      5 FORMAT(I5)
      READ(60,10)(NTESL(I),I=1,11)
      10 FORMAT(11I5)
      READ(60,10)(NTESH(I),I=1,11)
      20 READ(60,25)NINGRP,(HEAD(I),I=1,3)
      25 FORMAT(I5,5X,3A10)
      IF(EOF(60))200,26
      26 READ(60,28)(NGPUNIT(J),J=1,NINGRP)
      28 FORMAT(10I6)
C      HEADINGS FOR GROUP OF INDIVIDUAL UNITS.
      WRITE(61,32)NYEAR
      32 FORMAT(1H1,///,7X,*DISTRIBUTION OF STUDENTS, A.N.U. RESULTS
+AND GRADE SCORE BY TES PERCENTILE AND A.C.T. COLLEGE ATTENDED
+ - *,I5)
      WRITE(61,33)(HEAD(I),I=1,3)
      33 FORMAT(//,7X,3A10,5X,* - PAGE 1.,//)
C      INITIALISE COUNTING ARRAYS.
      DO 40 L=1,13
      TTES(L)=0.0
      DO 40 I=1,12
      NS(I,L)=0
      NR(I,L)=0
      NWT(I,L)=0
      NFAIL(I,L)=0
      40 TSCORE(I,L)=0.0
      KSTUD=0
C      READ IN STUDENT INFORMATION, ONE STUDENT AT A TIME,
C      AND INCREMENT APPROPRIATE VALUES.
      50 READ(1,55)NANU1,NCARDS,(NUNIT(J),WT(J),GRADE(J),J=1,4)
      55 FORMAT(I6,1X,I1,8X,4(I6,F4.1,1X,A2,3X))
      IF(EOF(1))150,60

```

```

60 KSTUD=KSTUD+1
   IF(NCARDS.GT.1)62,70
62 READ(2,65)NANU2,(NUNIT(J),WT(J),GRADE(J),J=5,8)
65 FORMAT(I6,3X,4(I6,F4.1,1X,A2,3X))
   IF(NANU1.NE.NANU2)67,75
67 WRITE(61,68)KSTUD
68 FORMAT(10X,*STUDENT NUMBERS DO NOT AGREE FOR STUDENT*,I4)
   GOTO 75
70 DO 72 J=5,8
72 NUNIT(J)=0
C   ++++ READ IN STUDENT COLLEGE AND TES VALUE. ++++
75 READ(3,80)NANU3,LCOLL,NTES
80 FORMAT(I6,1X,A2,8X,I4)
   IF(NANU1.NE.NANU3)82,90
82 WRITE(61,85)KSTUD
85 FORMAT(10X,*STUDENT NUMBERS ON FIRST COLLEGE AND FIRST ANU
+CARDS DO NOT AGREE FOR STUDENT*,I4)
C   ++++ IDENTIFY TES AND COLLEGE CATEGORIES. ++++
90 DO 95 I=1,11
   IF(NTES.GE.NTESL(I))92,95
92 IF(NTES.LE.NTESH(I))100,95
95 CONTINUE
   WRITE(61,97)KSTUD,NANU1
97 FORMAT(10X,*STUDENT NUMBER*,I5,* , WITH ANU STUDENT NUMBER*,
+I8,* DOES NOT HAVE TES IN RANGE SO IS IGNORED IN TABLE
+BELOW.*)
   GOTO 50
100 KTES=I
   DO 102 J=1,12
   IF(LCOLL.EQ.NAMCOLL(J))GOTO 103
102 CONTINUE
103 KCOLL=J
C   ++++ LOOP TO INCREMENT COUNTS AND TOTALS. ++++
   NSINC=0
   DO 120 J=1,8
   DO 105 K=1,NINGRP
   IF(NUNIT(J).EQ.NGPUNIT(K))GOTO 107
105 CONTINUE
   GOTO 120
107 NSINC=NSINC+1
   IF(NSINC.GT.1)GOTO 108
   NS(KTES,KCOLL)=NS(KTES,KCOLL)+1
   NS(KTES,13)=NS(KTES,13)+1
   NS(12,KCOLL)=NS(12,KCOLL)+1
   NS(12,13)=NS(12,13)+1
   TTES(KCOLL)=TTES(KCOLL)+FLOAT(NTES)
   TTES(13)=TTES(13)+FLOAT(NTES)
108 NR(KTES,KCOLL)=NR(KTES,KCOLL)+1
   NR(KTES,13)=NR(KTES,13)+1
   NR(12,KCOLL)=NR(12,KCOLL)+1
   NR(12,13)=NR(12,13)+1
   NWT(KTES,KCOLL)=NWT(KTES,KCOLL)+IFIX(WT(J)+0.1)
   NWT(KTES,13)=NWT(KTES,13)+IFIX(WT(J)+0.1)
   NWT(12,KCOLL)=NWT(12,KCOLL)+IFIX(WT(J)+0.1)
   NWT(12,13)=NWT(12,13)+IFIX(WT(J)+0.1)
   DO 110 LGR=1,10
   IF(GRADE(J).EQ.GNAME(LGR))GOTO 115
110 CONTINUE
115 IF(LGR.LT.9)GOTO 117

```

```

NFAIL(KTES,KCOLL)=NFAIL(KTES,KCOLL)+1
NFAIL(KTES,13)=NFAIL(KTES,13)+1
NFAIL(12,KCOLL)=NFAIL(12,KCOLL)+1
NFAIL(12,13)=NFAIL(12,13)+1
117 TSCORE(KTES,KCOLL)=TSCORE(KTES,KCOLL)+WT(J)*GVAL(LGR)
    TSCORE(KTES,13)=TSCORE(KTES,13)+WT(J)*GVAL(LGR)
    TSCORE(12,KCOLL)=TSCORE(12,KCOLL)+WT(J)*GVAL(LGR)
    TSCORE(12,13)=TSCORE(12,13)+WT(J)*GVAL(LGR)
120 CONTINUE
    GOTO 50
C    CALCULATE GRADE SCORES AND MEAN TES VALUES.
150 DO 160 J=1,13
    IF(NS(12,J).LT.1)GOTO 152
    TMNTES(J)=TTES(J)/FLOAT(NS(12,J))
    GOTO 153
152 TMNTES(J)=0.0
153 DO 160 I=1,12
    IF(NWT(I,J).LT.1)GOTO 155
    GRSCORE(I,J)=TSCORE(I,J)/FLOAT(NWT(I,J))
    GOTO 156
155 GRSCORE(I,J)=0.0
156 CONTINUE
160 CONTINUE
C    PRINT OUT REMAINDER OF TABLE OF RESULTS.
    WRITE(61,162)(NAMCOLL(J),J=1,12)
162 FORMAT(/,7X,10HPERCENTILE,6X9HTES RANGE,22X14HA.C.T,
+COLLEGE,46X12HALL COLLEGES,/,51X,12(3X,A2))
    DO 170 I=1,6
    WRITE(61,165)TPCN1(I),TPCN2(I),NTESL(I),NTESH(I),
+ (NS(I,J),J=1,13),(NR(I,J),J=1,13),(NWT(I,J),J=1,13),
+ (NFAIL(I,J),J=1,13),(GRSCORE(I,J),J=1,13)
165 FORMAT(/,7X,A10,A3,3X,13,3H - ,13,3X,12HNO. STUDENTS,4X,12I5,
+5X,I5,/,35X,11HNO. RESULTS,5X,12I5,5X,I5,/,35X,
+14HTOTAL UNIT WT.,2X,12I5,5X,I5,/,35X,12HNO. FAIL + W,4X,
+12I5,5X,I5,/,35X,11HGRADE SCORE,5X,12F5.2,5X,F5.2)
170 CONTINUE
    WRITE(61,32)NYEAR
    WRITE(61,175)(HEAD(I),I=1,3)
175 FORMAT(/,7X,3A10,5X,* - PAGE 2.,/)
    WRITE(61,162)(NAMCOLL(J),J=1,12)
    DO 180 I=7,11
    WRITE(61,165)TPCN1(I),TPCN2(I),NTESL(I),NTESH(I),
+ (NS(I,J),J=1,13),(NR(I,J),J=1,13),(NWT(I,J),J=1,13),
+ (NFAIL(I,J),J=1,13),(GRSCORE(I,J),J=1,13)
180 CONTINUE
    WRITE(61,185)(NS(12,J),J=1,13),(NR(12,J),J=1,13),
+ (NWT(12,J),J=1,13),(NFAIL(12,J),J=1,13),
+ (GRSCORE(12,J),J=1,13)
185 FORMAT(/,7X,7HOVERALL,21X,12HNO. STUDENTS,4X,12I5,5X,I5,/,
+35X,11HNO. RESULTS,5X,12I5,5X,I5,/,35X,14HTOTAL UNIT WT.,2X,
+12I5,5X,I5,/,35X,12HNO. FAIL + W,4X,12I5,5X,I5,/,35X,
+11HGRADE SCORE,5X,12F5.2,5X,F5.2)
    WRITE(61,190)(TMNTES(J),J=1,13)
190 FORMAT(/,7X,15HMEAN TES VALUES,29X,12F5.0,F10.1)

```

```
      WRITE(61,195)
195 FORMAT(  ///,7X,*THE GRADE SCORE IS THE WEIGHTED MEAN SCORE
+OVER ALL RESULTS, WHERE WEIGHTS ARE UNIT WEIGHTS*,/,7X,
+*AND INDIVIDUAL RESULTS HAVE THE SCORES :*,/,20X,
+*HD 4,  D 3.5,  HM 3.5,  CR 3,  PM 3,  P1 2,  P 2,  P2 1.5,
+N 1,  W 1.%)
C      RETURN FOR MORE CATEGORIES.
      REWIND 1
      REWIND 2
      REWIND 3
      GOTO 20
200 STOP
      END
```

```
1978
332 313 302 292 284 277 270 265 259 253 123
360 331 312 301 291 283 276 269 264 258 252
89   ALL UNITS
10065 10106 10214 10366 10407 10504 10667 10902 11039 11448
```

REMAINDER OF DATA AS FOR PROGRAM 6.

PROGRAM 8 - DATA FILE FOR REGRESSIONS BASED ON MARKS.

ZEMK78.

GETSET,CMS8736.

REQUEST,TAPE11,%PF.

ATTACH,TAPE1,ZA781,ID=CMSXWM,SN=CMS8736.

ATTACH,TAPE2,ZA782,ID=CMSXWM,SN=CMS8736.

ATTACH,TAPE3,ZC771,ID=CMSXWM,SN=CMS8736.

FTN.

LGO.

CATALOG,TAPE11,ZU40501,ID=CMSXWM,RP=1.

```
      PROGRAM MARK78(TAPE1,TAPE2,TAPE3,INPUT,OUTPUT,TAPE60=INPUT,
+TAPE61=OUTPUT,TAPE11)
      DIMENSION NANU(150),COLL(150),SEX(150),TYPE(150),NAREA(150),
+NTES(150),NASATV(150),NASATR(150),NASATT(150),
+NPRACAD(150),NPRPERS(150),NPROALL(150),N(10),
+NUNIT(150),NWT(150),GRADE(150),MARK(150),IUNIT(8),IWT(8),
+AGRADE(8),IMARK(8)
C      READ IN UNIT INFORMATION.
      READ(60,1)NYEAR
      1 FORMAT(I5)
      READ(60,5)NUM,NAME1,NAME2
      5 FORMAT(I5,5X,2A10)
      READ(60,6)(N(I),I=1,NUM)
      6 FORMAT(10I8)
      NS=0
      NW=0
C      READ IN UNIT INFORMATION FOR EACH STUDENT FOR CURRENT
C      UNIT IN LOOP.
      7 KOUNT=0
      K=0
      REWIND 1
      REWIND 2
      REWIND 3
      NS=NS+1
      IF(NS.GT.NUM)121,9
      9 NU=N(NS)
      10 KOUNT=KOUNT+1
      READ(1,15)NANU1,NCARDS,IAREA,ATYPE,ASEX,
+ (IUNIT(J),IWT(J),AGRADE(J),IMARK(J),J=1,4)
      15 FORMAT(I6,1X,I1,2X,I2,1X,A1,1X,A1,4(I6,I2,3X,A2,I3))
      IF(EOF(1))100,20
      20 IF(NCARDS.GT.1)21,30
      21 READ(2,22)NANU2,(IUNIT(J),IWT(J),AGRADE(J),IMARK(J),J=5,8)
      22 FORMAT(I6,3X,4(I6,I2,3X,A2,I3))
      IF(NANU1.NE.NANU2)24,34
      24 WRITE(61,26)KOUNT
      26 FORMAT(10X,*STUDENT NUMBERS ON 2 ANU CARDS DO NOT AGREE FOR
+STUDENT*,I4)
      GOTO 34
      30 DO 32 J=5,8
      32 IUNIT(J)=0
      34 READ(3,35)NANU3,ACOLL,ITES,IAV,IAQ,IAT,IPRA,IPRP,IPRO
      35 FORMAT(I6,1X,A2,8X,I4,3I3,1X,3I1)
      IF(NANU1.NE.NANU3)36,40
      36 WRITE(61,37)KOUNT
```

```
37 FORMAT(10X,*STUDENT NUMBERS ON FIRST COLLEGE AND FIRST ANU
+CARDS DO NOT AGREE FOR STUDENT*,I4)
C SEARCH FOR RELEVANT INFORMATION AND PUT IN ARRAYS.
40 DO 50 J=1,8
  IF(NU.EQ.IUNIT(J))42,50
42 IF(IMARK(J).LT.1)50,43
43 K=K+1
  NANU(K)=NANU1
  COLL(K)=ACOLL
  SEX(K)=ASEX
  TYPE(K)=ATYPE
  NAREA(K)=IAREA
  NTES(K)=ITES
  NASATV(K)=IAV
  NASATQ(K)=IAQ
  NASATT(K)=IAT
  NPRACAD(K)=IPRA
  NPRPERS(K)=IPRP
  NPROALL(K)=IPRO
  NUNIT(K)=IUNIT(J)
  NWT(K)=IWT(J)
  GRADE(K)=AGRADE(J)
  MARK(K)=IMARK(J)
50 CONTINUE
  GOTO 10
C ADD INFORMATION TO OUTPUT FILE FOR CURRENT UNIT IN LOOP.
100 IF(K.LT.1)GOTO 7
  DO 120 I=1,100
    M=101-I
    DO 115 J=1,K
      IF(MARK(J).EQ.M)105,115
105 WRITE(11,110)NUNIT(J),NWT(J),NANU(J),GRADE(J),MARK(J),
+NTES(J),NASATV(J),NASATQ(J),NASATT(J),NPRACAD(J),
+NPRPERS(J),NPROALL(J),SEX(J),TYPE(J),COLL(J),NAREA(J)
110 FORMAT(I5,1X,I1,1X,I6,1X,A2,1X,I3,5X,I3,2X,I3,1X,I3,1X,
+I3,2X,I1,1X,I1,1X,I1,5X,A1,2X,A1,5X,A2,5X,I2)
  NW=NW+1
115 CONTINUE
120 CONTINUE
  GOTO 7
121 WRITE(11,125)
125 FORMAT(5H'EOD')
  WRITE(61,130)(N(I),I=1,NUM)
130 FORMAT(///,10X,*FILE CREATED FOR UNIT NUMBERS*,5X,10I8)
  WRITE(61,135)NAME1,NAME2,NW
135 FORMAT(/,10X,2A10,/,10X,*NUMBER OF DATA RECORDS :*,I6)
  STOP
  END

1978
  1 BOTANY A01
  40501
```

PROGRAM 9 - DATA FILE FOR GRADE SCORE REGRESSIONS.

ZEGS78.
GETSET,CMS8736.
REQUEST,TAPE11,*PF.
ATTACH,TAPE1,ZA781,ID=CMSXWM,SN=CMS8736.
ATTACH,TAPE2,ZA782,ID=CMSXWM,SN=CMS8736.
ATTACH,TAPE3,ZC771,ID=CMSXWM,SN=CMS8736.
FTN.
LGO.
CATALOG,TAPE11,ZUARTS,ID=CMSXWM,RF=1.

```
      PROGRAM SCORE78(TAPE1,TAPE2,TAPE3,INPUT,OUTPUT,TAPE60=INPUT,
+TAPE61=OUTPUT,TAPE11)
      DIMENSION NAME(4),GNAME(10),GVAL(10),N(100),
+IUNIT(8),IWT(8),AGRADE(8),IMARK(8)
      DATA(GNAME=2HHD,2HD,2HCR,2HHM,2HPM,2HP1,2HP2,2HP,2HN,2HW)
      DATA(GVAL=4.0,3.5,3.0,3.5,3.0,2.0,1.5,2.0,1.0,1.0)
C      READ IN GENERAL INFORMATION.
      READ(60,1)NYEAR
      1  FORMAT(I5)
      READ(60,5)NUM,GSIDENT,(NAME(I),I=1,4)
      5  FORMAT(I5,1X,A4,5X,4A10)
      READ(60,6)(N(I),I=1,NUM)
      6  FORMAT(10I6)
      KOUNT=0
      NS=0
C      READ IN INFORMATION FOR CURRENT STUDENT IN LOOP.
      10 KOUNT=KOUNT+1
      NWT=0
      TSCORE=0.0
      READ(1,15)NANU1,NCARDS,IAREA,ATYPE,ASEX,
+ (IUNIT(J),IWT(J),AGRADE(J),IMARK(J),J=1,4)
      15  FORMAT(I6,1X,I1,2X,I2,1X,A1,1X,A1,4(I6,I2,3X,A2,I3))
      IF(EOF(1))100,20
      20  IF(NCARDS.GT.1)21,30
      21  READ(2,22)NANU2,(IUNIT(J),IWT(J),AGRADE(J),IMARK(J),J=5,8)
      22  FORMAT(I6,3X,4(I6,I2,3X,A2,I3))
      IF(NANU1.NE.NANU2)24,34
      24  WRITE(61,26)KOUNT
      26  FORMAT(10X,*STUDENT NUMBERS ON 2 ANU CARDS DO NOT AGREE FOR
+STUDENT*,I4)
      GOTO 34
      30  DO 32 J=5,8
      32  IUNIT(J)=0
      34  READ(3,35)NANU3,ACOLL,ITES,IAV,IAQ,IAT,IPRA,IPRP,IPRO
      35  FORMAT(I6,1X,A2,8X,I4,3I3,1X,3I1)
      IF(NANU1.NE.NANU3)36,40
      36  WRITE(61,37)KOUNT
      37  FORMAT(10X,*STUDENT NUMBERS ON FIRST COLLEGE AND FIRST ANU
+CARDS DO NOT AGREE FOR STUDENT*,I4)
C      CALCULATION OF TOTAL WEIGHT AND GRADE SCORE.
      40  DO 60 J=1,8
      DO 50 I=1,NUM
      IF(IUNIT(J).EQ.N(I))GOTO 52
      50  CONTINUE
      GOTO 60
```

```
52 NWT=NWT+IWT(J)
   DO 54 LGR=1,10
     IF(AGRADE(J).EQ.GNAME(LGR))GOTO 56
54 CONTINUE
56 TSCORE=TSCORE+FLOAT(IWT(J))*GVAL(LGR)
60 CONTINUE
   IF(NWT.LT.1)GOTO 10
   GSCORE=TSCORE/FLOAT(NWT)
   NS=NS+1
C   ADD INFORMATION TO OUTPUT FILE FOR CURRENT STUDENT IN LOOP.
   WRITE(11,80)GIDENT,NANU1,NWT,GSCORE,ITES,IAV,IAQ,IAT,IPRA,
+IPRP,IPRO,ASEX,ATYPE,ACOLL,IAREA
80 FORMAT(A4,2X,I6,I4,F5.2,5X,I3,2X,I3,1X,I3,1X,I3,2X,
+I1,1X,I1,1X,I1,5X,A1,2X,A1,5X,A2,5X,I2)
   GOTO 10
100 WRITE(11,105)
105 FORMAT(5H'EOD')
   WRITE(61,110)(N(I),I=1,NUM)
110 FORMAT(///,10X,*FILE CREATED FOR UNIT NUMBERS*,5X,10I8,/,
+ (44X,10I8))
   WRITE(61,115)(NAME(I),I=1,4),NS
115 FORMAT(/,10X,4A10,/,10X,*NUMBER OF DATA RECORDS :*,I6)
   STOP
   END
```

1978

```
89 ALLU      ALL UNITS
10065 10106 10214 10366 10407 10504 10667 10902 11039 11448
```

REMAINDER OF DATA AS FOR PROGRAM 6.

APPENDIX 4

GENSTAT PROGRAMS

The statistical package GENSTAT was used to perform the Principal Components Analyses and all correlations and regression analyses. Programs 2 and 3 (below) had to be run for each A.N.U. unit or group of units for which results are presented in chapters 4, 5 and 6; a considerable amount of computing.

PROGRAM 1 - PRINCIPAL COMPONENTS ANALYSES AND TABULATIONS
OF PRINCIPAL'S RECOMMENDATIONS

ZX77PCA : Produces a correlation matrix and Principal Components Analysis for the seven college variables, and tabulates frequencies of all possible combinations of Principal's Recommendations.

PROGRAM 2 - CORRELATIONS AND REGRESSIONS FOR MARKS

ZR78A : Does all correlations and regression analyses for marks in individual A.N.U. units or groups of units. Results in chapter 4 are based on this program.

PROGRAM 3 - CORRELATIONS AND REGRESSIONS FOR GRADE SCORES

ZS78A : Does all correlations and regression analyses for grade scores for groups of A.N.U. units. Results in chapters 5 and 6 are based on this program.

PROGRAM 1 - PRINCIPAL COMPONENTS ANALYSES AND TABULATIONS OF
PRINCIPAL'S RECOMMENDATIONS.

```
ZX77PCA.  
GETSET,CMS8736.  
ATTACH,TAPE2,ZCP77,ID=CMSXWM,SN=CMS8736.  
ATTACH,G,GENSTAT.  
RFL,L=100.  
G.  
  
'REFE/NID=200,NUNN=200' POPN1977  
'UNITS' $1701  
'SET' VL=TES,ASATV,ASATQ,ASATT,PRACAD,FRPERS,PROALL  
'INPUT' 2  
'READ/P' VL $ F,10X,4(5),2X,3(1),/  
'INPUT' 1  
'PAGE'  
'REGRESS/PRIN=C' VL  
'DSSF' VARCOV $ VL  
'SSP' VARCOV  
'CALC' VARCOV=VARCOV/1696  
'LINE' 4  
'CAPTION' ''VARIANCE-COVARIANCE MATRIX''  
'PRINT' VARCOV $10.4  
'SCALAR' SMEAN(1...7),SVAR(1...7),SSD(1...7)  
'FOR' V=VL; SM=SMEAN(1...7); SV=SVAR(1...7); SS=SSD(1...7)  
'CALC' SM=MEAN(V)  
      : SV=VAR(V)  
      : SS=SQRT(SV)  
'REPEAT'  
'VARI' XMEAN,XVAR,XSD $7  
'EQUATE' XMEAN=SMEAN(1...7)  
      : XVAR=SVAR(1...7)  
      : XSD=SSD(1...7)  
'NAME' XNAME=TES,ASATV,ASATQ,ASATT,PRACAD,FRPERS,PROALL  
'PRINT/P' XNAME,XMEAN,XVAR,XSD $ 10,3(10.4)  
'PAGE'  
'PCP/PRIN=LTS,CORR=Y' VL  
'PAGE'  
'PCP/PRIN=LTS,CORR=Y' TES,ASATV,ASATQ,ASATT  
'FACTOR' ACADEMIC $6 ; PERSONAL $6 ; OVERALL $6  
'GROUPS' ACADEMIC=INTPT(PRACAD)  
      : PERSONAL=INTPT(FRPERS)  
      : OVERALL=INTPT(PROALL)  
'TABLE/M' T $OVERALL,ACADEMIC,PERSONAL  
'TABU/MARG=TOT' TES; ;T  
'PAGE'  
'CAPTION' ''TABLE OF DISTRIBUTION OF PRINCIPALS' RECOMMENDATIONS''  
'PRINT' T $8  
'RUN'  
'CLOSE'  
'STOP'
```

PROGRAM 2 - CORRELATIONS AND REGRESSIONS FOR MARKS.

ZR78A.

ATTACH,TAPE2,ZU40501,1D=CMSXWM.

ATTACH,G,GENSTAT.

RFL,L=50.

G.

'REFE/NID=200,NUNN=200' MARK_REGRESSION_1978

'HEAD' HR='BOTANY A01 - 1978'

'NAME' GRADE : SN=M,F : TN=F,P

: CN=BR,CO,DA,DK,ED,GG,GR,HK,MA,NB,PH,ST

'FACTOR' SEX \$SN : TYPE \$TN : COLLEGE \$CN : AREA \$13

'INPUT' 2

'READ/P,NUN=V' NUNIT,WT,NANU,GRADE,MARK,TES,ASATV,ASATQ,ASATT,
PRACAD,PRPERS,PROALL,SEX,TYPE,COLLEGE,AREA

'INPUT' 1

'SCALAR' NV

'CALC' NV=NVAL(NANU)

'RUN'

'UNITS' \$NV

'FOR' V=TES,ASATV,ASATQ,ASATT,PRACAD,PRPERS,PROALL

'CALC' V=(V/V)*V

'REPEAT'

'PAGE'

'PRINT' HR

'PRINT/P' NUNIT,WT,NANU,GRADE,MARK,TES,ASATV,ASATQ,ASATT,PRACAD,
PRPERS,PROALL,SEX,TYPE,COLLEGE,AREA \$ 16(7)

'CALC' XTE=(TES-252)/46

: XAV=(ASATV-65)/15

: XAQ=(ASATQ-65)/15

: XAT=(ASATT-65)/15

: XPA=(PRACAD-3.75)/1.275

: XPP=(PRPERS-4.05)/1.275

: XPD=(PROALL-3.90)/1.275

: PCSCORE1=0.40*XTE+0.34*XAV+0.35*XAQ+0.38*XAT+0.40*XPA
+0.37*XPP+0.40*XPD

: PCSCORE2=-0.10*XTE+0.38*XAV+0.45*XAQ+0.47*XAT-0.30*XPA
-0.43*XPP-0.37*XPD

: PCSCORE3=-0.17*XTE+0.78*XAV-0.60*XAQ-0.04*XAT+0.01*XPA
+0.01*XPP+0.02*XPD

'PAGE'

'PRINT' HR

'PRINT/P' NANU,TES,ASATV,ASATQ,ASATT,PRACAD,PRPERS,PROALL,PCSCORE1,
PCSCORE2,PCSCORE3 \$ 8(10),3(10.4)

'PAGE'

'PRINT' HR

'REGRESS/PRIN=C' MARK,TES,ASATV,ASATQ,ASATT,PCSCORE1,PCSCORE2,
PCSCORE3,PRACAD,PRPERS,PROALL

'Y' MARK

'FIT' TES

'HEAD' HY='MARK'

: HX='TES'

'GRAPH/ATY=HY,ATX=HX' MARK;TES

'PAGE'

'PRINT' HR

'FIT' ASATV

: ASATQ

```
'PAGE'
'PRINT' HR
'FIT' ASATT
      : PCSCORE1
'PAGE'
'PRINT' HR
'FIT' PCSCORE2
      : PCSCORE3
'INTE' YG=1,1,1,1
      : XG=1,1,1,1
'GRAPH/YCNT=YG,XCNT=XG' MARK; ASATT,PCSCORE1,PCSCORE2,PCSCORE3
'LINE' 1
'CAPTION' ''GRAPHS ARE MARK VS : TOP LEFT, ASAT TOTAL;
          TOP RIGHT, PC 1 SCORE; BOTTOM LEFT, PC 2 SCORE;
          BOTTOM RIGHT, PC 3 SCORE.'

'PAGE'
'PRINT' HR
'FIT' PRACAD
      : PRPERS
'PAGE'
'PRINT' HR
'FIT' PROALL
      : PRACAD,PRPERS,PROALL
'INTE' YGG=1,1,1
      : XGG=1,1,1
'GRAPH/YCNT=YGG,XCNT=XGG' MARK; PRACAD,PRPERS,PROALL
'LINE' 1
'CAPTION' ''GRAPHS ARE MARK VS PRINCIPALS RECOMMENDATIONS :
          TOP LEFT, ACADEMIC; TOP RIGHT, PERSONAL;
          BOTTOM LEFT, OVERALL.'

'PAGE'
'PRINT' HR
'FIT' TES,ASATV,ASATQ,ASATT
      : PCSCORE1,PCSCORE2,PCSCORE3
'PAGE'
'PRINT' HR
'REGRESS' MARK,TES,ASATV,ASATQ,ASATT,PRACAD,PRPERS,PROALL,SEX
'Y' MARK
'FIT' TES,PRACAD,PRPERS,PROALL
'ADD' SEX
'PAGE'
'PRINT' HR
'FIT' TES,ASATV,ASATQ,ASATT,PRACAD,PRPERS,PROALL
'ADD' SEX
'RUN'
'CLOSE'
'STOP'
```

PROGRAM 3 - CORRELATIONS AND REGRESSIONS FOR GRADE SCORES.

ZS78A.

ATTACH,TAPE2,ZUARTS,ID=CMSXWN.

ATTACH,G,GENSTAT.

RFL,L=50.

G.

```
'REFE/NID=200,NUNN=200' GRADE_SCORE_REGRESSION_1978
'HEAD' HR='FACULTY OF ARTS - 1978'
'NAME' NGROUP : SN=M,F : TN=F,P
      : CN=BR,DA,DK,ED,GG,GR,HK,MA,NB,PH,ST
'FACTOR' SEX $SN : TYPE $TN : COLLEGE $CN : AREA $13
'INPUT' 2
'READ/P,NUN=V' NGROUP,NANU,WT,SCORE,TES,ASATV,ASATQ,ASATT,PRACAD,
      PRPERS,PROALL,SEX,TYPE,COLLEGE,AREA
'INPUT' 1
'SCALAR' NV
'CALC' NV=NVAL(NANU)
'RUN'
'UNITS' $NV
'FOR' V=TES,ASATV,ASATQ,ASATT,PRACAD,PRPERS,PROALL
'CALC' V=(V/V)*V
'REPEAT'
'LINE' 3
'CAPTION' 'NUMBER OF STUDENTS'
'PRINT' NV $ 10.0
'LINE' 3
'CAPTION' 'TOTAL WEIGHT'
'SCALAR' TOTWT,WMSCORE
'CALC' TOTWT=SUM(WT)
'PRINT' TOTWT $ 10.0
'LINE' 3
'CAPTION' 'WEIGHTED MEAN GRADE SCORE'
'CALC' WSCORE=WT*SCORE
      : WMSCORE=SUM(WSCORE)/TOTWT
'PRINT' WMSCORE $10.3
'CALC' XTE=(TES-252)/46
      : XAV=(ASATV-65)/15
      : XAQ=(ASATQ-65)/15
      : XAT=(ASATT-65)/15
      : XPA=(PRACAD-3.75)/1.275
      : XPP=(PRPERS-4.05)/1.275
      : XPO=(PROALL-3.90)/1.275
      : PCSC1=0.40*XTE+0.34*XAV+0.35*XAQ+0.38*XAT+0.40*XPA
      :       +0.37*XPP+0.40*XPO
      : PCSC2=-0.10*XTE+0.38*XAV+0.45*XAQ+0.47*XAT-0.30*XPA
      :       -0.43*XPP-0.37*XPO
      : PCSC3=-0.17*XTE+0.78*XAV-0.60*XAQ-0.04*XAT+0.01*XPA
      :       +0.01*XPP+0.02*XPO
'PAGE'
'PRINT' HR
'PRINT/P' NGROUP,NANU,WT,SCORE,TES,ASATV,ASATQ,ASATT,PRACAD,PRPERS,
      PROALL,SEX,TYPE,COLLEGE,AREA,PCSC1 $ 3(7),7.2,11(7),7.2
'PAGE'
'PRINT' HR
'REGRESS/PRIN=C' SCORE,TES,ASATV,ASATQ,ASATT,PCSC1,PCSC2,PCSC3,
      PRACAD,PRPERS,PROALL
```

```

'Y' SCORE
'FIT' TES
'HEAD' HY='GRADE SCORE'
      : HX='TES'
'GRAPH/ATY=HY,ATX=HX' SCORE;TES
'PAGE'
'PRINT' HR
'FIT' ASATV
      : ASATQ
'PAGE'
'PRINT' HR
'FIT' ASATT
      : ASATV,ASATQ,ASATT
'PAGE'
'PRINT' HR
'FIT' PCSC1
      : PCSC2
'PAGE'
'PRINT' HR
'FIT' PCSC3
      : PCSC1,PCSC2,PCSC3
'INTE' YG=1,1,1,1
      : XG=1,1,1,1
'GRAPH/YCNT=YG,XCNT=XG' SCORE; ASATT,PCSC1,PCSC2,PCSC3
'LINE' 1
'CAPTION' 'GRAPHS ARE SCORE VS : TOP LEFT, ASAT TOTAL;
          TOP RIGHT, PC 1 SCORE; BOTTOM LEFT, PC 2 SCORE;
          BOTTOM RIGHT, PC 3 SCORE.'
'PAGE'
'PRINT' HR
'FIT' PRACAD
      : PRPERS
'PAGE'
'PRINT' HR
'FIT' PROALL
      : PRACAD,PRPERS,PROALL
'INTE' YGG=1,1,1
      : XGG=1,1,1
'GRAPH/YCNT=YGG,XCNT=XGG' SCORE; PRACAD,PRPERS,PROALL
'LINE' 1
'CAPTION' 'GRAPHS ARE SCORE VS PRINCIPALS RECOMMENDATIONS :
          TOP LEFT, ACADEMIC; TOP RIGHT, PERSONAL;
          BOTTOM LEFT, OVERALL.'
'REGRESS' SCORE,TES,ASATV,ASATQ,ASATT,PRACAD,PRPERS,PROALL,
          SEX,COLLEGE
'Y' SCORE
'PAGE'
'PRINT' HR
'FIT' TES,ASATV,ASATQ,ASATT
'ADD' SEX
'PAGE'
'PRINT' HR
'FIT' TES,PRACAD,PRPERS,PROALL
'ADD' SEX
'PAGE'
'PRINT' HR
'FIT' TES,ASATV,ASATQ,ASATT,PRACAD,PRPERS,PROALL

```

```
'PAGE'  
'PRINT' HR  
'ADD' SEX  
'PAGE'  
'PRINT' HR  
'FIT' TES, COLLEGE  
'PAGE'  
'PRINT' HR  
'ADD' SEX  
'PAGE'  
'PRINT' HR  
'FIT' TES, ASATV, ASATQ, ASATT, COLLEGE  
'PAGE'  
'PRINT' HR  
'ADD' SEX  
'PAGE'  
'PRINT' HR  
'FIT' TES, PRACAD, PRPERS, PROALL, COLLEGE  
'PAGE'  
'PRINT' HR  
'ADD' SEX  
'PAGE'  
'PRINT' HR  
'FIT' TES, ASATV, ASATQ, ASATT, PRACAD, PRPERS, PROALL, COLLEGE  
'PAGE'  
'PRINT' HR  
'ADD' SEX  
'RUN'  
'CLOSE'  
'STOP'
```