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ABSTRACT

A recent decline in the ability to predict first-year grade point average using the traditional regression analyses incorporating Scholastic Aptitude Tests (SAT) and high school rank as predictors fostered an investigation of the effectiveness of alternative procedures to predict academic success. Four procedures were investigated and compared, using multiple regression analyses, multiple discriminant analyses, and quadratic analyses. Of the procedures for improving predictive validity of SAT and high school rank, the quadratic equation appeared to be most effective. Four recommendations were made to the public, southern university from which the data were obtained: (1) the 1978 quadratic equation should be used as the official admissions criterion for predicting grade point average; (2) the predicted grade point average for admission, using this method, should be raised from 1.7 to 1.8; (3) the admissions policy should be modified to accept those students who have the minimum grade point average, have a minimum SAT total of 750 and converted high school rank of 50; and (4) more effective procedures for monitoring course and university withdrawal be used. A bibliography and data tables are appended. (MSE)

An Examination of Alternative Methods and Policies for Improving the Predictive Validity of SAT Scores and High School Rank in Freshman Admissions Decisions

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Abstract

A recent decline in the ability to predict first-year GPA, using the traditional regression analyses incorporating SAT and high school rank as predictors, fostered an investigation of the effectiveness of alternative procedures to predict academic success. Four procedures utilizing multiple regression analyses, multiple discriminant analyses, and quadratic analyses were investigated and compared. Each procedure is discussed in terms of policy implications for admission offices.

An Examination of Alternative Methods and Policies for Improving the Predictive Validity of SAT Scores and High School Rank in Freshman Admissions Decisions

The selection of students for admission to a college or university has typically relied on regression equations predicting the students' first or second semester/year grade point average (GPA). Students with a predicted GPA above a given level are normally accepted for admission into the university or college. Students with a predicted GPA below the specified level are rejected or may be admitted under special conditions.

Measures often used as predictors of the GPA in regression equations have been the Scholastic Aptitude Test (SAT) of the College Entrance Examination Board or the American College Test (ACT) generally in combination with high school grade point average or rank (HSR). In recent years, the multiple correlation of these measures with the students' actual GPA at the end of the first or second semester has ranged from .39 (Michael & Jones, 1963) to .76 (Larson & Scontrino, 1976).

Historically, the SAT and high school achievement scores have accounted for approximately 25% of the GPA variance (Aleamoni & Oboler, 1978; Bowers, Note 1; Chissom & Lanier, 1975; Franz, Davis, & Garcia, 1958; Mann, 1961). Although the percentage of variance accounted for may appear to be low, it is not unusual given the difficulties associated with predicting the GPA (Goldman & Slaughter, 1976; Humphreys, 1968, 1976). The cumulative GPA is a composite based upon grades from different types of classes using apparently different grading standards. As suggested by Goldman and Slaughter (1976, p. 14): "the validity problem in the GPA prediction is a result of the shortcomings of the GPA criterion rather than the tests that are used as predictors."

Recently, Dalton (1976) noted that the predictive validity of SAT scores and high school rank has been declining. At Indiana University, the multiple correlations of first-semester grade point average (GPA) with high school rank (HSR) and SAT Total scores for males declined from .62 in 1961 to .47 in 1974, and from .64 to .49 for freshman female students. Reasons for the decline in the multiple correlation were not investigated. Therefore the generalizability of the results is limited.

At a public Southern university, the multiple correlation of the SAT and HSR measures with first-year GPA ranged from .494 to .565 during the academic years 1970 to 1976. In 1977 and 1978, the multiple correlation decreased to .371 and .405, respectively. Analyses of the 1977 and 1978 data indicated an approximate J-shape distribution, when plotting the students' first-year GPA with the predicted GPA using the official admissions criteria (i.e., beta weights from the regression equation based on 1976 entering freshmen). For an individual with a high school rank at the 50th percentile, the decline in the predictive validity of the SAT and HSR has meant that the minimum SAT Total score necessary to meet the admission standard of a 1.7 predicted grade point has declined from 813 in 1976 to 505 in 1978. Because the SAT Total scores necessary to predict a 1.7 GPA were too low to satisfy the Admissions Policy Committee, the University has been unable to utilize current regression equations derived by traditional means in formulating admissions policies for the last three years.

Purpose

The decline in the multiple correlation prompted an investigation of the predictive validity of the SAT and high school rank measures and led to the present study, the specific purposes of which were (1) to investigate alternative methods for increasing the accuracy of the prediction of the first-year GPA; and (2) to investigate the policy implications inherent in employing alternative admissions procedures.

Data Source and Methodology

The data source utilized was 1977 (N = 1295) and 1978 (N = 1383) freshmen from a public, Southern university, for whom SAT-Verbal, SAT-Math, converted high school rank, and first-year cumulative GPA data were available. A breakdown of the sample by race, sex, and admission status is presented in Table 1. The specific methods to be investigated and compared were:

1. Traditional regression equations to predict the first-year GPA utilizing SAT scores and igh school rank for the total freshman population.

2. Separate regression equations predicting GPA's for regular and special service admissions students, white and black students, and male and female students.
3. Quadratic equations predicting the GPA based on the total freshman population.
4. Multiple discriminant analyses for the following groups: (1) students whose actual GPA is below 1.7 versus those with a GPA above 1.7; (2) students whose actual GPA is below 1.3 versus those with a GPA between 1.3 and 1.7 versus those with a GPA above 1.7; and (3) students whose actual GPA is in the bottom, middle, and top-third of the overall first-year GPA distribution.

The above analyses were employed separately for the Fall 1977 and Fall 1978 entering Freshman classes to determine the stability of the results. When data from previous years are available, such results are also reported.

Insert Table 1 about here

Results

Regression Equations

The first methods compared were the traditional regression equations based upon the total populations for each year and the separate regression equations based upon male, female, white, black, special service students, and regular admission students.

The multiple correlations for the various subgroups using the SAT Total score and converted high school rank are given in Table 2. Discussion is limited to the utilization of SAT Total scores and converted high school rank in predicting first-year GPA since differences in all the multiple correlations for 1977 and 1978 were less than .004, when separate SAT Verbal and SAT Math scores as well as high school rank were used as predictors. Thus, for example, the multiple correlation for 1978 white females was .443 using the SAT Total score and high school rank as predictors, compared to .444 using SAT Verbal, SAT Math, and high school rank as predictors.

Insert Table 2 about here

As indicated in Table 2, the multiple correlations for 1978 entering freshmen as a total group and for special sub-groups ranged from .280 for male students to .491 for special service students for 1978 entering freshmen, and from .363 for white students to .416 for black students for 1977 entering freshmen. The multiple correlations were generally higher for female students, which is consistent with previous research (Angoff, 1971; Dalton, 1976; Larson & Scontrino, 1976). There were no major differences in the multiple correlations for black and white students.

The multiple correlations for white-female, black-female, white-male, and black-male 1977 and 1978 entering freshmen are presented in Table 2. For 1978 entering freshmen, there was an appreciable increase in the black-male and white-male multiple correlations when compared to the total male population. However, there was no appreciable increase in the multiple correlations when separate analyses were performed for female students.

The correlations between the actual and predicted GPA, using the beta weights from the 1976 Admissions formula as applied to 1977 and 1978 freshmen, were .367 and .405, respectively. As indicated in Table 2, the multiple correlation for the 1976 entering freshmen was .555. When applying a set of beta weights derived in one sample to the predictor scores of another sample, one would expect a shrinkage in the multiple correlation. When the beta weights from the 1976 regression formula were applied to the 1977 and 1978 data, the estimated multiple correlation was .554. As is apparent, the multiple correlations for the 1977 and 1978 samples were well below the estimated multiple correlation.

Quadratic Equations

As reported earlier, a J-shape distribution was indicated between the predicted and actual GPA for 1977 and 1978. When bivariate distributions are linear, multiple regression or correlation provides an effective description of the relationship between the variables. However, when such distributions are nonlinear, multiple regression procedures provide a distorted picture of the relationship between the variables, necessitating the use of other techniques.

To test for the nonlinear relationship between the predicted and actual GPA for 1977 and 1978 entering freshmen, quadratic regression equations were employed. Table 2 also presents the multiple correlations for four quadratic equations using combinations of: SAT-Math, SAT-Verbal, SAT-Total, SAT-Total^2, high school rank, and high school rank^2 as predictors. As indicated, the quadratic equations substantially improved the prediction of first-year GPA. For both the 1977 and 1978 populations, the highest multiple correlations utilized SAT-Total^2 and high school rank^2. The multiple correlations were .471 and .513, respectively.

When the 1977 quadratic regression weights were applied to the 1978 entering freshman scores, the correlation between the predicted and actual first-year GPA was .509. Thus, the quadratic equation indicated a stronger relationship between the predicted and actual GPA for 1978 entering students ($r = .509$) than the official Admissions formula, ($r = .405$).

The multiple correlations for 1977 and 1978 data using the official Admissions criteria (i.e., the SAT Total score and high school rank beta weights from the 1976 total populations) were .367 and .405, respectively. In comparing these multiple correlations with those using the quadratic equations, one finds that the quadratic equations account for approximately 10% more of the GPA variance than the official Admissions equation. However, both methods account for a very low percentage of the variance (approximately 15% using the official Admissions criteria, compared to 25% using SAT-Total^2 and high school rank^2).

Effectiveness of the Regression and Quadratic Equations

The effectiveness of the various regression and quadratic equations was first investigated by comparing the standard errors of estimate (SE). This statistic can be used to set limits around a predicted score, within which a person's actual score is likely to fall. As shown in Table 3, the lowest SE's were noted for regression equations based upon the black and special service student populations; the SE's ranged from .55 to .64. For the other regression equations, the SE's ranged from .66 to .85. The standard error of estimate for the official admissions formula was .70 in 1977 and .75 in 1978. Thus, it appeared that the equations based upon the black and special service student sub-populations provided a more accurate prediction of the students' GPA for the respective populations than did the other regression equations.

Insert Table 3 about here

To investigate the effects of different levels of predicted GPA's for use as cutoff scores in the admissions process, SAT Total scores were computed from each regression equation using a high school rank of 50. Extreme differences were noted in the required SAT Total scores for various predicted GPA's (Table 4). The highest required SAT Total scores for predicted GPA's of 1.5 to 2.0 were noted for the regression equation using the 1976 total population. One exception was the SAT Total scores required for predicted GPAs of 1.9 and 2.0 for the black student subpopulation in 1978. This implies that black students were performing lower than white students of equal aptitude. Therefore, black students must have higher SAT scores to obtain the same predicted GPA as a white student, when both rank at the 50th percentile in their high school class.

Insert Table 4 about here

Relative to other regression equations, some regression formulas required a higher SAT Total score in predicting GPA's of less than 1.7, and a relatively lower SAT score in order to predict GPA's above 1.7 (i.e., Special Service regression formula). In general, a student ranking at the middle of his high school class with a SAT Total score of 800 would have a predicted GPA of 1.7 using the 1976 official admissions formula, and a predicted GPA of 1.8 using the 1978 quadratic equation with SAT Total^2 and Rank^2 as predictors. Thus, depending upon the desired GPA and population, one may wish to employ different regression equations.

Discriminant Analysis

The final method investigated for improving the prediction of the first-year GPA was discriminant analysis. Three discriminant analyses were conducted using SAT Verbal, SAT Math and high school rank as predictors. In the first analysis, students were grouped according to whether their actual earned first-year GPA was above or below 1.7. In the second analysis students were classified into one of three groups--those with actual earned GPA's below 1.3, those with GPA's between 1.3 and 1.7, and those with GPA's above 1.7. In the third analysis, students were grouped on the bases of whether their actual earned first-year GPA fell in the lower, middle, or top third distribution of GPA's for entering freshmen. The lower distribution were those with GPA's below 2.1; the middle distribution were those with GPA's between 2.1 and 2.8; and the top distribution were those with GPA's above 2.8.

The discriminant functions for each of the respective analyses were significant (Λ = .939, .937, and .850; $p < .001$). It should be noted that a high statistical significance does not necessarily imply a large degree of difference, especially when the sample size is large. As stated by Tatsuoka (1970, p. 48): "Even if the statistic . . . is highly significant, it does not automatically guarantee that the predictor battery exhibits a high degree of differentiation among the several groups." To measure the extent of differentiation, or the total discriminatory power, Tatsuoka recommends using an extension of Hays' omega^2 (Sachdeva, 1973). The omega^2's for the discriminant analyses were very high (Ω^2 = .94, .94, and .85, respectively), which indicates that 94% and 85% of the variability in the discriminant space was attributable to group differences.

The number of possible discriminant functicns in any discriminant analysis is equal to the number of groups minus one (k-1). In the second and third discriminant analyses there were two possible discriminant functions. However, the second discriminant function was not significant in either analysis.

The group means on each of the predictor variables for the respective analyses are shown in Table 5. In general, there was a positive linear relationship between group membership and scores on the predictor variables. One exception was Group 1 of the second discriminant analysis. Here, students with GPA's below 1.3 tended to have higher SAT scores and high school ranks than students with GPA's between 1.3 and 1.7. It is hypothesized that many students with GPA's below 1.3 dropped courses after the withdrawal period or withdrew from the university and failed to notify the university. Such action would result in the student receiving a withdraw failing grade (WF) in his/her courses, which would be calculated in the grade point average.

Insert Table 5 about here

Table 6 presents the group centroids and the standardized discriminant weights for each analysis. The table indicates that the most important variables for separating students into the respective groups were high school rank and SAT-Verbal scores. The percent of cases classified into the correct group for each of the three discriminant analyses were 68%, 58%, and 52%, respectively. In comparison, the quadratic equation using SAT-Total^2 and high school rank^2 as predictors was able to correctly classify 78% of the students with actual earned GPA's above and below 1.7.

Insert Table 6 about here

A major disadvantage of the discriminant analyses is that they provide a very conservative estimate of the students' GPA. Using the 1.7 predicted GPA as the minimum criteria for admission, applicants would need a minimum high school rank of 60 and a SAT Verbal score of 450 and a SAT Math score of 400, or a high school rank of 55 with a SAT Math and Verbal score of 500 to be admitted. Thus, many students who would be admitted using the current Admissions criteria would be rejected using the discriminant analysis procedure.

Discussion

Several factors were investigated as to potential reasons for the decline in the predictive validity of SAT scores and high school rank which was observed. First to be investigated was the distribution of the SAT scores and high school rank. The nationwide trend of declining SAT scores has been apparent for some years (Admissions Testing Program of the College Board, Note 2). Although a decline in SAT scores and high school rank would not necessarily lead to a decline in the multiple correlation between the predicted and actual GPA, a restriction of range problem might generally be expected to occur, resulting in lower simple correlations between the SAT and high school rank and the first-year GPA,if the SAT scores and high school rank scores were very homogeneous. The lower simple correlations would in turn result in a lower multiple correlation. An inspection of the distribution of the SAT and high school rank scores for 1977 and 1978 entering freshmen indicated that the scores became more heterogeneous than in previous years. Thus, the decline in the multiple correlation does not appear to be related to the decline in SAT or high school rank scores.

A more plausible explanation for the decline in the multiple correlation is a change in the makeup of the criterion (i.e., the first-year GPA). There are several possible reasons for the change in the GPA. First, students are receiving lower grades than in previous years due to grading standards which may be more strict. Second, changes in the withdrawal and pass/fail policies may have resulted in an increased number and percentage of students receiving withdraw-failing (WF) and F grades. The increase in the number of students receiving WF or F may in turn have resulted in the more pronounced J-shaped distribution of the predicted and actual first-year GPA which was observed. Also, inconsistencies in the recording of individual WF and F grades which fail to distinguish between students who failed or were failing a course and students who neglected to follow appropriate university or course withdrawal procedures may have contributed to the decline in the multiple correlation.

The situation described above may not be unique to just one university. Suslow (1977) has found the undergraduate GPA's to be declining among several research universities and institutes of technology, which suggests that the grading practices are becoming more strict at other universities. Other universities are also considering changing the lenient academic policies which were implemented in the late sixties and early seventies. Such changes in the grading practices and academic policies may also result in a pronounced J-shaped distribution of the predicted and actual GPA's and a decline in the predictive validity of SAT and high school rank scores using the traditional regression equation.

The decline in the predictive validity of SAT and high school rank scores has several important implications. Perhaps most important is the fact that the decline in the multiple correlation has meant a loss in the accuracy of predicting the first-year GPA. Many students who otherwise would succeed at the university are being rejected for having too low a predicted GPA.

In view of the fact that the Western Interstate Commission on Higher Education (Note 3) has projected that the number f high school graduates nationwide will decrease approximately 17% by 1985, greater accuracy in the prediction of first-year GPA is increasingly important when one takes into account the serious fiscal implications posed by declining enrollments for colleges and universities which are supported primarily by enrollment-driven funding systems.

At the Southern university where the data for this study was derived, freshman enrollment is projected to decline by 10% from Fall 1979 to Fall 1985. The university also has a policy of not admitting any applicant who has a SAT Total score of less than 800. If the SAT scores continue to decline in a linear fashion, and if the minimum SAT requirement is adhered to, the freshman enrollment is projected to decline by an additional 4% by 1985. The cumulative effects of declining freshman enrollments over a period of five years would result in an estimated decline of approximately 300-335 FTE students. If unaccompanied by increases in enrollment in other sectors (i.e., graduate, special adult, etc.), the drop of 300-335 FTE students would mean a potential decrease of 23 faculty positions based upon a student/faculty ratio of approximately 14.5:1.

Of the several alternatives investigated in this study for improving the predictive validity of SAT and high school rank scores, the quadratic equation appeared to be most effective. There are several reasons why the quadratic is most effective. First, regression equations based on selected populations involve several legal implications which the writers are unqualified to address. Although such regression equations showed potential for predicting academic success, particularly those for female, black, and special service student populations, a number of legal questions would need to be clarified before the regression equations for selected populations could be implemented in an institution.

A second reason why the quadratic was most effective was the fact that the discriminant analyses provided too conservative estimatesof the first-year GPA to be applied in the admissions process. In this regard, a student who ranked in the middle of his/her high school class needed a SAT total score of over 1000 to obtain a predicted GPA of 1.7 or above using the discriminant analysis procedure; the same student would need an SAT Total score of 813 using the current Admissions formula for the same predicted GPA. Discriminant analysis may be very effective in predicting academic success at other institutions. The relatively poor performance of the discriminant analysis in the institution under study may, however, reflect more upon the sample population examined than the technique itself.

Perhaps the most important reason why the quadratic was most effective was that it took into account the J-shaped distribution of the predicted and actual GPA. In this regard, the quadratic equation had one of the lowest standard errors of estimate and was more accurate in predicting the students' first-year GPA than the current admissions formula which is based on the regression equation for 1976 entering freshmen. Universities which also witness a J-shaped distribution in the predicted and actual GPA's, may also find the quadratic to be more effective in predicting academic success than the traditional regression equation.

In view of the above findings, the following four recommendations were submitted to the Southern university's Admissions Policy Committee:

1. The 1978 quadratic equation with SAT Total^2 and high school rank^2 as predictors should be used as the official admissions criteria in predicting a student's grade point average.
2. If the quadratic equation is adopted as the official admissions criteria, the predicted GPA for admission should be raised from 1.7 to 1.8.
3. The official admissions policy should be modified to accept those students who (1) meet the minimum predicted GPA requirements; (2) have a minimum SAT Total score of 750 and a converted high school rank of 55; or (3) have a minimum SAT Total score of 800 and a converted high school rank of 50.
4. More effective procedures for monitoring course and university withdrawal procedures as they affect the determination of a student's grade point average need to be developed and implemented.

The net combined effects of adopting the quadratic equation noted in recommendation one and raising the required first-year predicted GPA from 1.7 to 1.8 as indicated in recommendation two was to lower the minimum acceptable SAT Total score for students with a converted high school rank of 50 from the previously established minimum of 813 to 782. The lowering of the minimum SAT Total score by 32 points would not appear to drastically effect academic standards and serves to balance the probable effects which declining numbers of high school graduates and declining SAT scores would be expected to have upon the total yield of freshman applicants.

Recommendation three was based on a number of findings. First, it was found that marginal students who ranked high in their graduating class but had low SAT scores achieved significantly higher GPA's than students who had high SAT scores but ranked low in their high school class. Second, the change in policy was estimated to yield approximately 54 additional freshman enrollees per year. Finally, the quadratic equation was found to be more desirable than traditional regression approaches because it would serve to maintain approximately the same academic standards.

Each of the recommendations was adopted by the Admissions Policy Committee. Thus, in the realm of policy, the quadratic equation was found to have utility, especially in light of the declining enrollment, SAT and economic trends which will be facing most colleges and universities in the eighties.

Although the quadratic equation improved the predictive validity of SAT and high school rank scores, the amount of variance in the GPA accounted for in the GPA is still quite low (25%). Additional research designed to improve the predictive validity of freshman admissions decisions should include nontraditional measures which, when used in conjunction with SAT scores and high school rank, could possibly increase the correlation between the predicted and actual GPA by a significant degree. A variety of nontraditional measures could be incorporated in the equation. Pratt, Uhl, and Davis (Note 4) have found that motivational items from the College Student Questionnaire add significantly to the multiple correlation obtained from the traditional predictors. Personality measures, such as the Myers-Briggs Type Indicator, have also been found (Stricker, Schiffman, & Ross, 1965) to add significantly to the prediction of academic success. Attempts of a number of institutions to improve the prediction of academic success by including ratings of the applicant's high school have met with varied success (Watley & Merwin, 1967; Uhl & Nelson, Note 5). However, as statewide competency testing becomes more common, readily interpreted qualitative standards for in-state high schools based on the percentage of graduates passing competency tests may be available which would significantly add to the multiple correlation when included with SAT scores and high school rank.

Historically, SAT scores and high school rank have accounted for approximately 25% of the GPA variance. If the variance accounted for continues to decline, as is the case at many universities, use of SAT scores and high school rank in the admissions process will be open to question. In view of declining numbers of high school graduates, SAT scores, and economic conditions, attempts to improve the predictive validity of SAT and high school rank will become more important in the 1980's.

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TABLE 1

SAMPLE SIZES FOR REGRESSION AND QUADRATIC ANALYSES

	1976	1977	1978
Total	1231	1295	1383
Sex			
Male	286	300	342
Female	945	995	1041
Race			
White	NA	1149	1173
Black	NA	137	194
Admission Totals			
Regular Admission	NA	NA	1226
Special Service	NA	NA	157
White-Female	NA	903	865
White-Male	NA	297	308
Black-Female	NA	124	165
Black-Male	NA	17	29

NA not available

TABLE 2

MULTIPLE CORRELATIONS BETWEEN PREDICTED AND ACTUAL FIRST-YEAR GPA FOR 1970 THROUGH 1978, USING SAT TOTAL, HIGH SCHOOL RANK, AND QUADRATIC SCORES AS PREDICTORS OF FIRST YEAR GPA

SAT-Total H.S. Rank	1970	1970-1971	1972-1973	1974	1975	1976	1977	1978
Total	.563	.550	.494	.525		.555	.371	.405
Using '76 Betas[a]							.367	.405
Female	.582	.572	.537	.570		.585	.398	.443
Male	.308	.319	.320	.378		.443	.367	.280
Regular Admission								.346
Special Service								.491
White				.523			.363	.389
Black				.523			.416	.404
White-Female							.332	.393
White-Male							.292	.364
Black-Female							.395	.453
Black-Male							.502	.391
Quadratic Equations								
SAT-Total^2 + Rank							.410	.450
SAT-Total + Rank^2							.444	.484
SAT-Total^2 + Rank^2							.471	.513
SAT-V + SAT-M + Rank^2							.447	.487

[a] official admissions formula

TABLE 3

STANDARD ERRORS OF ESTIMATE FOR REGRESSION EQUATIONS BASED UPON 1977 AND 1978 TOTAL GROUPS AND SUB-GROUPS USING SAT TOTAL AND HIGH SCHOOL RANK AS PREDICTORS

POPULATIONS

Year	Total	Female	Male	Black	White	Regular Admission	Special Service	SAT^2 + Rank	SAT + $Rank^2$	SAT^2 + $Rank^2$
1977	.700	.659	.782	.546	701			.687	.675	.665
1978	.748	.705	.848	.642	.745	.829	.618	.731	.716	.702

TABLE 4

SAT - TOTAL SCORES REQUIRED TO PREDICT GPA'S AT DIFFERENT LEVELS

WITH A HIGH SCHOOL RANK OF 50 AS DERIVED FROM VARIOUS REGRESSION EQUATIONS

Regression Equation Population	N	R	GPA 1.5	1.6	1.7	1.8	1.9	2.0	2.4	2.5
1976 - Total Sample[a]	1231	.554	710	762	813	864	915	966	1170	1221
1978 Black	194	.404	499	629	759	888	1018	1148	1668	1797
1978 Special Admission	157	.491	639	690	740	790	841	891	1092	1143
1978 SAT-T^2 + Rank^2	1383	.531	467	591	693	782	862	935	1183	1238
1978 SAT-T + Rank^2	1383	.484	391	500	610	719	828	935	1372	1481
1978 SAT-T^2 + Rank	1383	.450	353	487	592	680	759	830	1068	1119
1978 Male	341	.280	409	495	580	667	753	839	1183	1268
1978 Female	1041	.443	360	439	519	598	678	757	1075	1154
1978 - Total Sample	1383	.409	327	416	505	594	683	773	1129	1218
1977 - Total Sample	1295	.371	258	344	430	515	602	687	1030	1115
1978 White	1173	.389	158	273	387	501	616	730	1188	1302
1978 Regular Admission	1256	.346	-82	81	243	406	568	731	1381	1543

[a] official admissions formula

TABLE 5

SAT AND HIGH SCHOOL RANK MEANS FOR EACH GROUP AND DISCRIMINANT ANALYSIS

Discriminant Analysis	Group GPA's	Group Means			N
		SAT-V	SAT-M	Rank	
1	< 1.7	419	439	55.1	271
	≥ 1.7	463	480	60.0	1111
2	< 1.3	423	447	55.2	133
	$1.3 \leq x < 1.7$	415	431	54.9	138
	≥ 1.7	463	480	60.0	1111
3	< 2.1	422	445	55.6	467
	$2.1 \leq x < 2.8$	452	467	58.7	477
	≥ 2.8	492	505	63.1	438

TABLE 6

GROUP CENTROIDS AND STANDARDIZED DISCRIMINANT FUNCTIONS

Analysis	Group GPA's	Centroid	Standardized Discriminant Functions		
			SAT-V	SAT-M	Rank
1			192.6	118.7	323.8
	< 1.7	95.25			
	≥ 1.7	104.20			
II			193.0	128.7	323.8
	< 1.3	97.41			
	$1.3 \leq x < 1.7$	96.00			
	≥ 1.7	105.77			
III			224.9	91.0	312.2
	< 2.1	97.54			
	$2.1 \leq x < 2.8$	103.29			
	≥ 2.8	111.54			