Pearson Edexcel

Examiners' Report

Principal Examiner Feedback

Summer 2025

Pearson Edexcel GCE

In A Level Further Mathematics (9FM0)

Paper 4D Decision Mathematics 2

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Introduction

The paper proved to be accessible to almost all candidates, with many able to gain high marks on at least questions 1, 2 and 3. The remaining four questions differentiated well, challenging the most able candidates and producing a good spread of marks. It was pleasing to see that a good number of candidates were able to make good attempts at question 5, the dynamic programming question and at least part of question 6, the game theory question.

Question 1

This question was answered well by almost all candidates, although a small number made errors when calculating the EMVs. Some candidates lost the final mark by failing to clearly state which of the three options (A, B or C) was the best choice. It was pleasing to see that a good number of candidates completely the decision tree diagram by filling in the chance nodes and the decision node and crossing the inferior options.

Question 2

Most candidates were able to state the two modifications required in part (a) of this question and then carried these out at the start of part (b). Most candidates used a column of zeroes for their dummy, but some, instead, used a large number (e.g. 100) in their dummy. Those who opted for the latter were rewarded, as reducing rows and columns then gave the optimum solution directly. Those candidates using zeroes in their dummy, reduced columns and then applied the algorithm once to go from three lines to four lines. At this stage, there were then several possible ways to cover the zeroes and the choice of this, either lead directly to the optimum solution, or required additional iterations of the algorithm to reach this. Candidates should be aware that the most efficient choice of lines leaves the largest possible element to be subtracted for the next iteration. Most candidates who achieved an optimum solution, did so without errors and then stated the allocation and minimum time.

Question 3

Most candidates were able to write down the initial North-West corner solution and then calculate the shadow costs and improvement indices, although some made errors, e.g. by using the initial allocation instead of the costs to calculate the shadow costs. Most then used their most negative improvement index and found an improved solution, but some made errors by omitting to state the entry or exit cell or by having an additional zero in the exit cell.

In part (b) some candidates struggled to formulate the linear programming problem accurately. Common errors included not stating that x_{ij} represented the number of units transported from i to j, or failing to define i and j correctly as well as omitting the word minimise from the objective.

Question 4

A significant number of candidates struggled to answer this question well. While a good number of candidates calculated the value of cut C_1 correctly, many did not calculate C_2 correctly. Most candidates related the maximum value of the flow to the smaller value of their cuts, but some incorrectly stated that it was equal to this, rather than less than or equal to the value. Some candidates were able to deduce the value of the initial flow, but a significant number failed to do so. Most candidates were able to find at least two correct flow augmenting routes, although relatively few found all four and the correct final flow of 67. Very few candidates drew a correct final flow diagram and relatively few even attempted to prove that their flow was maximal. Of those that did attempt this, only some were able to build a complete argument that this was true.

Question 5

A significant number of candidates made a reasonable attempt at this question, and they were assisted by having the first stage printed as a starting point. Some common errors seen were not remembering to include the optimum values from the previous stage in the calculations and omitting either a whole state or one or more rows from a state. Some candidates realised from their subsequent calculations that February state 3 was not required for the final solution and chose to delete this, which was penalised. Other errors were generally due to numerical slips when calculating values. In part (b) many candidates failed to calculate the minimum additional cost.

Question 6

In part (a) a good number of candidates correctly calculated the row minima and column maxima and identified the maximin and minimax values, before verifying that these were not equal. A small number of candidates made errors, or did not state all five values and were penalised here. In part (b) those candidates who attempted this, generally wrote down or formed the correct three probability expressions, although some made errors. They then attempted to draw a graph with incorrect scales and drawn without the use of a ruler. Candidates then attempted to find the optimum point, although some incorrectly chose the lowest point of intersection. Most stated the strategy based on their calculated value of p. In part (c) most candidates who attempted this, augmented the table by either 5 or 6 and then attempted to form the relevant equations for the tableau. However, some incorrectly used the rows of the table instead of the columns. In part (d) several candidates who attempted this, only calculated one value of V for the 3 x 3 game and were penalised. Candidates must understand that they need to calculate all three values and then choose the lowest of these. Those candidates who did this, struggled to compare their value with the value for 2 x 3 game, typically because they did not subtract 5 or 6 from their value.

Question 7

This was a challenging question, which a significant number of candidates did not attempt. In part (a), some candidates were able to write down the complimentary function and chose the correct form of the solution. Those that did so, were then generally able to substitute this into the recurrence relation and solve this to obtain the general solution, although some made errors rearranging their algebra.

In part (b), most candidates who had obtained the general solution in (a) used the given values to write down two equations, but many stopped at this stage. Some attempted to eliminate their constants and it was pleasing to see several candidates doing so successfully and going on to obtain the correct given result.

In part (c) many candidates confused the values of α and k and relatively few realised that β represented the initial repayment.

Only a small number of candidates attempted part (d), but most of those who did so obtained the correct value.

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