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Mathematics MD02

(Specification 6360)

Decision 2

Report on the Examination

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General

Most students were well prepared for the exam and many outstanding scripts were seen. Students were well-drilled with the familiar algorithms. However, questions that were set in a style different from the 'norm' proved to be challenging. The general standard of presentation was quite good. The majority of answers were very well presented; this is essential when examiners are required to check each step of an algorithm.

Question 1

This question proved to be a good source of marks for all students, with many scoring full marks. There were problems in part (e) where some students left 'holes' with their blocks and others had the correct histogram profile, but failed to indicate the activities linked to each block.

Question 2

Although the majority of students had an idea of the requirements of this question, full marks were rarely achieved. It is essential that students give full and clear statements to provide evidence to the examiner; simply writing down seven numbers, circling two of the numbers, then stating '$3 = 3$' will not score full marks. Students needed to show the seven numbers, but then they had to state; '$\text{maximin(row)} = 3$' and '$\text{minimax(col)} = 3$', followed by 'as $\text{maximin(row)} = \text{minimax(col)}$, there is a stable solution'. The play-safe strategies were well-answered, but there were very few correct answers for the saddle point.

Question 3

Although most students were able to apply the Hungarian algorithm correctly, a significant number failed to deal with the non-square matrix. Students should be encouraged to produce a new matrix at each stage of the algorithm and not merely cross out values and over-write with new values on one matrix. This makes the examiner's task of checking earlier values almost impossible. Students needed to justify continuing with augmentation and later confirm that they had found an optimum solution to gain full marks. Students should be encouraged to write short statements, for example, 'all zeros covered with four lines, therefore not optimal' at the appropriate point in their solution. Some students lost a mark by failing to state the match corresponding to the maximum value found.

Question 4

This question proved to be a challenge for students. Students were required to think of the implications of statements and not merely apply an algorithm. Part (a)(i) was answered quite well, but in part (a)(ii), many students failed to state a range for the maximum flow. Some students realised that there had to be an error in part (a)(iii). Fully correct answers to part (b) were rarely seen. Many students highlighted the problem at a vertex other than 'F' and justified their answer by considering maximum flow in and minimum flow out.

Question 5

A number of students failed to score the marks in part (a) as they simply converted the inequalities into equations. Despite reference to the requirements for question (b)(i) in previous reports on the exam for this unit, many students failed to give a fully correct answer. Part (b)(ii) was generally well done. For part (c)(i), students should justify their choice of pivot as a matter of course in any Simplex question, and many students failed to either justify or state the pivot that they were using. Although many students arrived at a correct final tableau in part (c)(ii), a significant number failed to state that an optimum solution had been obtained, and also failed to give the values of x, y and z.

Question 6

This question was demanding, but it was encouraging to see many fully correct solutions. For part (a), students needed to state that strategy B was dominated by strategy C, and not merely state that 'other strategies are better'. Some students lost marks in part (b) by not drawing an accurate graph. This was essential in this question as the intersections of the lines were close together. Although it has been stated in previous reports on the examination for this unit, it is essential that an accurate graph with a scale on the vertical lines is used. A number of students failed to state the value of the game. The majority of students used probabilities of p, q and $(1 - p - q)$ in their attempt at part (c). Although many students obtained two correct expressions, a significant number failed to equate these expressions to the value of the game. A minority of students stated that the 'probability of D was 0', following from the previous part. These students almost always scored full marks.

Question 7

Most students scored full marks on this question. This demonstrates a good understanding of dynamic programming in this context.

Question 8

Most students answered part (a) correctly. Although there were many correct solutions for part (b)(i), a significant number of students failed to give a convincing solution on their diagram. It is essential that students use 'backward' arrows to show existing flows and 'forward' arrows to show potential flows. There was a significant number of students who scored 5 marks in part (b)(i) but failed to score both marks in part (b)(ii). Part (c) was answered poorly. Students were asked to list the edges of their cut; many simply drew a cut on their diagram.

Mark Ranges and Award of Grades

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