AQA

A-LEVEL
MATHEMATICS

MD02 Decision 2
Report on the Examination

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General

Students were very well prepared for this paper with many producing work of a very high standard.

The overall presentation was good with answers being very clear and precise.

Question 1

Part (a) was well answered, with the common mistake being the student misunderstanding positive to mean the same as non-negative.

Part (b) was again, completed well on the whole. Some slips were caused by the r column containing an entry of 1, with some students into believing that r then had a non-zero value.

Question 2

Most students were able to identify the row minima and column maxima, and then proceed on to determining the play-safe strategy/strategies for each player. However only a small proportion of students gave a complete argument as to why the game did not have a stable solution, ie referring to the maximin and minimax correctly, as opposed to students who randomly stated that two numbers were not equal. Some slips on this question included only writing down one play-safe strategy for Erica and the major error of determining the row maximums and column minimums.

Question 3

Most students were able to score a good number of marks on this question, performing the reductions and augmentations correctly and then interpreting the final array. Slips included not using the algebraic approach that was necessary, instead substituting in a value for x or writing this entry in the array as an inequality. Many students did not conclude the final augmentation with a statement stating why no further augmentations were necessary.

Question 4

In part (a) the vast majority of students were able to produce an activity network with the correct connections. The most common slip was to have J-K-L connected in a single line at the end, but these students still scored 1out of 2.

In part (b), the modal score on this part was 4 out of 5, owing to most students performing the forward pass correctly, performing the backward pass correctly at G, H and I and then obtaining the two critical paths, but only the most able students were able to identify that the latest finish time of activity C was the minimum of 12 and $14 - x$.

In part (c), few students arrived at $32 + x$ for the minimum completion time for the project, owing to being unable to work with the algebra in the network. Similarly, only the strongest students were able to get a float of 2 as the answer, with a lot of students getting an answer of 0 due to poor algebra.

In part (d), the students who used individual lines for each activity fared better than those who did not. The students who used rectangles often put a non-critical activity on a row which had critical activities, or two non-critical activities on the same row. Students who scored 2 out of 3 did so as their float for activity C was wrong owing to an earlier error in part (b).

Question 5

Most students gave a good, clear method for this question, with a large number scoring at least 5 marks. Common mistakes were often a simple numerical slip on a row, which often lost an accuracy mark with the potential to lose one of the final B marks. Weaker students failed to appreciate that the pivot row is selected by determining the smallest **positive** ratio, with some students selecting the most negative ratio and subsequently diverging from the method and answer. The traditional fractional version of the simplex method was more common than the integer method.

Question 6

Most students spotted the dominance in the table; those that did not tended to score very few marks. Students answered the question well. A common mistake was the failure to appreciate the nature of a zero-sum game, not changing the sign on the value of the game for player 1 in order to obtain the value of the game for player 2. They instead proceeded to determine the optimal mixed strategy for player 2, which nearly always lead to an error and an incorrect answer.

Question 7

This question was performed well. The most common mistake was the incorrect addition of '$20 + 22 = 44$' early on in the solution. Solutions that made this mistake could still achieve the correct routes and so tended to score 7 out of 10. Common slips included missing 'S' at the beginning of the routes, or numerical slips which then carried forward. Virtually no students performed a minimax, maximin or minimum procedure which is a significant improvement on previous years.

Question 8

Part (a) was well answered. Common slips included adding the lower capacities instead of the upper capacities.

In part (b), most students did not supply enough information to score the first mark. As this was an explanation question, very few students provided the explicit detail that was necessary.

In part (c), most students were able to show correctly the flow into and out of the two nodes for the first B1 mark, but very few students were able to determine the correct flows on the remaining arcs.

Question 9

Part (a) was correctly answered by virtually all students. A common mistake was not labelling the two nodes correctly.

In part (b), the majority of students adopted the convention of using two arrows on each edges and this was performed well. Some students did not include two arrows on the newly introduced arcs from the supersource and to the supersink, and some students did not correctly determine the potential decreases for each arc.

Part (c) was well answered by many students. Most were able to identify two or more flow augmentations. Common mistakes were not writing the flow augmentations correctly, by missing

out either a node or the supersink. Some students incorrectly found an increase of 8, which then lead to incorrect answers in part (d).

In part (d), many students were able to find the maximum flow of 64, but very few listed the correct arcs for the cut of 64, with those who got this far using arcs going to the fictitious supersink, or just drawing the cut on the insert or using a set notation.

Use of statistics

Statistics used in this report may be taken from incomplete processing data. However, this data still gives a true account on how students have performed for each question.

Mark Ranges and Award of Grades

Grade boundaries and cumulative percentage grades are available on the Results Statistics page of the AQA Website.

Converting Marks into UMS marks

Convert raw marks into Uniform Mark Scale (UMS) marks by using the link below.
UMS conversion calculator