Results of the test: University of Durham

The student body participating in the test

The test was held on October 10th, 2003, in the first week of term. A total number of 392 first year students from the Faculty of Science participated in the test. Mainly they were drawn from three areas Mathematics, Engineering and Natural Sciences. We believe the first two subject areas to be well-understood in terms of the material to be covered. The Natural Sciences degree allows students to mix and match modules from all Sciences which includes Mathematics, Physics, Chemistry, Psychology, Biology, etc. Due to the flexible nature of this degree it was not possible to determine which route students would subsequently follow.

The student body at the University of Durham

The University of Durham was founded in 1832 and is the third oldest in England. The University of Durham is collegiate and is located in the city of Durham and the nearby town of Stockton. As mentioned previously, entrance to English universities is competitive and offers to students are normally made subject to sufficiently good A-levels or Scottish Highers - in fact only 11 out of 392 did *not* take this route. The maximum achievable tariff score for three A-levels is 360 (three grade A's), the average tariff for Mathematics students was in the region of 340, the second highest score. Hence, we can say with confidence that the Mathematics students are a very good group which appear to be homogeneous. Natural Sciences students tariff is even higher, closer to the maximum score, however their A-levels have a wider subject base with fewer taking Further Mathematics A-level. Both Mathematics and Natural Sciences students *must* achieve a grade A at A-level Mathematics, unlike Engineering students who must get a grade B or better. The Engineering students A-level Mathematics grades and tariff score is lower than the other two groups.

Results

It should be noted that the questions were paired

Questions	1& 8	2 & 9	3 & 10	4 & 11	5 & 12	6 & 13	7 & 14
Topic	logic	logs & exps	trig	equations & inequalities	geometry	differentiation	integration

With the exception of Question 4, the most popular answer was always the correct

answer. We make a brief list of significant points which appear from the data, we have not tested the statistical significance of these points.

1. With the exception of Question 1, students did not appear to like selecting that "none of the answers are correct". This exception to the rule may be reflected in the fact that students obtained the joint best score in the other logic question, Question 8. Further, in each case where the correct answer was E, students did significantly worse as compared with the other question in the pair.

2. The most popular incorrect answers worth commenting on which reveal something about the way students think were:

   (i) 3B: $2\sin x = \sin(2x) = 2\sin x \cos x$, when dividing by $\sin x$ they failed realise that this could be zero.

   (ii) 4B: Assumed the denominator was positive; D: only took the positive root when solving $x^2 - 1 > 0$.

   (iii) 7C: Thought that the following was the answer to the indefinite integral: $\int^x \sin t \, dt = \cos x$.

   (iv) 10B: Thought that $\sin(\pi/2) = 0$.

3. The only questions where more than 30 student failed to give any answer were Questions 7, 13 and 14. This may reflect that some students were pressed for time or that they were uncomfortable with integration techniques.

In general students did best where basic numeracy was tested, i.e. Questions 9 & 11. Taking the point 1 above into account, they appear to be weakest at basic trigonometry, differentiation and integration which is what experience has told us in the past.

As for a comparison between the sexes there is little to comment upon. However, comparing disciplines it appears that typically Mathematics students do better on questions where the question is perceived to be more difficult, the obvious exception to the rule is Question 3. The higher scores on the test reflect the background of the students and appears to be consistent with the A-level grades and volume of Mathematics studied at school.

Data

Below are histograms for each question. The x-axis reading from left to right show the bins for the answers **N** (for no answer), **A**, **B**, **C**, **D** and **E** respectively for Question 1 through to Question 14 reading from left to right, then top to bottom.
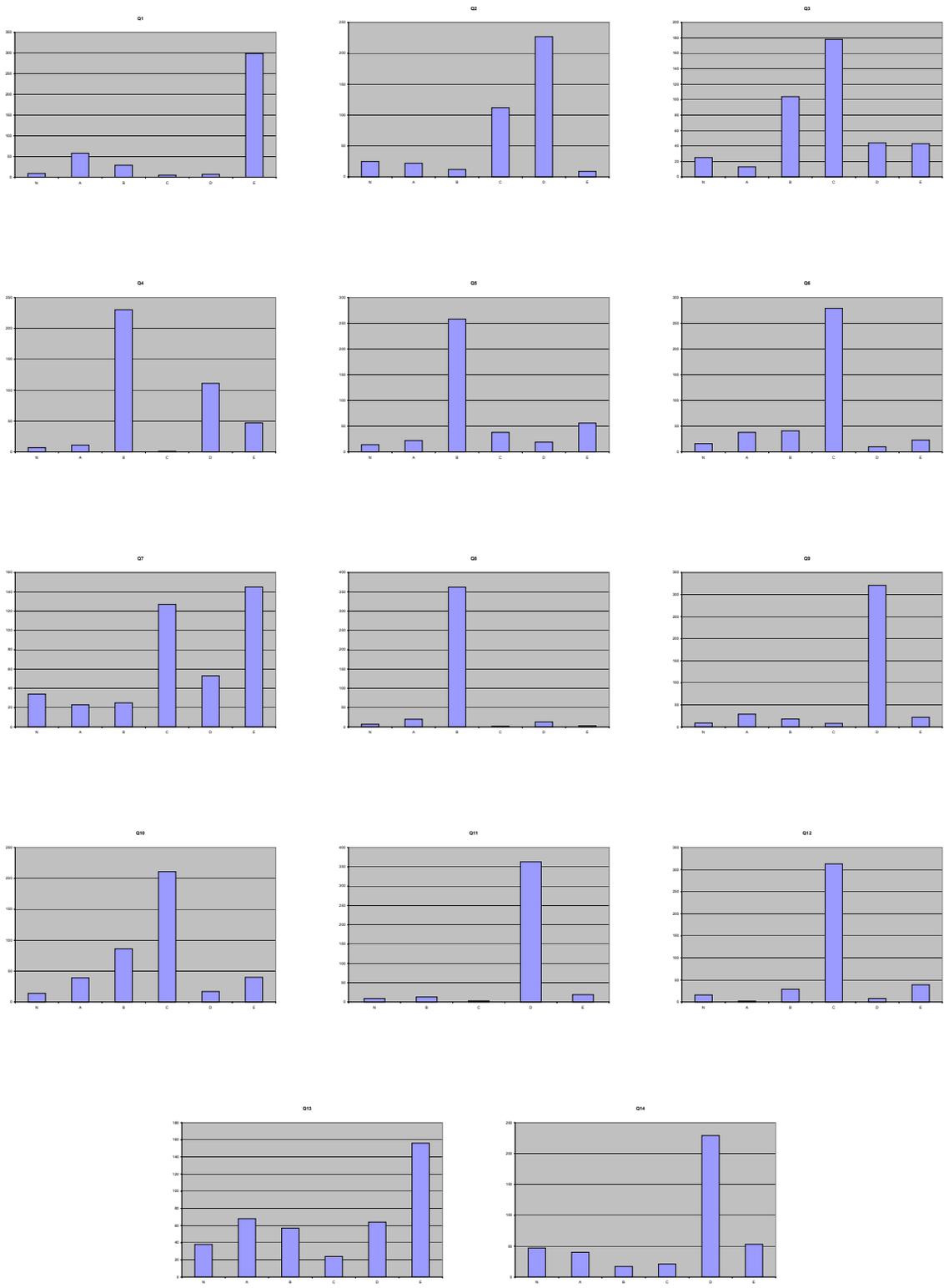
The percentages are shown in the table below:

Questionnaire results for the *Socrates* programme - University of Durham

Course	N°	Percentage	Percentage correct per question for each course/sex													
			Qu 1	Qu 2	Qu 3	Qu 4	Qu 5	Qu 6	Qu 7	Qu 8	Qu 9	Qu 10	Qu 11	Qu 12	Qu 13	Qu 14
Natural Sciences	119	61.3%	79.8%	63.0%	48.7%	10.1%	64.7%	72.3%	29.4%	89.9%	81.5%	52.1%	91.6%	79.0%	37.0%	59.7%
Male:	81	62.8%	82.7%	61.7%	48.1%	8.6%	64.2%	75.3%	30.9%	95.1%	86.4%	53.1%	93.8%	82.7%	33.3%	63.0%
Female:	38	58.3%	73.7%	65.8%	50.0%	13.2%	65.8%	65.8%	26.3%	78.9%	71.1%	50.0%	86.8%	71.1%	44.7%	52.6%
Mathematics	105	67.0%	79.0%	64.8%	39.0%	21.9%	76.2%	77.1%	56.2%	94.3%	82.9%	54.3%	92.4%	78.1%	52.4%	69.5%
Male:	64	69.9%	79.7%	70.3%	37.5%	28.1%	78.1%	78.1%	60.9%	96.9%	90.6%	59.4%	92.2%	78.1%	56.3%	71.9%
Female:	41	62.5%	78.0%	56.1%	41.5%	12.2%	73.2%	75.6%	48.8%	90.2%	70.7%	46.3%	92.7%	78.0%	46.3%	65.9%
Engineering	148	56.3%	67.6%	48.0%	46.6%	7.4%	58.1%	60.1%	31.8%	88.5%	79.7%	53.4%	87.8%	78.4%	31.1%	49.3%
Male:	129	56.3%	65.9%	47.3%	48.8%	7.8%	56.6%	59.7%	31.8%	89.1%	82.2%	55.0%	87.6%	79.1%	29.5%	48.1%
Female:	19	56.0%	78.9%	52.6%	31.6%	5.3%	68.4%	63.2%	31.6%	84.2%	63.2%	42.1%	89.5%	73.7%	42.1%	57.9%
Other	20	54.6%	75.0%	45.0%	40.0%	5.0%	55.0%	80.0%	10.0%	90.0%	60.0%	55.0%	95.0%	80.0%	40.0%	35.0%
Male:	11	59.7%	81.8%	54.5%	45.5%	9.1%	45.5%	81.8%	18.2%	100.0%	72.7%	54.5%	100.0%	81.8%	45.5%	45.5%
Female:	9	48.4%	66.7%	33.3%	33.3%	0.0%	66.7%	77.8%	0.0%	77.8%	44.4%	55.6%	88.9%	77.8%	33.3%	22.2%
Percentage per column		60.6%	74.74%	56.89%	44.90%	11.99%	64.80%	69.39%	36.48%	90.56%	80.10%	53.32%	90.56%	78.57%	39.03%	57.14%
Student Total	**392**															

Percentage of correct answers over all students   **61%**   0.606

Total of correct answers over all students   3326

In the table above the results of the test are listed by discipline, by gender and by question.

Finally, in the figure below we show three histograms dependent on discipline (Natural Science, Mathematics and Engineers respectively). The vertical scale represents volume, while the horizontal scale represents the mark on the quiz per student (bins go from 0 to 14).

Natural Scientists

Mathematics

Engineers