

A Correlation-based Study of the Admissions Criteria in a B.Sc. Engineering Program*

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Applicants to undergraduate programs at the Ivy League schools along with their parents find, from time to time, the admission process as secretive, unpredictable, confusing, and arbitrary. This paper presents a model of the admission process in terms of the applications that encapsulate the characteristics of the applicants and the admissions officers who represent the educational philosophy of the university or college. It describes a correlation-based, scientific study to evaluate the proposed model, wherein the parameter design reflects the knowledge and experience acquired during the second author's tenure as an advisor to the undergraduate admissions office for the B.Sc. Engineering program at Brown University between 1989 and 1992. Analysis of the correlations reveal that (1) admission officer biases play a strong role in determining the admission decision outcomes, and (2) applicants with strong math ability, indicated through high math achievement test score, high physics achievement test score, strong parental educational background, high grade point average, and outstanding teacher recommendations, are favored by the representative type of admissions officers who evaluate B.Sc. Engineering applicants to Brown University. The findings corroborate well with actual experiences of the second author.

INTRODUCTION

MCDONOUGH [1] observes that, among primarily upper-middle-class high school students and parents who view college as a pivotal career investment, the process of choosing colleges and preparing for admission has become extremely important. Parents are aware that going to a selective college increases one's social standing, contacts, and income potential. Today, the admissions process is often viewed as an erratic, highly competitive, chancy game over which neither parents nor students have much control. Kravets [24] paints a vivid picture of the typical applicant's frustration and apprehension. McDonough labels the nonschool-based admission assistance services as admissions management and describes their evolution in the 1980s and 1990s. The revenues for Stanley Kaplan's SAT preparation services has doubled from 1983 to 1988 and a 1987 New York State study commissioned for the National Association of College Admissions Counselors (NACAC) reports 20% of college-bound seniors used private counselors. McDonough notes that high socio-economic status-oriented students with low to moderate academic ability currently prepare for the 'right' colleges in innovative ways:

hiring counselors and test coaches, securing professional help with essays, and maximizing summer vacations with educational experiences and travel.

Davis [13] notes that recently, there has been a decline in the number of applications to select universities despite a concurrent increase in the number of outstanding applications. While this has fueled a sense of overwhelming disappointment, anguish and frustration among the outstanding applicants and their parents, the lack of detailed reasons for the non-acceptance, from the admissions office, has created an atmosphere of disbelief and mystery.

Karen [17] describes the roles of academic achievement and 'ascription' in the admission process at Harvard University, as examined in 1994. Karen notes that students whose parents have attended graduate or professional schools are over-represented among the Harvard applicant pool. Although Harvard requires the usual test scores, GPA, class rank, etc., and while an applicant with a stellar academic background has a high chance of being admitted, having family connection to Harvard, being black or American Indian, elite prep school attendance, being an athlete, and hailing from the local area, significantly affect one's probability of admission. Karen's analysis reveals huge differences in the achievement test averages among admitted applicants—those with family connections, athletes, or attending elite prep

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schools, rank significantly lower academically than others.

The process of admission to engineering programs at universities and colleges including Ivy League schools such as Brown, is elaborate and comprehensive. Applicants, typically high school students in their senior year, are required to submit a comprehensive package that may include their:

- transcripts from grades 9 through 12;
- recommendations from three or four teachers, one or two preferably from the areas of mathematics, physics, and chemistry;
- SAT verbal and math sub-scores;
- ACH scores in math-II, physics, chemistry, history, English, etc.;
- AP test scores in chemistry, computer science, etc.;
- evaluation from the school's guidance counselor with a statement relative to class ranking;
- a school profile listing the percentage of the graduates going into four-year degree programs;
- a hand-written essay describing an important experience in the applicant's life;
- an essay describing the applicant's special aptitude and reasons for pursuing engineering;
- a duly filled standard application;
- rank-ordered list of program/degree choices of the applicant;
- parental educational and employment background and marital status;
- background on siblings' education;
- interview with an appropriate person related to the university.

A number of other factors are utilized in the admissions process but are not considered in this study. These include the parents' ability to pay all or part of the tuition, citizenship or immigration status, payment of application fee or waiver, the state of origin of the applicant [23], and the psycho-educational characteristics [2] of the recovering student, where appropriate. Applications are accepted either in November, under the early action program, or in January as regular submissions.

Once an application folder is complete, it is assigned for review by the admissions officers, with the goal that every applicant is reviewed by at least three officers. The guidelines for the reviews differ greatly, ranging from an orally transmitted set of rules that constitutes the school's tradition to the complete discretion of the admissions officer. Given that there is appreciable turnover among admissions officers, this may result in wide variations of assessments. While one officer may deem an applicant a straight accept, another officer may completely reject the application. The expectation is that with three semi-independent reviews for each application, a consensus is likely. Although the general rule in evaluating the individual factors continues to be uniform, i.e. an essay with a lot of grammatical

and spelling errors reflects poorly on the applicant while high ACH scores and strong letters of recommendations speaks highly of the student, the overall decision process is many times more complex.

The problem of determining a set of criteria, defining them with meticulous care, and utilizing them in the college admissions process, is a difficult one and is generic to all universities and colleges. McManus [9] reports that in 1988–89, 1,088,223 high school students took the College Board's SAT while some 855,000 students took the ACT Assessment. She notes that some admissions offices are known to focus entirely on these test results to the exclusion of other factors in making admission decisions. SAT's underlying philosophy [21] may be stated as, '...the idea of comprehensive examinations in which students would not be asked to repeat the facts that they had learned in school but to demonstrate an understanding of the relation of discrete facts to one another, to generalize the facts into working principles, and to apply them to new and unexpected situations...' This philosophy is sharply contradicted by an internal study [25] in the late 1970s and early 1980s, conducted by the Division of Engineering at Brown University. The study observed a high positive correlation between the math-I ACH score and success in engineering while the correlation with the SAT math and verbal scores was nil. A 1974 American College Testing program study [22] examined the then Scholastic Aptitude Test and found that it 'offered virtually no clue to capacity for significant intellectual or creative contributions in mature life'.

Fields [14] reports that in a survey, colleges and universities ranked the following relevant factors—the difficulty of the class, the student's average grade, the counselor recommendation, the teacher recommendation, the student's class rank, SAT or ACT score, depth of excellence in a co-curricular activity and student application essay, student leadership, and student employment. Other factors cited as relevant include on-campus interviews or interviews with alumni, and the rating of the high school.

Talley and Mohr [12] report that their research shows that a significant percentage, 68%, of college admission officers surveyed favor weighting high school grades based on honors or AP. They also report that the grade point average followed by the courses taken and rank-in-class were the most important factors determining the outcome of the admission process.

In analyzing the current admission process, Peacock [8] notes that it is more of an art than science. During the prolonged period of evaluation, biases and inconsistencies often develop in the admission officers, resulting from mood swings and changes in expectations and lead to unwise decisions. Often, the admissions officers develop a rating system which is determined not by a

systematic process but the individual officer's desire to admit a student regardless of academic and personal strengths of the applicant. Peacock hypothesizes a fictional institution and proposes that assign 75% and 25% weightings to the academic and personal qualities. The academic record is evaluated from standardized tests, grade point average, and course rigor using the relative weights—40%, 40%, and 20%. As further refinement, minimum acceptable subscores are set for each of the three components of academic record, e.g. minimum acceptable SAT or ACT score, and minimum acceptable grade point average. The personal rating is organized through a five-point scale where scores of 5 and 1 imply significantly in excess of all expectations and significantly short of expectations, respectively. The final score for the applicants, according to Peacock, would encourage consistency, objectivity, efficiency, and fair decisions.

The frequent lack of clear, consistent, unambiguous, and concise reasons underlying a non-admission, is amplified by Sturgeon [5]. While every rating process is subject to some ambiguity and uncertainty, it is imperative that the process adheres to some rules of logic and fairness, have a firm foundation in the facts, can be systematically verified or refuted, and is subject to periodic revision. Sturgeon reports that the root of the problem is that there are two major strands in thinking in admission: one holds that rating applicants is an art, the other contends that is a science. To the first set of thinkers, believers in 'people person,' those that consider admission as a science are cold and calculating and ultimately unconcerned with the individual. To the second set of thinkers, the 'people person' is emotional, illogical, and unconcerned with facts. Sturgeon claims that there are important strengths and weaknesses on both sides of the aisle and that both points of view must be reflected in the final decision, for it to be logical and meaningful on the whole.

McDonough and Robertson [20] report on the significant evolution in the college admissions process over the past three decades, notes the significant expected increase in the number of college-going students in the early 21st century, and calls for professional standards for the admissions officers. Given the increasing trend of admissions officers specializing in marketing and computers in 1988 as opposed to 1964, McDonough and Robertson suggest that the officers need to participate more with the faculty in shaping the college curriculum, improve their background in education, and understand and believe in colleges' educational philosophies.

With the exception of [15], none of the previous efforts reviewed in this paper engage in an objective and scientific evaluation of the role of the relevant factors in the admissions process. They focus primarily on surveys, frequently from

admissions officers and teachers, and infrequently from parents and applicants. Furthermore, none of the efforts reviewed in this paper report any detailed study of the special requirements for the arts, sciences, or engineering disciplines. This paper focuses on the admission process for the engineering discipline, presents a correlation-based study to uncover the key criteria, and evaluates them in the light of the actual experiences of the second author at Brown University. The remainder of the paper is organized as follows. The next section presents a correlation-based approach to evaluating the admissions criteria. The following section describes an implementation of this approach which is then subject to test with 10,000 synthetic engineering applications, i.e. where the relevant factors, also termed fields in this paper, are synthesized stochastically. The final sections present an analysis of the results and some conclusions.

A CORRELATION-BASED APPROACH TO EVALUATING ADMISSIONS CRITERIA

Intuitively, an applicant with very high math and physics skills, reflected by high ACH scores, is likely to succeed in engineering. However, to base the admission decision solely on these scores may be unwise since success requires both academic and personal qualities. One can probably find many cases where applicants with high ACH scores failed to succeed in engineering. As evident from the literature, there is neither a consensus nor a scientific rationale underlying which relevant factor(s) must be examined in arriving at a decision. The admissions officers who read and analyze applicant folders tend to dramatically differ in their views of what combination of application traits—academic and personal, constitutes success. While some may stress heavily on the SAT verbal score, others favor the SAT math as the leading indicator.

This paper proposes an underlying model of the admissions process and a statistical correlation-based mechanism to examine the validity of the model. The key relevant factors, utilized to arrive at the admission decision, include:

- SAT Math score
- SAT Verbal score
- PSAT Math score
- PSAT Verbal score
- ACH Math I score
- ACH Math II score
- ACH Physics score
- ACH Biology score
- ACH Chemistry score
- ACH English score
- AP Math score
- AP English score
- AP Computer Science score

- AP Biology score
- AP Chemistry score
- AP Physics score
- Math recommendation letter
- Humanities recommendation letter
- grade point average (GPA)
- class, rank, number of students matriculated from the school
- college father attended
- degree father earned
- college mother attended
- degree mother earned
- college sibling attended
- degree sibling earned.

In the proposed model, every admissions officer's evaluation of an applicant reflects his/her own philosophy of education and his/her understanding of the college's underlying educational philosophy. The officer's philosophy manifests in a series of beliefs relative to each of the relevant factors which collectively determine his/her evaluation of the applicants. In this paper, for an officer, a number between 0 and 100 is assigned to each of the fields. A 0 for a given field implies that the officer places neither value nor relevance on this field relative to the admissions process. In contrast, a belief of 100 reflects that the officer places significant importance to this field. A belief of 50 implies average importance assigned by the officer to the field in question. An officer's evaluation of an applicant consists in multiplying the values in each of the fields of the application by his/her corresponding belief values and generating a cumulative sum, termed 'processed score'. Once an officer has determined the processed scores for all of the applicants, he/she sets a cutoff threshold, and arrives at the final admittance decision based on whether the applicant's processed score exceeds or falls short of the threshold.

While the absence of a consensus and an unambiguous set of criteria to test the accuracy of the decisions in the literature is noted, this paper proposes the following scheme to evaluate the proposed model. First, a set of 10,000 applicant profiles are synthesized wherein the value of each of the relevant factors is determined stochastically. This constitutes a representative and unbiased applicant pool which, presumably, includes all types of college applicants. Second, for each applicant, a raw score is computed as the cumulative sum of the values of all of the fields. Third, for each admissions officer and in increments of N ($=50$) applicants, the raw scores of the applicants are correlated against the corresponding processed scores, and the correlation coefficients and levels of significance, are computed. That is, a correlation coefficient is obtained for the first 50 applicants, the subsequent coefficient is determined for 100 applicants including the first 50, the next coefficient is determined for the previous 100 applicants plus 50 new applicants, and this process continues until the final correlation coefficient that

accounts for all 10,000 applicants, is determined. Last, the successively computed correlation coefficients are plotted through a correlation graph and analyzed for insights into the admissions process.

The design of the educational beliefs of the admissions officers reflect both reality and the admissions-related experience of the second author. Although the set of beliefs are unique to each admission officer, a few of the officers, termed type I, reflect the purely math and science oriented type who place great emphasis on math and science scores only. Another set of officers (type II) reflect the type that place strong emphasis on verbal and English alone. The third set of officers (type III) emphasize values that strike a balance between the science and math achievement and the applicant's parental support which, in turn, is reflected by the parents' educational background. The second author's personal experience at Brown reveals that the third type of admissions officers admit applicants that are most likely to succeed in engineering followed by the first type of officers while those selected by the type II officers are least likely to succeed in engineering.

In this study, a total of 20 officers are selected, characterized by the following philosophies, and they constitute a representative set of engineering admissions officers. While officers 0 and 1 are solely mathematics oriented, officers 2 and 3 are solely verbal oriented, and officers 4 and 5 are solely oriented towards math and verbal abilities. While officer 6 and 7 emphasize applicant's family background only, officers 8 and 9 are neither mathematics, verbal, nor background oriented. Officers 10 and 11 emphasize mathematics, verbal, and background only and officers 12 and 13 are mathematics and background oriented. In contrast, officers 14 and 15 are verbal and background oriented. Each of officers 16 through 19 are interested in a single criterion—GPA, class rank, school reputation as reflected by the number of students graduating from the school and joining college, and SAT math score.

The correlation coefficient is a widely used statistical measure to investigate the relationship, dependence, or association between two variables. In an effort to bring objectivity into the admissions process, this paper examines the correlation graphs for the large, representative, and unbiased applicant pool subject to the representative set of admissions officers, ranging from those whose admissions related decisions create successful future engineers to those whose decisions are unlikely to create future engineers. The paper hypothesizes that, in general, most of the fields that constitute an application are composed of mathematics-related fields. Therefore, those admissions officers with strong bias towards math are likely to reveal a stronger correlation and, thus, the selected individuals are better candidates for admissions to an undergraduate engineering program. Conversely, admissions officers with strong

Table 1. The belief structure of the first 10 admissions officers

Beliefs	0	1	2	3	4	5	6	7	8	9
satMath	90	80	30	30	80	85	20	30	3	1
satVerbal	30	20	80	95	85	90	20	20	10	1
psatMath	80	80	20	20	70	75	10	25	20	1
psatVerbal	20	20	75	80	70	85	10	10	10	1
achMathI	90	95	30	20	95	95	30	20	30	1
achMathII	95	95	30	20	95	100	20	10	20	1
achPhy	80	80	20	10	80	70	25	30	10	1
achBio	70	70	20	15	70	70	10	20	30	1
achChem	60	60	30	10	80	60	15	10	10	1
achEng	50	30	95	90	90	90	20	30	20	1
apMath	95	90	30	30	80	80	40	20	15	1
apEng	30	40	95	95	85	85	20	30	1	1
apCS	70	60	10	20	60	70	30	10	14	1
apChem	70	70	10	10	70	70	10	10	15	1
apBio	80	60	10	10	70	70	30	5	12	1
apPhy	80	80	10	10	80	80	20	5	1	1
mathRec	90	95	15	10	90	90	4	5	10	1
humanitiesRec	30	40	90	85	90	85	20	5	20	1
GPA	50	70	80	70	70	70	20	10	10	1
numMtr	30	20	30	10	20	10	30	10	1	1
rank	80	80	85	90	80	70	10	20	10	1
collegeFather	50	40	20	25	10	20	90	80	20	1
degreeFather	30	30	30	10	10	20	90	100	10	1
collegeMother	50	40	20	30	10	10	90	90	20	1
degreeMother	30	30	30	20	10	10	90	100	10	1
collegeSibling	50	40	20	30	10	5	90	100	20	1
degreeSibling	30	30	30	20	10	5	90	100	10	1

Table 2. The belief structure of the subsequent 10 admissions officers

Beliefs	10	11	12	13	14	15	16	17	18	19
satMath	90	80	80	80	10	1	1	1	1	100
satVerbal	80	70	10	5	90	100	1	1	1	1
psatMath	90	90	70	70	10	1	1	1	1	1
psatVerbal	70	80	20	5	90	90	1	1	1	1
achMathI	80	85	95	95	5	10	1	1	1	1
achMathII	70	80	90	95	5	10	1	1	1	1
achPhy	90	70	80	80	10	10	1	1	1	1
achBio	70	90	80	70	10	1	1	1	1	1
achChem	80	96	70	70	10	1	1	1	1	1
achEng	70	100	10	10	100	100	1	1	1	1
apMath	90	100	80	90	20	15	1	1	1	1
apEng	99	80	5	10	90	90	1	1	1	1
apCS	100	90	60	70	10	10	1	1	1	1
apChem	70	88	70	80	30	20	1	1	1	1
apBio	80	99	80	70	20	10	1	1	1	1
apPhy	70	77	70	90	10	20	1	1	1	1
mathRec	60	89	95	100	30	10	1	1	1	1
humanitiesRec	90	90	1	1	100	100	1	1	1	1
GPA	70	70	70	60	80	1	100	1	1	1
numMtr	80	80	20	20	20	10	1	1	100	1
rank	60	90	80	70	80	80	1	100	1	1
collegeFather	70	80	90	80	100	90	1	1	1	1
degreeFather	80	90	90	100	90	90	1	1	1	1
collegeMother	90	70	90	90	80	80	1	1	1	1
degreeMother	80	80	90	90	90	90	1	1	1	1
collegeSibling	70	90	90	80	80	100	1	1	1	1
degreeSibling	90	80	90	90	90	100	1	1	1	1

bias towards verbal and weak bias towards math are more likely to reveal a weak correlation.

IMPLEMENTATION

The proposed model is implemented in C/C++ for a Unix platform and is compiled, debugged,

and executed on both a Sun Sparc 10 workstation and a Linux-based Intel 486/DX2 66 MHz workstation. The program is approximately 1200 lines long. For every admissions officer, the execution of 10,000 applicants require 15 minutes of wall clock time.

For each of the fields, the maximum and minimum possible values are known. While the

standardized test scores range from 200 to 800, the AP test scores vary between 1 and 5, and the traditional GPA ranges from 0.0 to 4.0 for straight As. The recommendations letters are scored from a low of 1 to a high of 5. The class rank is assumed to vary from 1 to 99. The colleges attended and degrees earned for both parents and siblings are rated from 1 through 5, with 5 referring to the best universities in the nation and the highest degree (Ph.D., M.D., D.B.A., LL.D., or equivalent), respectively.

The individual scores for each of the fields of all 10,000 applications are stochastic. They are generated through the use of the Linux pseudo-random number generator, 'drand48', which accepts the minimum and maximum bounding values for the respective field as its arguments. The generated pseudo-random value is restricted to lie within these bounds. The use of drand48 is intended to ensure that the scores in the college application fields are evenly distributed and reflect an unbiased application pool.

Given that the absolute values of the different fields of an application are bounded by different ranges, the computation of the raw score by merely summing the values will fail to assign equal emphasis on each of the fields. Therefore, every field value is first normalized to a range between 0 and 100, utilizing the following conversion formula:

$$\frac{(rawAppFieldScore - rawAppFieldMin)}{(rawAppFieldMax - rawAppFieldMin)} \times 100$$

Upon receiving a normalized application, the admission officer computes the processed score, utilizing his/her beliefs. The processed scores are propagated back to the AdmOffice and the officer awaits a subsequent normalized application. This process continues until every officer has generated processed scores for all 10,000 applications. Corresponding to every officer, the AdmOffice correlates the processed vs. raw score for every applicant as it is read and evaluated. The correlation values are generated progressively as groups of 50 applications are evaluated by the officer, until the officer in question completes the evaluation of all 10,000 applications.

SIMULATION OF THE PROPOSED APPROACH AND PERFORMANCE ANALYSIS

As indicated earlier, a total of 10,000 applicant profiles are synthesized wherein the value of each of the relevant factors is determined stochastically. The deliberate choice of the large number of applicants aims at providing confidence in the correlations and the results of this investigation. Indeed, the level of significance, associated with the correlation values, are given by $\alpha = 0.01$ implying that the correlations are statistically significant. The applicant pool also constitutes

a representative and unbiased applicant pool, presumably including all types of college applicants.

Every officer maintained a list of 27 beliefs, each corresponding to a field of the applications. The criteria includes an applicants SAT cores, ACH score, background, etc. and are detailed in Tables 1 and 2.

Thus, in this investigation, college applications are modeled through 27 representative criteria while admissions officers are modeled by their belief structure, i.e. their individual beliefs in the relative importance of each of the 27 fields, derived from their own and the relevant university's education philosophies. Of the 27 beliefs, 15 are math oriented, 7 verbal oriented, and 6 are family background oriented, while the last one falls under a miscellaneous category. Given that an overwhelming number of the 27 beliefs are mathematically oriented, this paper projects that admission officers with math emphasis would yield higher correlation values relative to those with other emphasis.

Figure 1 presents the correlations obtained for all 10,000 applicants corresponding to Officer 1 through Officer 4. While the behaviors of the correlation graphs for the first 50 to 1000 applicants appear unsettled, they quickly settle down to steady and relatively constant values for the remainder of the 10,000 applicants. It is observed that the steady-state value of the graphs for Officers 0 and 1, both math oriented, approximates 0.925, reflecting strong correlation between the processed and raw scores. The steady-state correlation values for Officers 2 and 3, both verbally oriented, are 0.8 and 0.76 respectively—significantly lower than those for the math oriented admission officers.

Figure 2 reveals that the correlation graphs corresponding to Officers 6 and 7, both of whom emphasized only the family background, reflect smaller values of 0.770 and 0.771 respectively. In contrast, the steady-state correlation values for Officers 4 and 5, who favor math and verbal abilities, is relatively high, at 0.870. Furthermore, a comparison of the graphs in Figs 1 and 2 reveal higher correlation values for officers with solely math emphasis as opposed to those with emphasis on math and verbal.

The graphs in Fig. 3 corresponding to Officers 10 and 11, both of whom emphasize math, verbal, and family background, reflect high correlation values of 0.986 and 0.987. While Officer 8's beliefs for all of the fields are uniformly low, those for Officer 9 are consistently 1. Clearly, the raw and processed scores for Officer 9 track one another, generating a correlation value of unity, while that for Officer 8 is 0.88. Given the uniform beliefs of the officers across all fields and the lack of discrimination between them, the two latter correlation graphs do not convey meaningful insight into the admissions process.

Figure 4 reveals that for Officers 12 and 13 who place strong emphasis on math and family

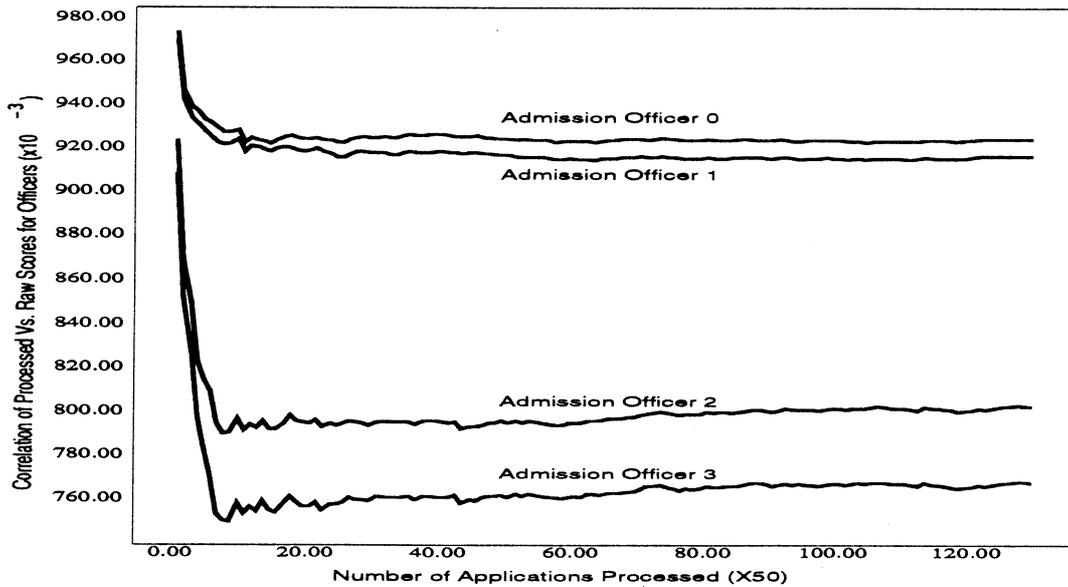


Fig. 1. Correlation of processed vs. raw scores for 10,000 applicants for officer 0 through officer 3.

background, the correlation values are consistently high—0.92 and 0.91. For Officers 14 and 15, who emphasize verbal and family background, the correlation values are relatively lower, at 0.835 and 0.76 respectively.

Figure 5 reveals that the correlation values for the graphs are consistently very low, ranging from 0.24 to 0.26. Each of the Officers 16 through 19 emphasize a single criteria, namely GPA, class rank, school reputation, and SAT math, respectively. Clearly, reliance on a single criteria, regardless of whether it relates to math or verbal ability, may be unwise for the purpose of admission decisions. Colleges and universities are therefore justified in requiring comprehensive information on the applicants including the different criteria enumerated in this paper.

SUMMARY OF FINDINGS

For the large, representative, and unbiased applicant pool, the steady-state behavior of each of the correlation graphs is significant. First, graph 5 reveals that the results obtained corresponding to a single factor differ significantly from those where a number of factors are utilized, and may not imply a reliable basis for decision. Second, the correlation values in Graphs 1 through 4, corresponding to different combinations of factors each involving math, are uniformly high. Third, the very high correlation values for officers 10 and 11 who emphasize math, family background, and verbal, coupled with the above observation corroborate this paper’s hypothesis in that a predominant number of the fields that constitute an application

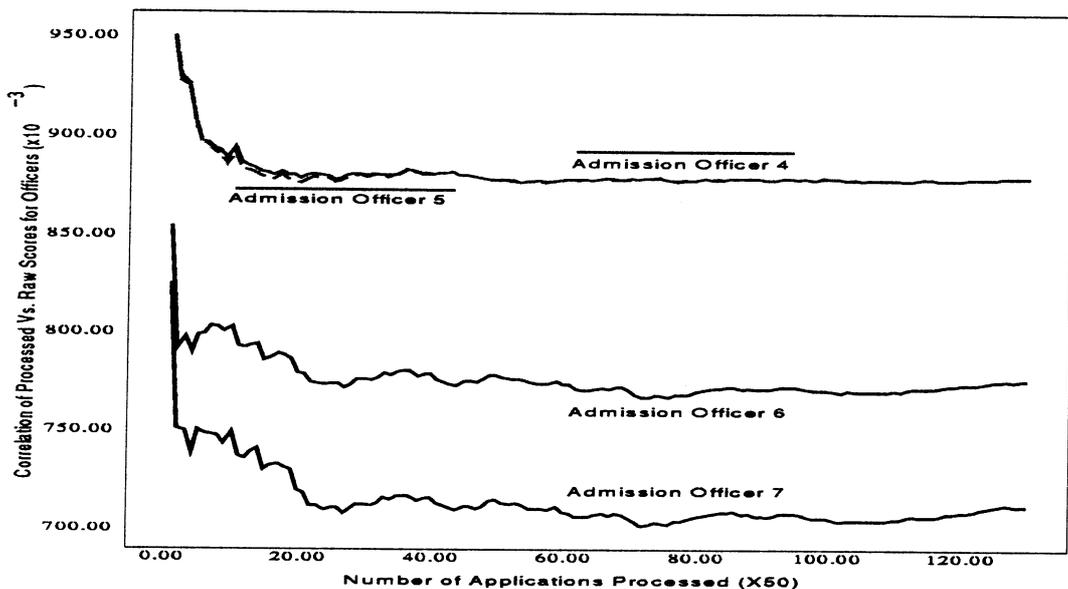


Fig. 2. Correlation of processed vs. raw scores for 10,000 applicants for officer 4 through officer 7.

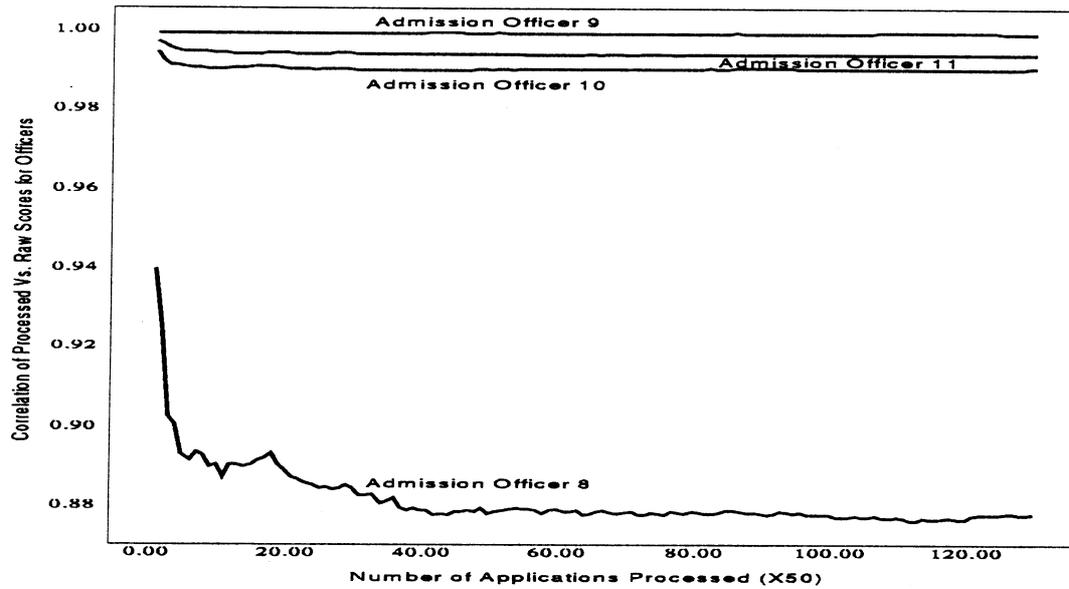


Fig. 3. Correlation of processed vs. raw scores for 10,000 applicants for officer 8 through officer 11.

are composed of mathematics-related fields. Evidently, ACH scores in Math, Physics, and Chemistry, and many of the other criteria require extensive mathematical manipulation and knowledge. The corroboration underscores the fact that mathematical manipulation plays a surprisingly strong role in today's society. Last, it has also been the second author's experience that officers with math emphasis are the predominant evaluators of engineering applications at Brown University and, informal tracking of students from admission through graduation reveals that the students identified by them are most likely to emerge as successful engineers. Thus, the mathematics related fields and the family background appear to be the key factors in predicting successful engineers. This paper suggests that as an aid to

the admission process, and not as a substitute, the admissions officers may record their beliefs in the computer, automatically generate the processed scores for the applications, and compare the scores with their independent assessments to detect any anomaly in the decision process.

CONCLUSIONS

This paper has presented a correlation-based approach to model and evaluate the admissions process into the undergraduate B.Sc. Engineering program. The results are compared against the actual experiences at Brown University over a 3

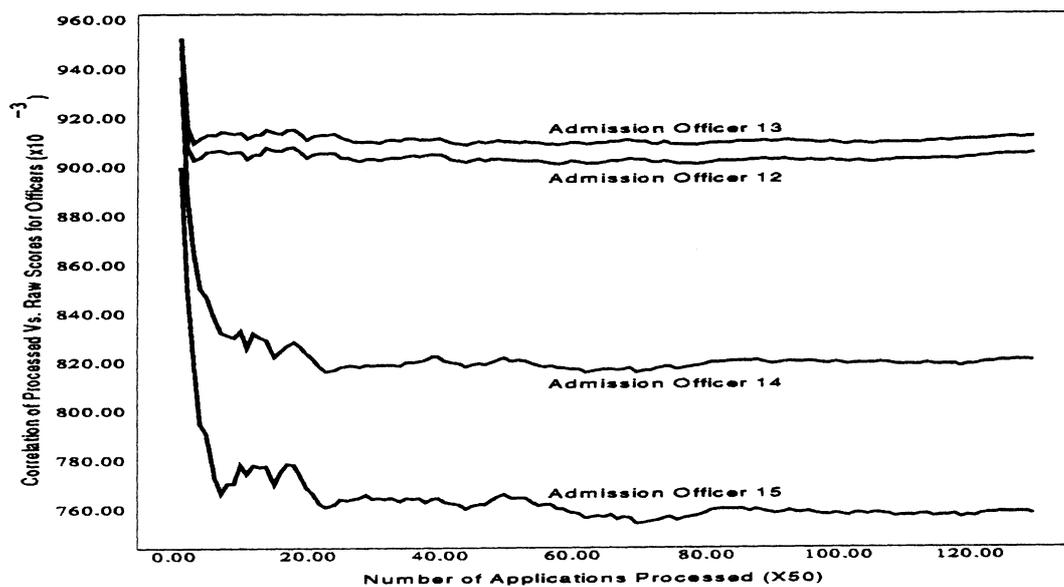


Fig. 4. Correlation of processed vs. raw scores for 10,000 applicants for officer 12 through officer 15.

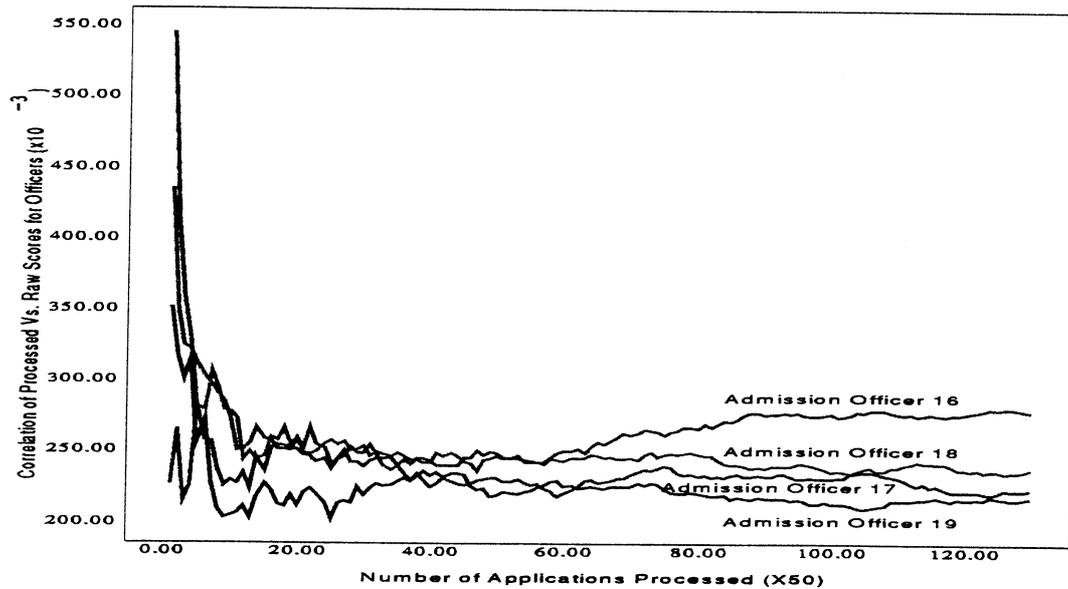


Fig. 5. Correlation of processed vs. raw scores for 10,000 applicants for officer 16 through officer 19.

year period and there is strong agreement. The paper synthesizes hypothetical applicants with stochastic yet representative profiles, develops a computer model of the proposed admission process that encapsulates the interaction between the beliefs of the admission officers and the applicant profiles, and simulates the admissions process for 10,000 engineering applicants. Analysis of the results reveal:

1. Admission officer biases play a strong role in determining the admission decision outcomes.
2. Applicants with strong math ability, indicated through high math achievement test score, high physics achievement test score, strong parental educational background, high grade point average, and outstanding teacher recommendations are favored by the

representative type of admissions officers who evaluate B.Sc. engineering applicants to Brown University.

3. Reliance on a single criteria relative to the admission decision may be unwise.
4. Universities and colleges are justified in requiring comprehensive information on the applicants.
5. SAT scores play a surprisingly minor role in the admission decision.

Although it focuses on engineering admissions, conceivably, the ideas in this paper may be extended to other disciplines including arts and sciences. Last, it is noted that not all students actually admitted to the Brown engineering program fulfill the criteria outlined in this paper.

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