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Examiners' Report / Principal Examiner Feedback

Summer 2010

GCE

Decision Mathematics D2 (6690)

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Introduction

The paper proved accessible to most candidates, who demonstrated good knowledge and understanding, and most had sufficient time to complete the paper, although some blank responses were seen to Q7.

The general quality of presentation was good but there were many arithmetic errors, especially in Q1, Q3 and Q6. Poorly written numbers caused problems for a number of candidates, misreading their own writing especially in Q3. Candidates continue to use clear and efficient styles of presentation and good use of the tables given in the answer book.

The questions were arranged in order of perceived difficulty and this proved a correct ordering. There seemed sufficient material for the weaker candidates to make progress and also sufficient material for the more able.

Candidates are reminded that they should not use methods of presentation that depend on colour, this proved a particular problem in Q3 on this paper. Candidates are advised to complete diagrams in (dark) pencil.

Report on individual questions

Question 1

This proved a good first question with over a third of the candidates scoring full marks and over 50% getting at least 10 marks.

In part (a) many candidates did not list the arcs or draw the tree, BD was often included. Almost all were able to correctly find an initial upper bound based on their tree.

In (c) most candidates were able to find the two nearest neighbour routes but a surprisingly large number did not return to A, others found the NN route from A to B and A to D and then, alarmingly, doubled it.

Those who completed (c) correctly usually completed (d) correctly.

Many completed part (e) correctly but BD was, once again, often included in the residual minimum spanning tree.

Question 2

This gave rise to a good spread of marks. Most candidates correctly subtracted the values from some value, n, greater than 27, although a significant minority failed to do so and minimised instead of maximising. Some failed to reduce rows and columns, or just reduced rows, or did so before subtracting the elements from n. A large number of candidates failed to deal with J4, just leaving it blank, or putting in a dash. Most then went on to apply the algorithm correctly though some arithmetical errors were seen.

Question 3

This also proved an excellent discriminator and a challenging question for some. Part (a) was correctly completed by most candidates, although some included extra zeros. Many candidates got the first set of shadow costs and improvement indices correct although some stated 8 'improvement indices'. Many were then able to find the correct stepping stone route, although some tried to include two empty cells in their route.

It cannot be stressed enough that in this algorithm candidates must differentiate between a cell containing the number zero and an empty cell. In the first application of the stepping stone route either XA or YC must be empty and the other one must contain the number zero.

Many solutions were muddled and poorly structured and although there were many blank tables printed in the answer book many candidates persist in trying to fit a solution, improvement indices and a stepping stone route all into one table making it very difficult for examiners to decipher. Some candidates did not recalculate their shadow costs and 4 improvement indices each time.

Question 4

This question was a good source of marks for many. The vast majority completed the table correctly, but a significant number answered this as a minimum route problem, others as a maximum route problem and a few as a maximin problem. A very few worked forwards or reversed the states. Most candidates selected a correct route, and value, for the problem they solved.

Part (c) proved a challenge for many, with a wide range of incorrect methods seen.

Question 5

Again this question was a good source of marks for many candidates. Most found the flow of 41, but the correct cut capacities of 69 and 64, were not seen often.

A few omitted one of the pairs of labels in (c). Most were able to find one correct flow augmenting route and many of these went on to find a second route, but many incorrect routes were seen.

Specific reference to the Max flow-min cut theorem was required in part (e) as well as finding a minimum cut.

Question 6

This generated a good spread of marks and differentiated well. The majority of candidates correctly stated the objective function, although some had the signs reversed. Most were able to select the first pivot correctly and went on to produce a good first tableau, with the occasional arithmetic error. The choice of the second pivot caused problems, with many candidates choosing -1/4. A negative number may never be selected as a pivot. Many candidates realised they had made an error as negative numbers started to appear for the basic variables and stopped, but others gave negative values for their final answer. Candidates should be reminded that they should state the values of all 7 variables at the end; many only gave the four non-zero values.

Question 7

Candidates commonly either obtained very few marks for this question, or virtually full marks. Some did not attempt the question. Some attempted to solve the problem instead of formulating it as a linear programming problem. Many failed to add 5 to the elements and/or define their probabilities and/or state that they were maximising P = v. Many attempts involved 9 variables. Many used the rows of the table rather than the columns and some used slack variables and equalities rather than the inequalities requested. Some omitted the non-negativity constraints. Despite this a good number, nearly 20% were able to get full marks on this question.

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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