CAMBRIDGE ASSESSMENT

Predicting degree performance with the Thinking Skills Assessment: report 2

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31 August 2006

RESEARCH

Summary

The Thinking Skills Assessment (TSA) is an admissions test used by the University of Cambridge to assist in the student selection process. This report examines the relationship between TSA scores and the 2006 Tripos results for students of Computer Science, Economics, Engineering and Natural Sciences (TSA 2003 and 2004 sittings). Correlations, descriptive statistics and logistic regression functions are presented in support of the predictive validity of the test.

Correlations between the TSA and subsequent exam performance are largely in the beneficial range despite the problems associated with restricted score ranges in such highly-selected candidates. The magnitude of its coefficients with the Part 1B exams are barely reduced from those for the previous year's exams, contrary to the fact that predictive validity evidence tends to be weak after the initial year of study. Logistic regression analyses also show that higher TSA scores are associated with a higher probability of attaining a 1st class outcome.

TSA Scores of Accepted and Rejected Applicants

A total of 1551 candidates sat the TSA in 2003 and a total of 2136 candidates sat the test in 2004. These were mainly applicants for Computer Science, Economics, Engineering and Natural Sciences courses. The TSA is used by many of the University of Cambridge Colleges but currently only for certain courses requiring reasoning in the domains of maths and science. Performance on the TSA is reported as a Problem Solving (PS) and a Critical Thinking (CT) score and as a total combined score. The Problem Solving component assesses reasoning using numeric and spatial skills and the Critical Thinking component assesses reasoning using everyday written language. Scores are calibrated to allow candidates taking different versions of the test to be reported on a common interval scale.

Table 1 displays the numbers of candidates accepted and rejected for each course and their mean scores on the TSA components. The proportion of candidates accepted from those who sat the TSA varies from around 0.4 for Computer Science to less than 0.2 for Economics in 2004. However, a higher proportion of candidates for Computer Science were required to sit the TSA due to its use by most of the Colleges offering this as a subject. Table 2 displays the proportions of students on each course who had TSA data.

Scores are slightly lower (around 2 marks) in the 2004 TSA sitting for both the accepted and rejected candidates. This is the case for all courses other than Economics, whose accepted candidates show similar scores in both years. The accepted Computer Science students have the highest mean Problem Solving and total TSA scores (this is not the case for their rejected applicants), suggesting that they are the most highly selected group. The Critical Thinking scores of the accepted candidates appear more similar between the courses.

Table 1: TSA Descriptive Statistics for Accepted and Rejected Candidates

2003 TSA Mean Scores (SDs)

	Accepted				Rejected			
Course	**CT**	**PS**	**Total**	**n**	**CT**	**PS**	**Total**	**n**
Computer Science	65.4 (9.2)	70 (10.5)	66.9 (7.8)	94	57.5 (10.5)	61.0 (8.2)	59.0 (7.6)	144
Economics	63.9 (8.4)	63.5 (11.9)	63.0 (8.2)	39	56.6 (8.3)	57.4 (8.4)	56.8 (7.0)	149
Engineering	63.4 (10.8)	66.9 (10.0)	64.6 (8.3)	194	56.1 (8.3)	60.8 (9.4)	58.3 (7.2)	444
Natural Sciences	64.6 (9.0)	67.4 (11.1)	65.3 (7.7)	158	58.5 (9.0)	61.7 (9.2)	59.7 (7.5)	297
All	64.2 (9.8)	67.4 (10.7)	65.1 (8.04)	485	57.0 (9.1)	60.6 (9.1)	58.6 (7.4)	1034

2004 TSA Mean Scores (SDs)

	Accepted				Rejected			
Course	**CT**	**PS**	**Total**	**n**	**CT**	**PS**	**Total**	**n**
Computer Science	63.4 (9.5)	67.4 (10.1)	64.8 (8.0)	78	56.7 (9.9)	58.1 (9.1)	57.3 (8.1)	119
Economics	64.0 (8.0)	62.8 (11.2)	63.0 (8.0)	66	54.5 (8.5)	54.9 (9.4)	54.6 (7.4)	295
Engineering	62.3 (10.4)	64.6 (10.0)	62.9 (8.0)	220	55.1 (9.1)	57.7 (8.6)	56.3 (7.4)	505
Natural Sciences	63.1 (9.2)	65.1 (10.8)	63.7 (8.2)	305	58.0 (8.8)	58.4 (9.1)	57.9 (7.2)	548
All	63.0 (9.5)	65.0 (10.5)	63.5 (8.1)	669	56.2 (9.0)	57.4 (9.1)	56.7 (7.5)	1467

Table 2: Proportion of Students in Each Year with TSA data

Course	1st Year Exams (TSA 2004)	2nd Year Exams (TSA 2003)
Computer Science	0.58	0.79
Economics	0.33	0.12
Engineering	0.43	0.35
Natural Sciences	0.38	0.19

The frequency polygons in Figure 1 display distributions of the TSA total scores for accepted and rejected candidates (note the y-axes vary due to differences in available places on each course). Separate score distributions for the Problem Solving and Critical Thinking components are given in the Appendix. The accepted candidates have higher mean TSA scores than the rejected candidates for all courses but there is considerable overlap in their distributions. This suggests that other admissions information also played an important role in the selection decisions.

The score ranges are similar for each course but the accepted Economics candidates appear to have relatively fewer candidates scoring very highly. The distributions for the accepted and rejected Economics candidates also appear less separated than they do for the other courses whilst the distributions for the accepted and rejected Computer Science applicants appear the most separated. This again suggests that the Computer Science students may be the most highly selected group on the basis of the TSA (particularly in 2004) and the Economics students the least so.

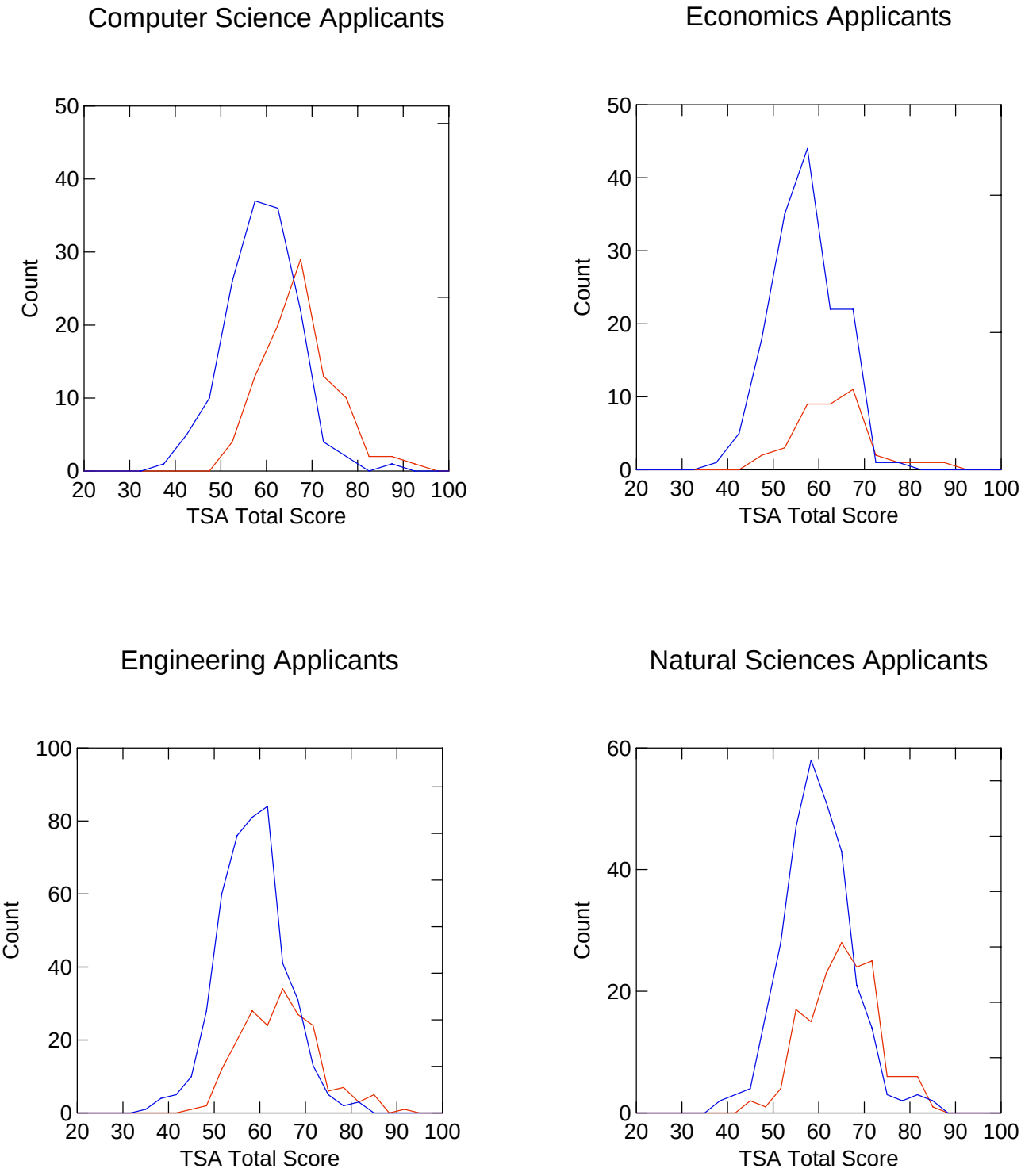
The score distributions are particularly useful for evaluating whether the TSA could be used for deselecting certain candidates prior to interview: very few of the accepted candidates had low total scores in either year. If the test were to be used in this way (with a cut-score set as a hurdle) then it needs to be asked why any relatively low scoring applicants are accepted and whether these candidates could still be spotted without an interviewer.

Data

Examination data from 2006 were supplied by the University of Cambridge Student Records Office and matched by name and course to the TSA 2003 and TSA 2004 results. Candidates who sat the TSA in 2003 took their 2nd year (Part 1B) exams in 2006 and candidates who sat the TSA in 2004 took their 1st year (Part 1A) exams in 2006. Thus the Part 1A and the Part 1B results refer to two different cohorts of students (note: for the Economics course, the 1st year exams are known as the 'Part 1s' and the 2nd year exams are known as the 'Part 2As'). Records were included for analysis only where the candidate had both TSA and follow-up exam data: relatively more students on the Economics, Engineering and Natural Sciences courses had not been required to take the TSA (see Table 2).

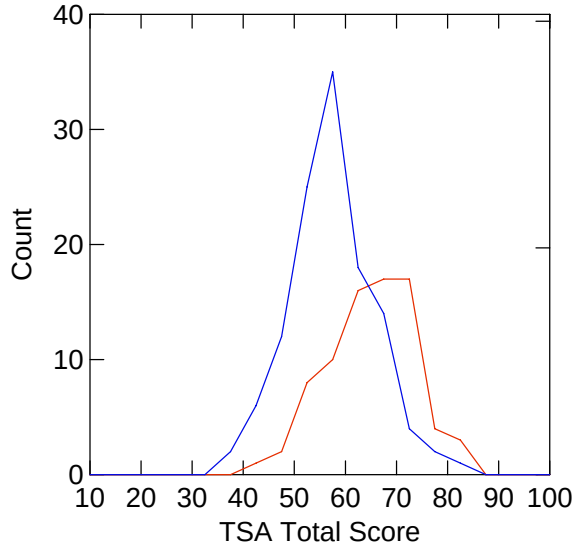
Figure 1: TSA Total Score Distributions for Accepted and Rejected Candidates

a) 2003

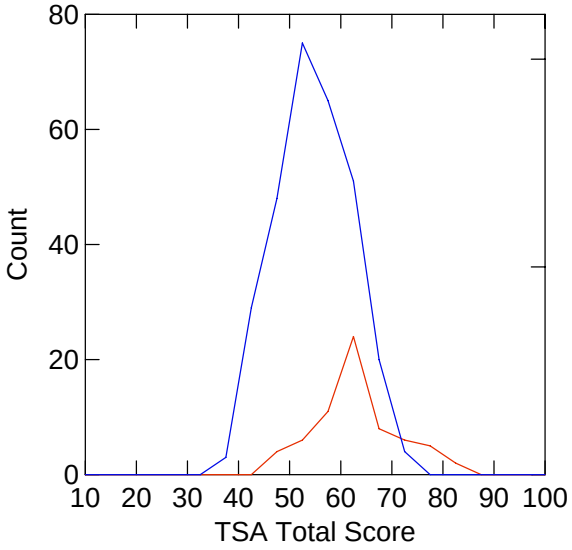


b) 2004

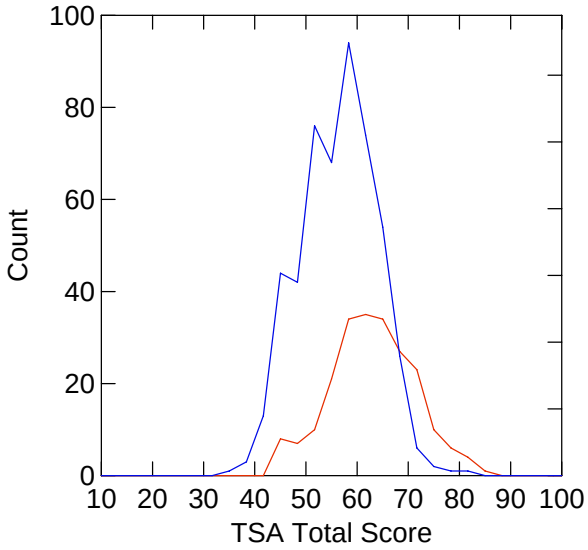
Computer Science Applicants



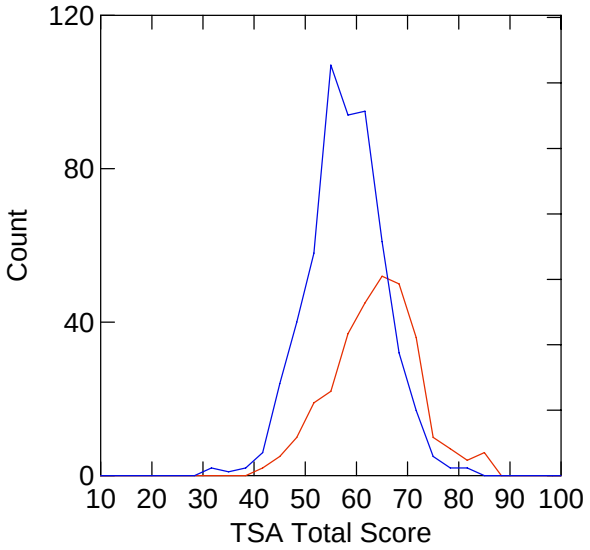
Economics Applicants



Engineering Applicants



Natural Sciences Applicants



Results

Correlations

Correlation is commonly used to evaluate predictive validity but can be problematic when the measures involve restricted ranges of scores (Bell, 2006). The accepted applicants are a highly-selected group and have a narrower range of test scores than that of the cohort as a whole. Range restriction tends to produce poor correlation coefficients: the greater the selection the weaker the coefficient. It is therefore common practice in validity studies to adjust for these effects by using corrective formulae to increase the strength of the coefficients (Sackett and Yang, 2000). However, the selection process here is too complex to make these appropriate. Thus the correlations presented throughout this report are simple, uncorrected figures. These can be interpreted using the guidelines given in Table 3 which reflect the fact that technical factors tend to limit the magnitude of the coefficient.

Table 3: Guidelines for Interpreting Correlation Coefficients in Validity Studies

Validity Coefficient	Interpretation
Above 0.35	very beneficial
0.21 to 0.35	likely to be useful
0.11 to 0.20	depends on circumstances
Below 0.11	unlikely to be useful

(US Department of Labor, Employment Training and Administration, 1999)

The following tables display the Spearman correlation coefficients between TSA scores and performance in the Summer 2006 exams. All hypotheses are one-tailed as only positive relationships with the exam variables were expected. Some 2nd year exam subcomponents in Economics and Natural Sciences were omitted due to small numbers of students taking these options (omitted where n<10). Correlations between the TSA 2003 and the Part 1B (2nd year) exams are presented first, followed by those between the TSA 2004 and the Part 1A (1st year) exams.

Table 4a: Correlations between TSA 2003 Scores and Part 1B Exams – Computer Science

		Problem Solving Score	Critical Thinking score	TSA Total Score
Problem Solving Score	Spearman's rho Sig. (1-tailed) N		.407** <.001 94	.830** <.001 94
Critical Thinking score	Spearman's rho Sig. (1-tailed) N			.831** <.001 94
Overall Part 1B Mark	Spearman's rho Sig. (1-tailed) N	.360** .003 59	.324** .006 59	.435** <.001 59
Paper 3	Spearman's rho Sig. (1-tailed) N	.447** <.001 59	.349** .003 59	.502** <.001 59
Paper 4	Spearman's rho Sig. (1-tailed) N	.308** .009 59	.400** .001 59	.455** <.001 59
Paper 5	Spearman's rho Sig. (1-tailed) N	.204 .061 59	.166 .105 59	.231* .039 59
Paper 6	Spearman's rho Sig. (1-tailed) N	.342** .004 59	.273* .018 59	.387** .001 59

** Correlation is significant at the 0.01 level
* Correlation is significant at the 0.05 level

There is a highly significant positive correlation between the TSA 2003 and 2nd year Computer Science exam performance, for both overall exam mark and most of the exam subcomponents, with higher TSA scores being associated with higher exam scores. Papers 3, 4, 5 and 6 are each composed of a variety of Computer Science subject areas. Correlations are largely in the 'very beneficial' range despite a highly-selected sample. The relationship appears slightly stronger for the Problem Solving component than the Critical Thinking component for all sections other than Paper 4. Total (combined) TSA score shows the strongest relationship with all the Part 1B exam components here. The magnitude of the correlations is similar to those in the previous validity report (Emery, Bell & Shannon, 2006) which correlated the TSA 2003 with 1st year exam performance in this same cohort. Thus the relationship between the TSA 2003 and Computer Science performance remains strong even after an interval of over two and a half years.

Table 4b: Correlations between TSA 2003 Scores and Part 2A Exams - Economics

		Problem Solving Score	Critical Thinking Score	TSA Total Score
Problem Solving Score	Spearman's rho Sig. (1-tailed) N		.361* .011 40	.890** <.001 40
Critical Thinking Score	Spearman's rho Sig. (1-tailed) N			.719** <.001 40
Overall Part 2A Mark	Spearman's rho Sig. (1-tailed) N	.349 .056 22	.323 .071 22	.351 .054 22
Microeconomics	Spearman's rho Sig. (1-tailed) N	.567** .003 22	.185 .204 22	.432* .022 22
Macroeconomics	Spearman's rho Sig. (1-tailed) N	.274 .108 22	.321 .072 22	.288 .097 22
Econometrics	Spearman's rho Sig. (1-tailed) N	.167 .228 22	.217 .166 22	.167 .229 22

** Correlation is significant at the 0.01 level (1-tailed).
* Correlation is significant at the 0.05 level (1-tailed).

For the 2nd year Economics exams, correlations with the TSA appear similar to those for Computer Science but often fail to reach statistical significance because of the smaller numbers here (n=22). However, the relationship between overall Part 2A exam mark and total TSA score is again in the ‘very beneficial’ range. The Microeconomics component appears to be strongly related to the Problem Solving component of the TSA and is significantly correlated with total TSA score. Differences in coefficients between the various exam components may be due to factors such as the range of scores available (ranges are typically higher for the overall mark than the subcomponents and correlate more strongly with the TSA). Again, the coefficients are barely reduced from those relating to the 1st year exams in the same cohort.

Table 4c: Correlations between TSA 2003 Scores and Part 1B Exams - Engineering

		Problem Solving Score	Critical Thinking Score	TSA Total Score
Problem Solving Score	Spearman's rho Sig. (1-tailed) N		.491** <.001 186	.833** <.001 186
Critical Thinking Score	Spearman's rho Sig. (1-tailed) N			.864** <.001 186
Overall Part 1B Mark	Spearman's rho Sig. (1-tailed) N	.145 .080 95	.124 .115 95	.155 .066 95
Mechanics	Spearman's rho Sig. (1-tailed) N	.235* .011 95	.111 .141 95	.166 .054 95
Structures	Spearman's rho Sig. (1-tailed) N	.062 .274 95	.097 .175 95	.102 .163 95
Materials	Spearman's rho Sig. (1-tailed) N	.181* .040 95	.271** .004 95	.304** .001 95
Thermo-fluid Mechanics	Spearman's rho Sig. (1-tailed) N	.252** .007 95	.197* .028 95	.238** .010 95
Electrical Engineering	Spearman's rho Sig. (1-tailed) N	.034 .371 95	.081 .218 95	.075 .234 95
Information Engineering	Spearman's rho Sig. (1-tailed) N	.150 .074 95	.174* .046 95	.161 .060 95
Mathematical Methods	Spearman's rho Sig. (1-tailed) N	-.012 .455 95	-.034 .372 95	-.049 .319 95

** Correlation is significant at the 0.01 level
* Correlation is significant at the 0.05 level

Correlations between the TSA 2003 and overall 2nd year Engineering exam performance are positive but weaker than for the other three courses and this is due to poor correlations with some of the exam components here. This was also the case in the previous report on the Part 1A exams in this cohort. The Materials and the Thermo-fluid Mechanics exam components are well predicted by the TSA, however, showing highly statistically significant relationships with total TSA score.

Table 4d: Correlations between TSA 2003 Scores and Part 1B Exams - Natural Sciences

		Problem Solving Score	Critical Thinking Score	TSA Total Score
Problem Solving Score	Spearman's rho Sig. (1-tailed) N		.455** <.001 152	.855** <.001 152
Critical Thinking Score	Spearman's rho Sig. (1-tailed) N			.835** <.001 152
Overall Part 1B Mark	Spearman's rho Sig. (1-tailed) N	.222* .011 105	.162* .050 105	.229** .010 105
Animal Biology	Spearman's rho Sig. (1-tailed) N	.000 .500 16	.096 .362 16	.037 .446 16
Advanced Physics	Spearman's rho Sig. (1-tailed) N	.287 .056 32	.070 .352 32	.291 .053 32
Biochemistry and Molecular Biology	Spearman's rho Sig. (1-tailed) N	.295 .125 17	.432* .041 17	.457* .033 17
Cellular and Developmental Biology	Spearman's rho Sig. (1-tailed) N	.107 .352 15	.208 .228 15	.120 .335 15
Chemistry A	Spearman's rho Sig. (1-tailed) N	.285 .084 25	.359* .039 25	.342* .047 25
Chemistry B	Spearman's rho Sig. (1-tailed) N	.190 .118 41	.176 .136 41	.184 .125 41
Geological Sciences A	Spearman's rho Sig. (1-tailed) N	.456* .050 14	.430 .062 14	.459* .049 14
Geological Sciences B	Spearman's rho Sig. (1-tailed) N	.012 .487 10	.018 .480 10	.042 .454 10
History and Philosophy of Science	Spearman's rho Sig. (1-tailed) N	.442 .087 11	.417 .101 11	.481 .067 11
Materials Science and Metallurgy	Spearman's rho Sig. (1-tailed) N	.552* .031 12	.474 .060 12	.646* .012 12
Mathematics	Spearman's rho Sig. (1-tailed) N	.248 .090 31	-.157 .199 31	.116 .267 31

		Problem Solving Score	Critical Thinking Score	TSA Total Score
Pathology	Spearman's rho Sig. (1-tailed) N	-.348 .122 13	.417 .078 13	.036 .454 13
Pharmacology	Spearman's rho Sig. (1-tailed) N	.074 .410 12	.375 .115 12	.336 .143 12
Physics	Spearman's rho Sig. (1-tailed) N	.245 .075 36	.086 .309 36	.265 .059 36

** Correlation is significant at the 0.01 level
* Correlation is significant at the 0.05 level

Part 1B exam outcome in the Natural Sciences is significantly related to both the Problem Solving and Critical Thinking TSA components and shows a coefficient with total TSA score in the 'likely to be useful' range. Unlike the other 2nd year exams here, overall performance in Natural Sciences is composed of many optional subcomponents with relatively small numbers of students in each and care should be taken in interpreting and comparing these. The subcomponents also have small score ranges in comparison to the overall Part 1B mark (ranges are between 20 and 50 marks compared with 140 marks for the overall score). Despite this, their correlations with total TSA score are mainly in the 'very beneficial' to 'likely to be useful' range but often fail to reach statistical significance due to the small numbers involved. Again, the coefficients between the TSA and overall exam performance are only slightly reduced from the previous year's exams despite a considerable time interval.

Table 5a: Correlations between TSA 2004 Scores and Part 1A Exams - Computer Science

		Problem Solving Score	Critical Thinking Score	TSA Total Score
Problem Solving Score	Spearman's rho Sig. (1-tailed) N		.421** <.001 77	.852** <.001 77
Critical Thinking Score	Spearman's rho Sig. (1-tailed) N			.812** <.001 77
Overall Part 1A Mark	Spearman's rho Sig. (1-tailed) N	.144 .167 47	.110 .230 47	.137 .179 47
Paper 1	Spearman's rho Sig. (1-tailed) N	.109 .233 47	.224 .065 47	.164 .135 47
Paper 2	Spearman's rho Sig. (1-tailed) N	.187 .104 47	.098 .257 47	.182 .110 47
Mathematics	Spearman's rho Sig. (1-tailed) N	.063 .338 47	-.064 .335 47	-.026 .431 47
Physics	Spearman's rho Sig. (1-tailed) N	.040 .406 39	.101 .270 39	.088 .298 39

** Correlation is significant at the 0.01 level (1-tailed).

Correlations between the TSA 2004 and overall 1st year exam performance in Computer Science are positive but weak in comparison to those for the TSA 2003. The reasons for this are unclear but may have to do with this group of students being the most highly selected (see Figure 1) or may be due to restricted ranges in their exam scores. Papers 1 and 2 are composed of a variety of Computer Science subject areas. The Mathematics and Physics components above are options from the Natural Sciences course and these correlate highly significantly with the TSA 2004 in the case of Natural Sciences students (see Table 5d). The wider ranges of exam scores attained by the latter group suggest that range restriction may be the reason for this.

Table 5b: Correlations between TSA 2004 Scores and Part 1 Exams - Economics

		Problem Solving Score	Critical Thinking Score	TSA Total Score
Problem Solving Score	Spearman's rho Sig. (1-tailed) N		.474** <.001 65	.906** <.001 65
Critical Thinking Score	Spearman's rho Sig. (1-tailed) N			.771** <.001 65
Overall Part 1 Mark	Spearman's rho Sig. (1-tailed) N	.375** .003 54	.430** .001 54	.484** <.001 54
Microeconomics	Spearman's rho Sig. (1-tailed) N	.461** <.001 54	.209 .065 54	.459** <.001 54
Macroeconomics	Spearman's rho Sig. (1-tailed) N	.144 .150 54	.186 .090 54	.221 .054 54
Quantitative Methods in Economics	Spearman's rho Sig. (1-tailed) N	.223 .053 54	.338** .006 54	.312* .011 54
Political and Sociological Aspects of Economics	Spearman's rho Sig. (1-tailed) N	.307* .012 54	.488** <.001 54	.421** .001 54
British Economic History	Spearman's rho Sig. (1-tailed) N	.227* .050 54	.415** .001 54	.374** .003 54

** Correlation is significant at the 0.01 level

* Correlation is significant at the

In the case of Economics, overall performance in the Part 1 exams is very well predicted by the TSA and its subcomponents. Correlation coefficients are in the ‘very beneficial’ range and are highly statistically significant between total TSA scores and most of the Economics exam components. Critical Thinking scores are most strongly related to all of the Economics exam components other than Microeconomics, showing higher coefficients than either the Problem Solving or the total TSA scores.

Table 5c: Correlations between TSA 2004 Scores and Part 1A Exams - Engineering

		Problem Solving Score	Critical Thinking Score	TSA Total Score
Problem Solving Score	Spearman's rho Sig. (1-tailed) N		.478** <.001 221	.828** <.001 221
Critical Thinking Score	Spearman's rho Sig. (1-tailed) N			.873** <.001 221
Overall Part 1A Mark	Spearman's rho Sig. (1-tailed) N	.158* .042 121	.129 .079 121	.160* .040 121
Mechanical Engineering	Spearman's rho Sig. (1-tailed) N	.120 .094 121	.086 .175 121	.112 .110 121
Structures and Materials	Spearman's rho Sig. (1-tailed) N	.201* .014 121	.199* .014 121	.224** .007 121
Electrical and Information Engineering	Spearman's rho Sig. (1-tailed) N	.141 .061 122	.086 .174 122	.130 .076 122
Mathematical Methods	Spearman's rho Sig. (1-tailed) N	.091 .160 122	.119 .096 122	.122 .091 122

** Correlation is significant at the 0.01 level
* Correlation is significant at the 0.05 level

Overall performance in the Part 1A Engineering exams is significantly but weakly correlated with both total TSA 2004 scores and the Problem Solving component. The Structures and Materials component shows the strongest association with the TSA in this cohort. Most of the Engineering exam components show a slightly stronger association with the Problem Solving than with the Critical Thinking aspect of the TSA.

Table 5d: Correlations between TSA 2004 Scores and Part 1A Exams - Natural Sciences

		Problem Solving Score	Critical Thinking Score	TSA Total Score
Problem Solving Score	Spearman's rho Sig. (1-tailed) N		.478** <.001 295	.899** <.001 295
Critical Thinking Score	Spearman's rho Sig. (1-tailed) N			.793** <.001 295
Overall Part 1A Mark	Spearman's rho Sig. (1-tailed) N	.235** <.001 225	.190** .002 225	.235** <.001 225
Biology of Cells	Spearman's rho Sig. (1-tailed) N	.094 .166 109	.215* .012 109	.153 .056 109
Chemistry	Spearman's rho Sig. (1-tailed) N	.325** <.001 174	.099 .097 174	.261** <.001 174
Evolution and Behaviour	Spearman's rho Sig. (1-tailed) N	-.100 .199 74	.185 .057 74	.028 .408 74
Geology	Spearman's rho Sig. (1-tailed) N	.026 .423 59	.253* .027 59	.114 .195 59
Materials and Mineral Sciences	Spearman's rho Sig. (1-tailed) N	.245* .015 79	.138 .113 79	.221* .025 79
Mathematics	Spearman's rho Sig. (1-tailed) N	.300** <.001 150	.091 .135 150	.217** .004 150
Physiology of Organisms	Spearman's rho Sig. (1-tailed) N	-.008 .476 56	.101 .230 56	.038 .390 56
Physics	Spearman's rho Sig. (1-tailed) N	.279** .001 124	.228** .005 124	.279** .001 124
Quantitative Biology	Spearman's rho Sig. (1-tailed) N	.050 .347 64	.209* .049 64	.094 .231 64

** Correlation is significant at the 0.01 level
* Correlation is significant at the 0.05 level

The relationship between the TSA 2004 and performance in the Natural Sciences 1st year exams is very similar to that in the previous report. Overall

exam performance is highly significantly related to total TSA score and both of its components (in the 'likely to be useful' range). Most of the course options here are significantly associated with at least one of the TSA components. The Mathematics and Physics options are well predicted by the TSA in this group of students despite failing to correlate with them in the case of the Computer Science students. Mathematics, Physics and Chemistry are more strongly associated with the Problem Solving than the Critical Thinking component of the TSA. Correlation coefficients again tend be higher where the numbers of students are greater and where the ranges of exam scores achieved are wider.

In all, the correlation coefficients between the TSA 2003 and 2nd year exam performance are very similar to those with their 1st year exam performance in the previous report. It is common in predictive validity research for correlations to become weak after the initial year of study but here they have remained stable over time. Overall performance in the Computer Science and Economics exams is particularly well correlated with the TSA, with coefficients still in the 'very beneficial' range. The relationship between the TSA 2004 and the 1st year exams appears weaker than previously for the Computer Science and the Engineering courses but is stronger for Economics and remains similar for the Natural Sciences. The reason for the weaker relationship with Computer Science in this cohort is unclear but may be due to range restriction. All of the coefficients presented are uncorrected for range restriction and may thus be underestimates of the true predictive validity of the TSA.

Descriptive Statistics

Tables 6a to 6d and 7a to 7d display the mean TSA scores of students grouped on the basis of their subsequent exam classes achieved in 2006. Scores for the TSA 2003 are presented first (grouped by 2nd year exam class) followed by those for 2004 (grouped by 1st year exam class). Students achieving higher exam classes tend to have achieved, on average, higher TSA scores. The pattern of scores is not as clear-cut as in the previous report. There are cases where students achieving a class 2:1 exam outcome have higher mean TSA scores than those achieving a class 1 (Economics Part 2As, Computer Science Part 1As) and cases where those achieving a 3rd had outperformed those achieving a 2:2 (Engineering and Natural Sciences Part 1Bs). It may be the case that candidates who struggle on their course do so for reasons that are not necessarily related to their academic abilities. The overall pattern of decreasing TSA scores with decreasing exam classes, however, supports the principle of selecting applicants with higher entrance test scores if all other things are equal.

Table 6a: TSA 2003 Descriptive Statistics by Part 1B Exam Class Achieved – Computer Science

			Statistic	N
Problem Solving Score	Class 1	Mean	75.29	14
		Std. Deviation	12.39	
	Class 2:1	Mean	73.98	20
		Std. Deviation	11.11	
	Class 2:2	Mean	67.09	22
		Std. Deviation	8.98	
	Class 3	Mean	58.10	2
		Std. Deviation	7.07	
Critical Thinking Score	Class 1	Mean	68.64	14
		Std. Deviation	9.24	
	Class 2:1	Mean	66.22	20
		Std. Deviation	8.39	
	Class 2:2	Mean	62.26	22
		Std. Deviation	8.35	
	Class 3	Mean	53.75	2
		Std. Deviation	.07	
TSA Total Score	Class 1	Mean	70.71	14
		Std. Deviation	8.75	
	Class 2:1	Mean	68.82	20
		Std. Deviation	6.83	
	Class 2:2	Mean	64.00	22
		Std. Deviation	6.77	
	Class 3	Mean	55.80	2
		Std. Deviation	3.39	

Table 6b: TSA 2003 Descriptive Statistics by Part 2A Exam Class Achieved – Economics

			Statistic	N
Problem Solving Score	Class 2:1	Mean	70.56	7
		Std. Deviation	15.97	
	Class 2:2	Mean	63.61	9
		Std. Deviation	8.15	
	Class 3	Mean	56.22	4
		Std. Deviation	10.17	
Critical Thinking Score	Class 1	Mean	63.35	2
		Std. Deviation	5.16	
	Class 2:1	Mean	66.03	7
		Std. Deviation	10.65	
	Class 2:2	Mean	63.87	9
		Std. Deviation	6.59	
	Class 3	Mean	61.70	4
		Std. Deviation	11.91	
TSA Total Score	Class 1	Mean	65.70	2
		Std. Deviation	2.83	
	Class 2:1	Mean	67.30	7
		Std. Deviation	11.76	
	Class 2:2	Mean	63.38	9
		Std. Deviation	5.69	
	Class 3	Mean	58.55	4
		Std. Deviation	10.08	

Problem Solving score is constant (68.5) when Class = 1

Table 6c: TSA 2003 Descriptive Statistics by Part 1B Exam Class Achieved – Engineering

			Statistic	N
Problem Solving Score	Class 1	Mean	69.51	28
		Std. Deviation	10.29	
	Class 2:1	Mean	66.33	43
		Std. Deviation	10.34	
	Class 2:2	Mean	64.89	14
		Std. Deviation	12.07	
	Class 3	Mean	67.71	10
		Std. Deviation	10.55	
Critical Thinking Score	Class 1	Mean	62.22	28
		Std. Deviation	10.41	
	Class 2:1	Mean	63.32	43
		Std. Deviation	12.29	
	Class 2:2	Mean	59.61	14
		Std. Deviation	8.40	
	Class 3	Mean	58.19	10
		Std. Deviation	8.09	
TSA Total Score	Class 1	Mean	65.65	28
		Std. Deviation	8.54	
	Class 2:1	Mean	64.09	43
		Std. Deviation	9.51	
	Class 2:2	Mean	61.58	14
		Std. Deviation	8.06	
	Class 3	Mean	62.02	10
		Std. Deviation	7.24	

Table 6d: TSA 2003 Descriptive Statistics by Part 1B Exam Class Achieved – Natural Sciences

			Statistic	N
Problem Solving Score	Class 1	Mean	72.44	23
		Std. Deviation	11.26	
	Class 2:1	Mean	68.04	48
		Std. Deviation	11.16	
	Class 2:2	Mean	66.19	24
		Std. Deviation	10.98	
	Class 3	Mean	69.87	9
		Std. Deviation	8.74	
Critical Thinking Score	Class 1	Mean	66.90	23
		Std. Deviation	8.49	
	Class 2:1	Mean	65.85	48
		Std. Deviation	8.97	
	Class 2:2	Mean	62.48	24
		Std. Deviation	8.20	
	Class 3	Mean	63.58	9
		Std. Deviation	8.90	
TSA Total Score	Class 1	Mean	68.77	23
		Std. Deviation	7.47	
	Class 2:1	Mean	66.06	48
		Std. Deviation	7.58	
	Class 2:2	Mean	63.68	24
		Std. Deviation	7.64	
	Class 3	Mean	66.27	9
		Std. Deviation	7.92	

Table 7a: TSA 2004 Descriptive Statistics by Part 1A Exam Class Achieved – Computer Science

			Statistic	N
Probem Solving Score	Class 1	Mean	69.36	11
		Std. Deviation	7.41	
	Class 2:1	Mean	71.12	13
		Std. Deviation	7.82	
	Class 2:2	Mean	68.41	18
		Std. Deviation	10.43	
	Class 3	Mean	66.18	5
		Std. Deviation	3.85	
Critical Thinking Score	Class 1	Mean	65.59	11
		Std. Deviation	11.02	
	Class 2:1	Mean	68.59	13
		Std. Deviation	7.20	
	Class 2:2	Mean	64.43	18
		Std. Deviation	8.83	
	Class 3	Mean	63.78	5
		Std. Deviation	12.75	
TSA Total Score	Class 1	Mean	66.75	11
		Std. Deviation	7.09	
	Class 2:1	Mean	69.32	13
		Std. Deviation	5.42	
	Class 2:2	Mean	65.88	18
		Std. Deviation	8.05	
	Class 3	Mean	64.24	5
		Std. Deviation	6.55	

Table 7b: TSA 2004 Descriptive Statistics by Part 1 Exam Class Achieved – Economics

			Statistic	N
Problem Solving Score	Class 1	Mean	65.72	14
		Std. Deviation	7.07	
	Class 2:1	Mean	63.22	30
		Std. Deviation	11.09	
	Class 2:2	Mean	54.90	10
		Std. Deviation	9.18	
Critical Thinking Score	Class 1	Mean	67.03	14
		Std. Deviation	7.15	
	Class 2:1	Mean	64.56	30
		Std. Deviation	7.77	
	Class 2:2	Mean	56.99	10
		Std. Deviation	7.77	
TSA Total Score	Class 1	Mean	65.94	14
		Std. Deviation	5.84	
	Class 2:1	Mean	63.29	30
		Std. Deviation	7.15	
	Class 2:2	Mean	55.81	10
		Std. Deviation	7.68	

Table 7c: TSA 2004 Descriptive Statistics by Part 1A Exam Class Achieved – Engineering

			Statistic	N
Problem Solving Score	Class 1	Mean	66.33	34
		Std. Deviation	10.48	
	Class 2:1	Mean	65.23	40
		Std. Deviation	9.75	
	Class 2:2	Mean	65.14	37
		Std. Deviation	10.00	
	Class 3	Mean	60.30	8
		Std. Deviation	5.17	
Critical Thinking Score	Class 1	Mean	63.58	34
		Std. Deviation	10.05	
	Class 2:1	Mean	60.37	40
		Std. Deviation	9.90	
	Class 2:2	Mean	62.48	37
		Std. Deviation	11.49	
	Class 3	Mean	59.28	8
		Std. Deviation	8.03	
TSA Total Score	Class 1	Mean	64.51	34
		Std. Deviation	8.48	
	Class 2:1	Mean	62.32	40
		Std. Deviation	7.76	
	Class 2:2	Mean	63.46	37
		Std. Deviation	9.28	
	Class 3	Mean	59.56	8
		Std. Deviation	5.23	

Table 7d: TSA 2004 Descriptive Statistics by Part 1A Exam Class Achieved – Natural Sciences

			Statistic	N
Problem Solving Score	Class 1	Mean	67.21	58
		Std. Deviation	10.10	
	Class 2	Mean	64.75	144
		Std. Deviation	11.26	
	Class 3	Mean	60.64	23
		Std. Deviation	8.19	
Critical Thinking Score	Class 1	Mean	63.99	58
		Std. Deviation	8.21	
	Class 2	Mean	63.85	144
		Std. Deviation	8.96	
	Class 3	Mean	56.43	23
		Std. Deviation	12.29	
TSA Total Score	Class 1	Mean	65.18	58
		Std. Deviation	7.19	
	Class 2	Mean	63.87	144
		Std. Deviation	8.38	
	Class 3	Mean	58.55	23
		Std. Deviation	8.68	

Logistic Regression Functions

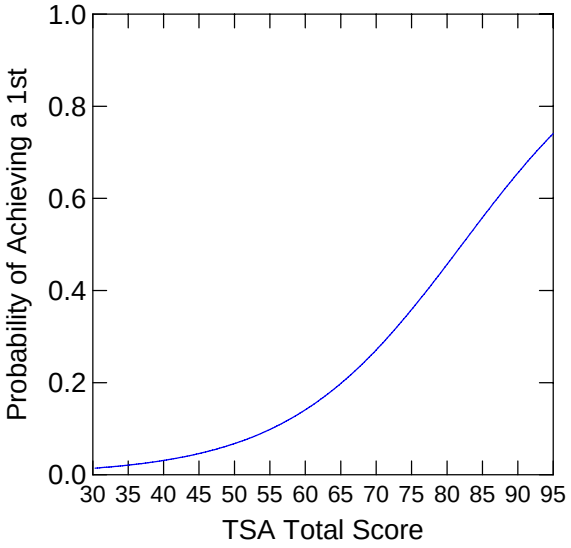
The following plots display the predicted probabilities of achieving a 1st class exam outcome as a function of total TSA scores for each course. Logistic regression models the probability of achieving a discrete outcome, such as a particular class of degree, as a function of the predictor variable(s). Unlike correlation, logistic regression makes no assumptions about the distribution of the independent variables. They do not need to be normally distributed, linearly related or have similar ranges in each group. It may therefore be a more appropriate method in this case.

The magnitude of the slope directly implies the strength of the relationship: steeper curves imply better discrimination and a flat, horizontal slope implies no predictive relationship. The ranges of scores on the x-axes cover those actually achieved on the TSA by the applicants for each course. Logistic regression analyses could not be performed on either the 2nd year Economics exams or the 1st year Computer Science exams due to insufficient numbers.

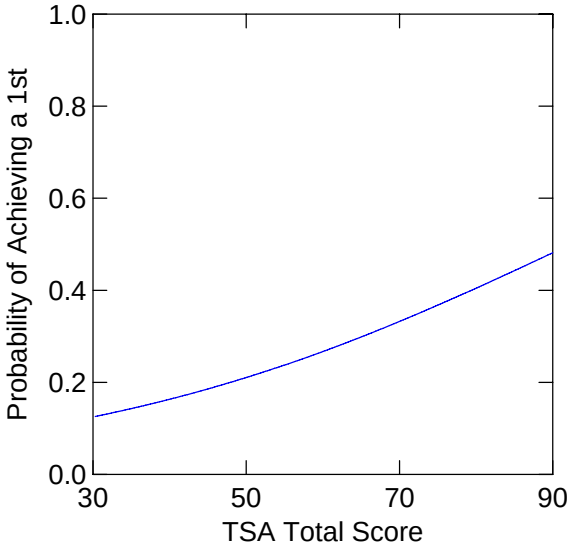
Figure 2: Logistic Regression Plots of the Probability of Achieving a 1st Class Exam Outcome as a Function of Total TSA Score

a) TSA 2003

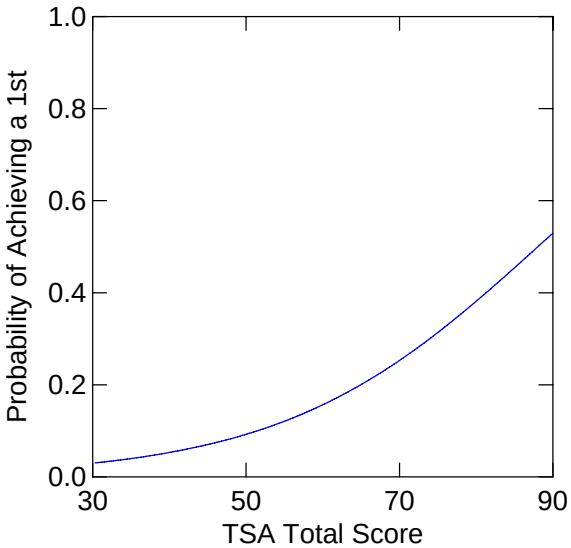
Computer Science Part 1B Exams



Engineering Part 1B Exams

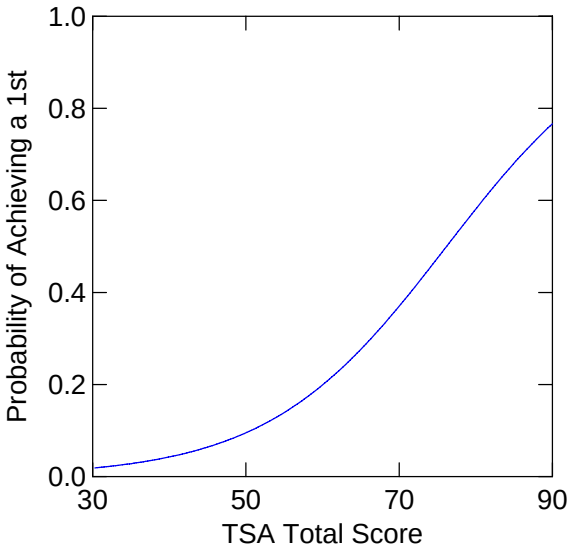


Natural Sciences Part 1B Exams

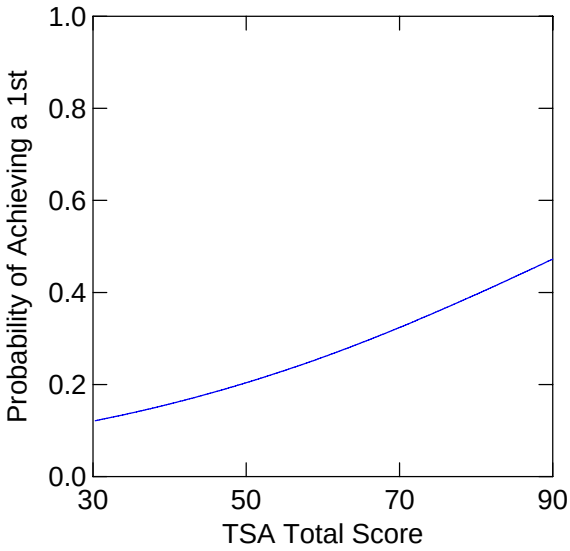


b) TSA 2004

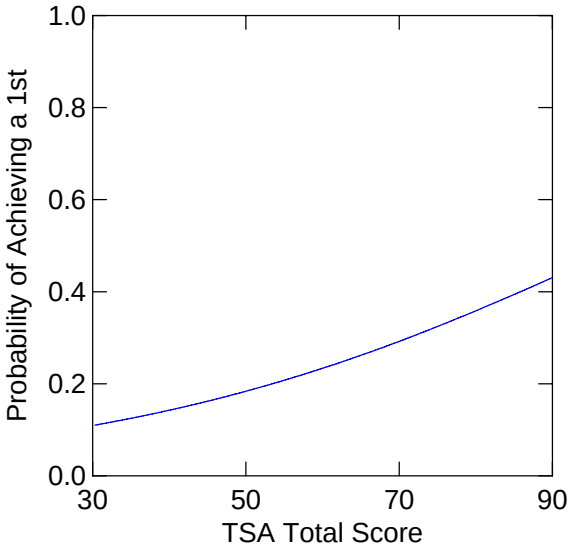
Economics Part 1 Exams



Engineering Part 1A Exams



Natural Sciences Part 1A Exams



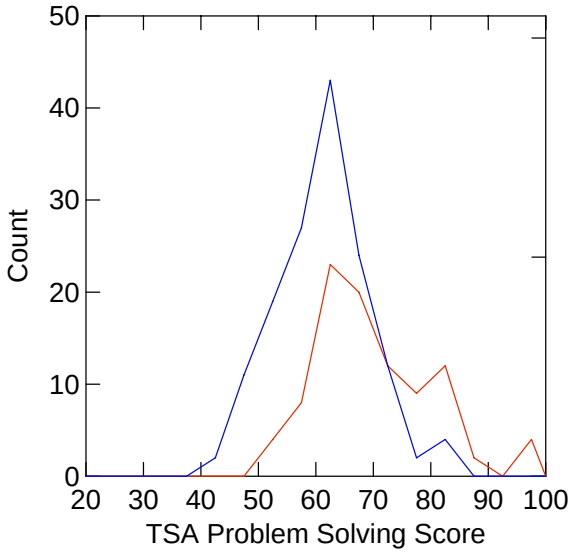
The logistic regression plots demonstrate that total TSA scores for both the 2003 and 2004 sittings clearly predict the probability of achieving a 1st class exam outcome. The relationship is particularly strong for the Computer Science course in 2003 and for the Economics course in 2004, with increases in TSA score making a considerable difference to the probability of success. It is useful to compare these plots with the score distributions in Figure 1. In the first plot, for example, accepted applicants with TSA scores below the mid-50s are much less likely to obtain a 1st class outcome than are those scoring above the mid-70s. This substantial difference in probability effectively demonstrates the utility of the TSA as evidence in the selection process.

Appendix

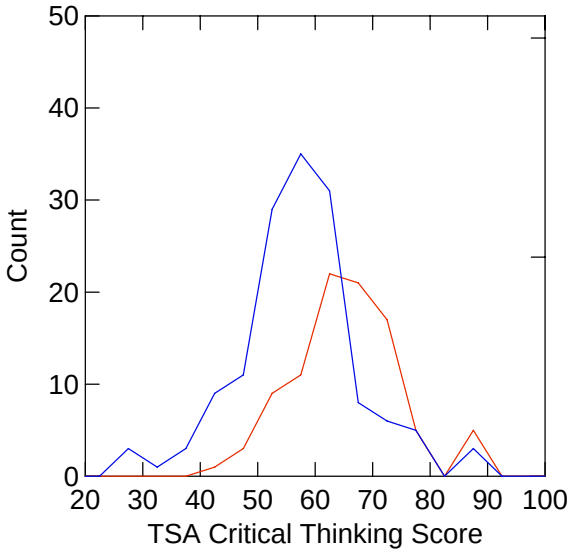
TSA Problem Solving and Critical Thinking Score Distributions for Accepted and Rejected Candidates

a) TSA 2003

Computer Science Applicants



Computer Science Applicants



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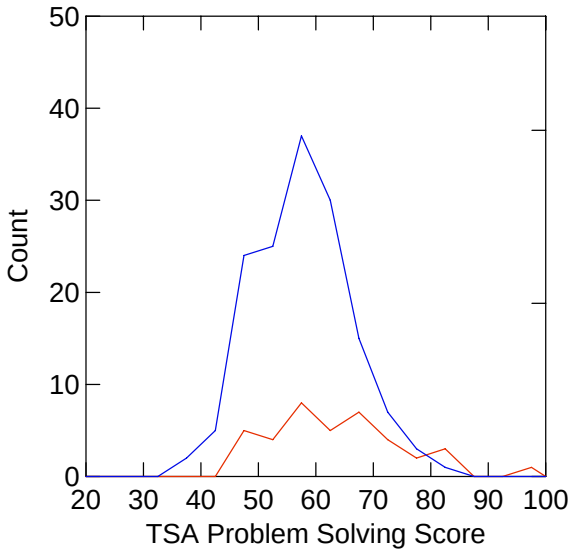

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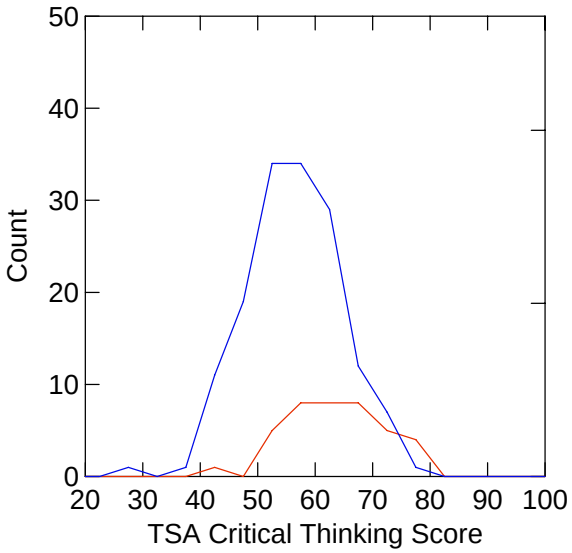
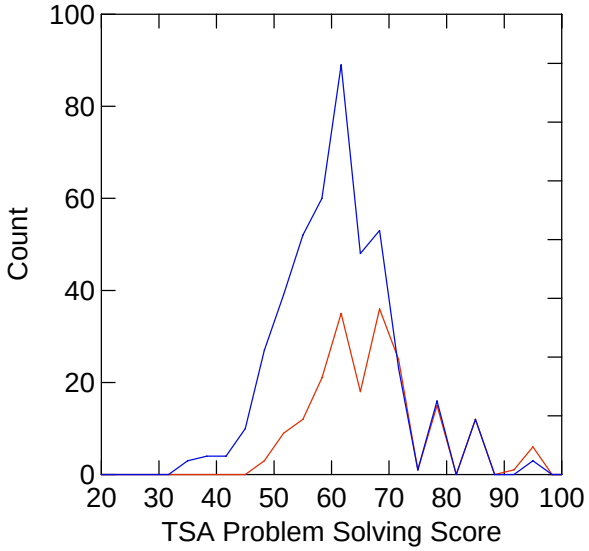
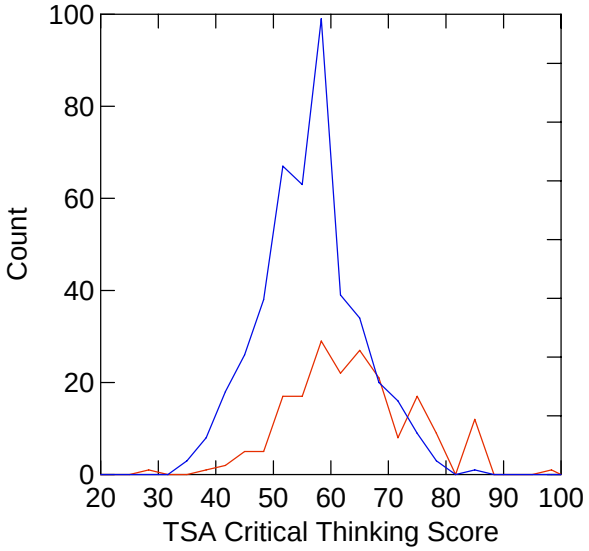


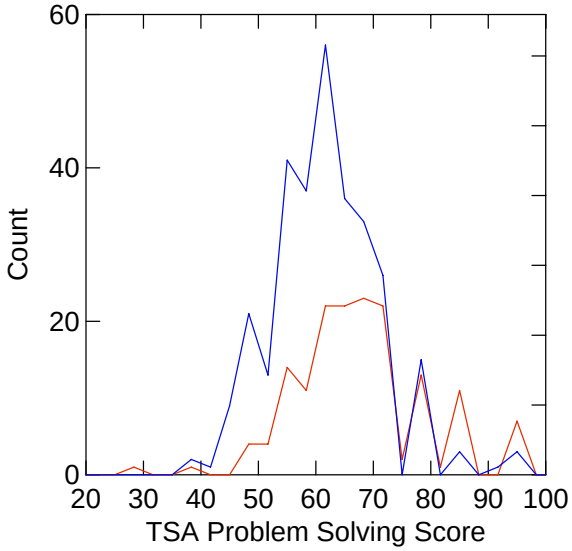
Engineering Applicants



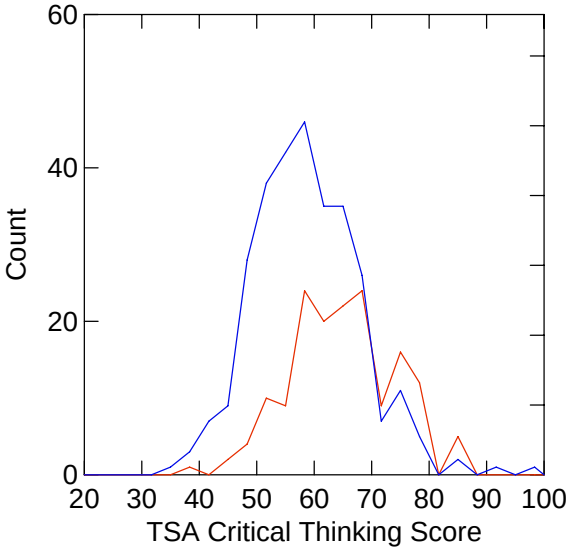
Engineering Applicants



Natural Sciences Applicants

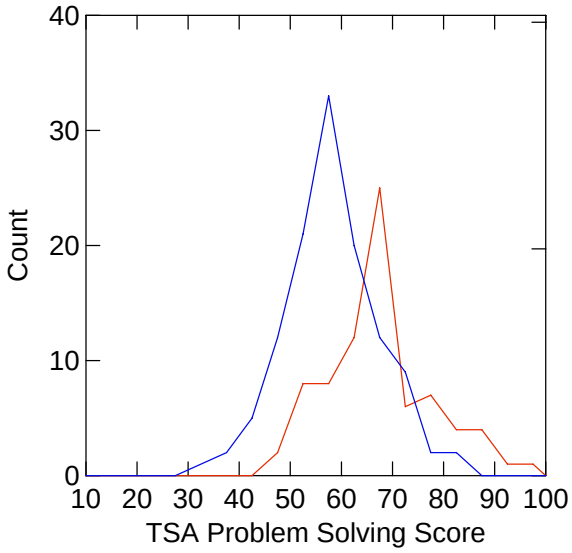


Natural Sciences Applicants

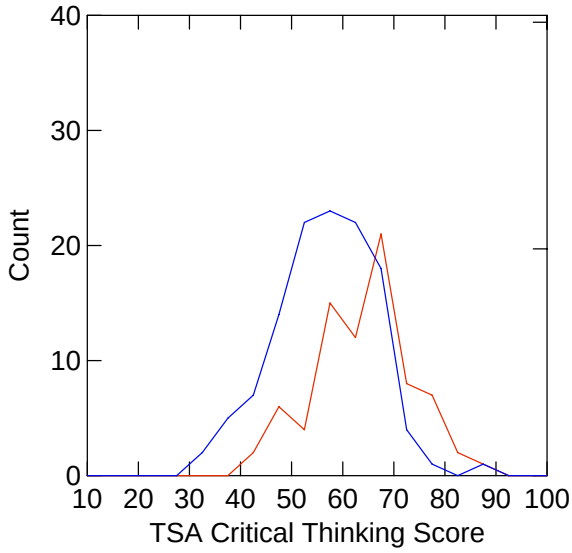


b) TSA 2004

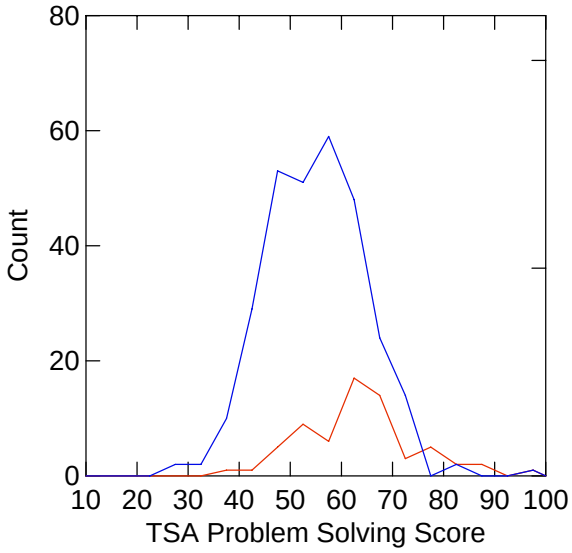
Computer Science Applicants



Computer Science Applicants



Economics Applicants



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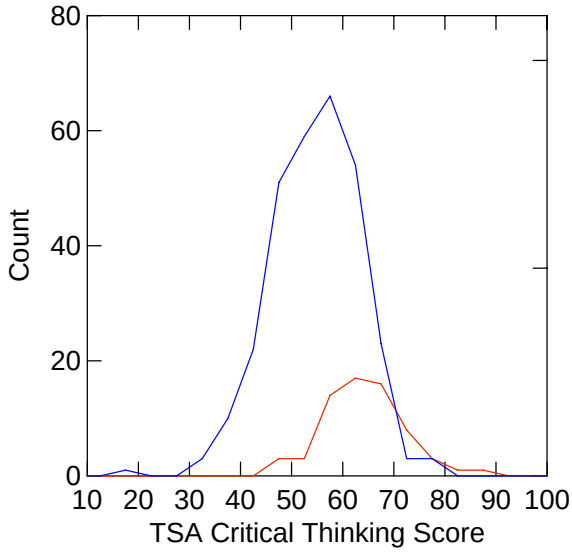
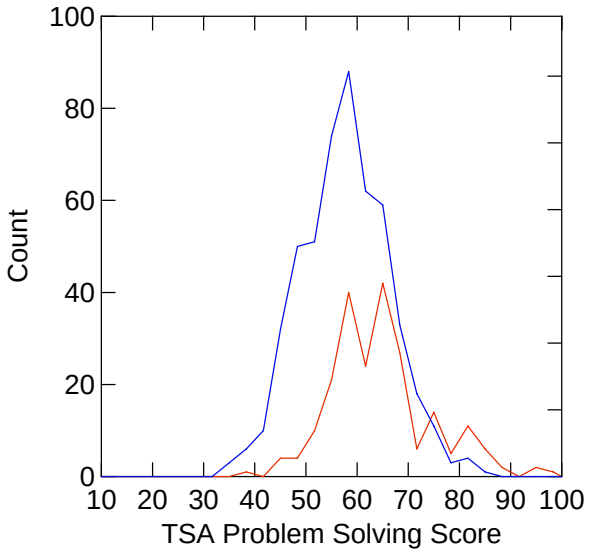
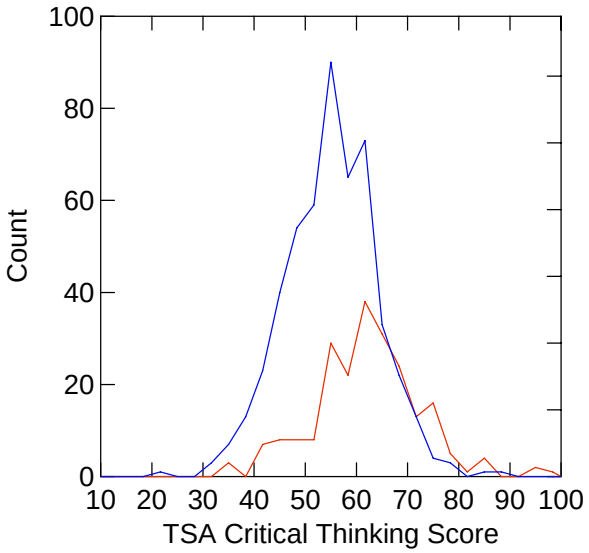


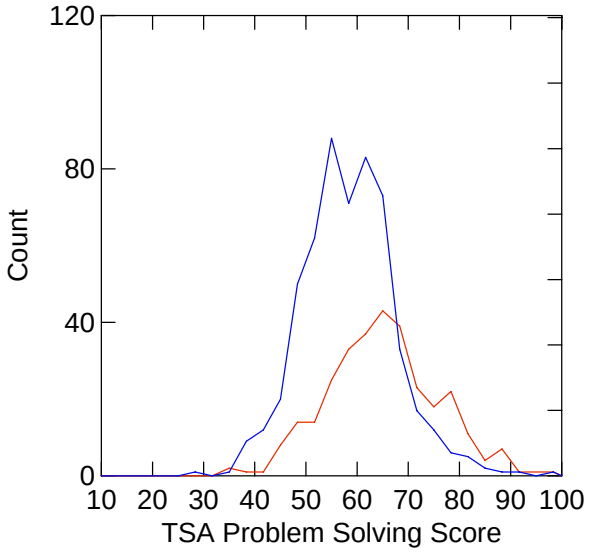
Engineering Applicants



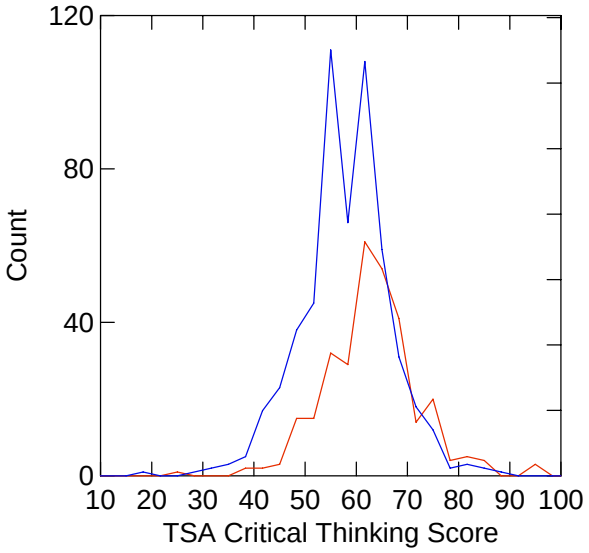
Engineering Applicants



Natural Sciences Applicants



Natural Sciences Applicants



Acknowledgements

Thanks to Mark Shannon and Sue Fiander (Cambridge Assessment) and to Jenny Green (University of Cambridge Student Records).

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