# Examiners' Report/
# Principal Examiner Feedback

# Summer 2010

# Decision Mathematics D1 (6689)

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# Decision Mathematics Unit D1
# Specification 6689

## Introduction

This paper proved accessible to the candidates. The questions differentiated well, with each giving rise to a good spread of marks. All questions contained marks available to the E grade candidate and there seemed to be sufficient material to challenge the A grade candidates also.

Candidates are reminded that they should not use methods of presentation that depend on colour, but are advised to complete diagrams in (dark) pencil. This remains a particular problem in the questions on sorts and on matchings (Q1 and Q5 on this paper).

Candidates are also reminded that this is a 'methods' paper. They need to make their method clear; 'spotting' the correct answer, with no working, rarely gains credit.

Some candidates are using methods of presentation that are too time-consuming. The space provided in the answer booklet and the marks allotted to each section should assist candidates in determining the amount of working they need to show.

Some very poorly presented work was seen and sometimes the writing was very difficult to decipher.

## Report on individual questions

### Question 1

This proved a good starter and was well answered by many candidates with around 55% getting full marks. The quick sort was well handled although some candidates did not choose their pivots consistently. A few candidates did not select a pivot when they had a two element sublist in the correct order – often HJ, and a minority sorted the list into reverse alphabetical order. It was alarming that some candidates only selected one pivot per iteration, so, in effect, just dealing with one sublist at a time. Candidates must show that they are selecting one pivot, per sublist, per iteration; that is what makes this algorithm so powerful. A number of candidates did not have the final list in alphabetical order.

Many candidates in part (b) lost marks for failing to reject the pivot and number of candidates attempted to use the original, unsorted list. Some, who tried for a more 'minimalist' solution, did not make their pivot choice clear, or the order in which they chose pivots.

## Question 2

Around 45% of the candidates gained full marks on this question. Candidates were directed to list the **arcs** in the order in which they included them in the tree, but many candidates did not do so.

In part (a) a number of candidates only stated the arcs they were including in their tree and did not state the arcs that they rejected, as they rejected them. Some candidates only referred to the length of the arc rather than by its end vertices, this makes it difficult for the examiners to determine which arc is being considered.

Part (b) was usually completed correctly.

In part (c) many candidates showed their working on the table but then did not list the arcs in the correct order, often adding BD too late.

Many candidates completed part (d) correctly.


## Question 3

This was a good source of marks for well-prepared candidates with over 75% gaining at least 7 marks, though the final part challenged all but the most able.

Part (a) was almost always completed correctly.

Part (b) was often well done, although some used first fit decreasing and 29 was sometimes either omitted from the list or changed to 39.

Most candidates were able to complete part (c) correctly but a few only listed one full bin.

In part (d) many incorrectly stated that the full bin solution was optimal, others made some vague reference to the statues being too heavy, relatively few attempted a valid numerically based answer and managed to express it clearly.


## Question 4

Around 70% of the candidates gained at least 7 marks.

In part (a) most candidates were able to state three pairings of the four correct odd vertices, and did so with pleasing few arithmetical errors, far fewer candidates realised that the path BC comprised of arcs BA and AC.

In part (b) most candidates calculated the length of the route correctly but many did not list a route.

Many candidates were able to gain at least one mark in (c) but only the more able secured both marks. Candidates needed to refer to BE specifically and present a numerical argument.

## Question 5

This was a good source of marks for well-prepared candidates with around 80% able to secure at least half marks and around 46% gaining full marks. Most were able to find a path from G to 6 or 1, though some then omitted the change status step and/or did not list the improved matching. Candidates should beware of trying to show too much on the printed diagrams, some try to show their flow augmenting route and the improved solution on the same diagram, often using colour, or highlighter, which may not be used in this paper.

Part (b) was generally well-answered, but candidates should note that for two marks the examiners are looking for a clear, complete answer, some imprecise or muddled answers were seen.

For those that completed part (a) correctly part (c) was often well done, although candidates should remember that an alternating path must go from an unmatched vertex on one side to an unmatched vertex on the other.

## Question 6

Most candidates were able to gain some marks in part (a) but many made errors and only the most able gained full marks. As always, candidates are reminded that it is the **order** of the working values that is key for examiners to determine if the algorithm has been applied correctly. Many candidates made errors at C, either labelling it fourth due to its position or omitting at least one of the four working values. Most candidates were able to determine the correct route.

A full demonstration of the appropriate calculations in part (b) tended to earn both marks, whereas more generalised explanations tended to omit some key point.

Part (c) was usually answered correctly though EFT was also seen.

## Question 7

This question gave rise to a good spread of marks. Most candidates completed part (a) correctly although some very lengthy responses were seen. $5x + 4y = 80$ was drawn correctly more often than $3x = 2y$ in part (b), with many candidates drawing the latter with a negative gradient. Pleasingly most candidates used a ruler to draw their lines, a great improvement on previous years. The feasible region was often incorrectly identified and labels were often absent.

Most were able to complete part (c) correctly.

Those who used the objective line method in (d) usually gained more marks than those who used the point testing method. Some of those using the latter method seemed confused by the y-axis scale and only considered vertices with even values of y, many tested points by reading from the graph rather than solving simultaneous equations.

A large number of solutions had $y = 6$ despite answering part (a) correctly. Some found the maximum solution. Many did not make their method clear.

Question 8

This question also gave rise to a good spread of marks. The dummies in part (a) caused problems for many, often values 2 and 6 instead of 3 and 3 were seen at the end of the dummy from C and 19 instead of 16 was often seen in the bottom box at the end of the dummy from G. Most were able to correctly identify the critical activities although B often replaced C.

Those candidates who had completed parts (a) and (b) correctly were usually able to complete part (c) correctly. The most common mistakes were having no float on B and having more float than necessary on activities F and G.

Part (d) was rarely completed correctly. In a number of cases candidates stated either a relevant time or the relevant activities but rarely both.

# Grade Boundary Statistics

The table below gives the lowest raw marks for the award of the stated uniform marks (UMS).

| Module | | Grade | A* | A | B | C | D | E |
|---|---|---|---|---|---|---|---|---|
| | | Uniform marks | 90 | 80 | 70 | 60 | 50 | 40 |
| AS | 6663 Core Mathematics C1 | | | 59 | 52 | 45 | 38 | 31 |
| AS | 6664 Core Mathematics C2 | | | 62 | 54 | 46 | 38 | 30 |
| AS | 6667 Further Pure Mathematics FP1 | | | 62 | 55 | 48 | 41 | 34 |
| AS | 6677 Mechanics M1 | | | 61 | 53 | 45 | 37 | 29 |
| AS | 6683 Statistics S1 | | | 55 | 48 | 41 | 35 | 29 |
| AS | 6689 Decision Maths D1 | | | 61 | 55 | 49 | 43 | 38 |
| A2 | 6665 Core Mathematics C3 | | 68 | 62 | 55 | 48 | 41 | 34 |
| A2 | 6666 Core Mathematics C4 | | 67 | 60 | 52 | 44 | 37 | 30 |
| A2 | 6668 Further Pure Mathematics FP2 | | 67 | 60 | 53 | 46 | 39 | 33 |
| A2 | 6669 Further Pure Mathematics FP3 | | 68 | 62 | 55 | 48 | 41 | 34 |
| A2 | 6678 Mechanics M2 | | 68 | 61 | 54 | 47 | 40 | 34 |
| A2 | 6679 Mechanics M3 | | 69 | 63 | 56 | 50 | 44 | 38 |
| A2 | 6680 Mechanics M4 | | 67 | 60 | 52 | 44 | 36 | 29 |
| A2 | 6681 Mechanics M5 | | 60 | 52 | 44 | 37 | 30 | 23 |
| A2 | 6684 Statistics S2 | | 68 | 62 | 54 | 46 | 38 | 31 |
| A2 | 6691 Statistics S3 | | 68 | 62 | 53 | 44 | 36 | 28 |
| A2 | 6686 Statistics S4 | | 68 | 62 | 54 | 46 | 38 | 30 |
| A2 | 6690 Decision Maths D2 | | 68 | 61 | 52 | 44 | 36 | 28 |

# Grade A*

Grade A* is awarded at A level, but not AS to candidates cashing in from this Summer.

- For candidates cashing in for GCE Mathematics (9371), grade A* will be awarded to candidates who obtain an A grade overall (480 UMS or more) *and* 180 UMS or more on the total of their C3 (6665) and C4 (6666) units.

- For candidates cashing in for GCE Further Mathematics (9372), grade A* will be awarded to candidates who obtain an A grade overall (480 UMS or more) *and* 270 UMS or more on the total of their best three A2 units.

- For candidates cashing in for GCE Pure Mathematics (9373), grade A* will be awarded to candidates who obtain an A grade overall (480 UMS or more) *and* 270 UMS or more on the total of their A2 units.

- For candidates cashing in for GCE Further Mathematics (Additional) (9374), grade A* will be awarded to candidates who obtain an A grade overall (480 UMS or more) *and* 270 UMS or more on the total of their best three A2 units.

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