Examiners' Report
Principal Examiner Feedback

Summer 2024

Pearson Edexcel GCE

In A Level Further Mathematics (9FM0)

Paper 4D Decision Mathematics 2

Edexcel and BTEC Qualifications

Edexcel and BTEC qualifications are awarded by Pearson, the UK's largest awarding body. We provide a wide range of qualifications including academic, vocational, occupational and specific programmes for employers. For further information visit our qualifications websites at www.edexcel.com or www.btec.co.uk. Alternatively, you can get in touch with us using the details on our contact us page at www.edexcel.com/contactus.

Pearson: helping people progress, everywhere

Pearson aspires to be the world's leading learning company. Our aim is to help everyone progress in their lives through education. We believe in every kind of learning, for all kinds of people, wherever they are in the world. We've been involved in education for over 150 years, and by working across 70 countries, in 100 languages, we have built an international reputation for our commitment to high standards and raising achievement through innovation in education. Find out more about how we can help you and your students at: www.pearson.com/uk

Summer 2024
Publications Code 9FM0_4D_2406_ER*

Introduction

The paper proved to be accessible to almost all candidates, with many able to gain high marks on at least questions 1, 3, 4 and 6, although some aspects of these proved to be challenging for some candidates. 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 decision tree and the first part of question 8, the second order recurrence relation.

Question 1

Most candidates produced a good response to this question and were generally able to answer parts a, b, c and d. Where some candidates had problems was in not drawing the correct cut or stating the arcs involved in the cut for (e). Others failed to state the final value of the flow or use the full statement "maximum flow = minimum cut" and so did not score full marks here. In (f) a significant number of candidates were unsure how to show the restricted flow using a split node with E_{IN} and E_{OUT}.

Question 2

This question proved to be challenging for many candidates and, despite being told in the question to consider u_{n+1}, a significant number just tried to solve the recurrence relation from first principles. While some were successful, this involved significant additional work. Those who did consider u_{n+1} were generally able to make some progress, although there were numerical errors in some cases. A third alternative involved forming the correct equation for $u_{n+1} + au_n$ and then comparing coefficients, which was more straightforward and led to success in the majority of cases.

Question 3

This question was generally answered well, with a significant number of candidates achieving full marks. A small number of candidates misunderstood the reason for needing a dummy demand point, incorrectly thinking that we needed an n x n matrix to apply the North-West Corner method. Some candidates did not read the instructions to part (c) closely enough and caried out unnecessary calculations to determine that GD was the entering cell (even though they were told this). Some candidates made errors with their routes, or with the calculation of shadow costs and improvement indices and some didn't include enough detail for the final mark, forgetting to mention all of the entering and exiting cells. In part (e) a small number of candidates made errors in calculating the shadow costs and improvement indices or failed to state why their solution was optimal.

Question 4

In part (a), a significant number of candidates failed to state the correct two modifications in the correct order and were penalised. However, many candidates then correctly modified the table. In part (b) most candidates used the correct notation, but a significant number omitted one or more element from their definitions. The majority of candidates then expressed the objective as minimise and wrote down a correct 15 or 16 term expression. Those candidates who chose to write their objective as maximise needed to omit (or use 0 as the coefficient) for BQ and DR. Some candidates made errors with the constraints, either using inequalities instead of equations, or only listing four of the eight constraints.

Question 5

A significant number of candidates were able to make a reasonable attempt at drawing the decision tree, although there were several common errors seen. A small number of candidates did not draw the triangles for the end pay offs, other failed to label the branches correctly with both the delay and the probability of that delay. Some made errors with one or more ends pay off value. Some candidates did not fill in the values at either their chance nodes or the decision node and some failed to cross through the inferior options. A small number of candidates including additional, unnecessary arcs, for the possible delays which had 0 probability, but were not penalised for this. Most candidates, who had made a reasonable attempt at the decision tree, stated the correct best option. In (c) a good number of candidates were able to apply the utility function correctly and obtained the new best option. However, a small number, incorrectly, just took the cube root of the EMVs calculated in (a).

Question 6

This proved to be a very accessible question, with many candidates obtaining full marks, or very close to full marks. Most candidates were able to produce the correct dynamic programming table, perhaps with one small error, either in indicating the optimum values or in a numerical value. Most also calculated the correct starting time and route. A small number of candidates found the minimax (or maximin) route instead of minimising and were penalised. A few candidates, instead of calculating the minimum duration needed to travel the route, started from the finishing time and worked in terms of the starting time for each stage on the route. This was perfectly acceptable and the best of these worked in the 24-hour clock.

Question 7

A significant number of candidates were able to make good progress with this question, with many finding the correct row maximin and column minimax in (a) and stating that they were not equal. However, some candidates made errors, either by finding row maxima and column minima or by failing to show their working. In (b) the majority of candidates were able to augment the matrix correctly and attempted to form inequalities or equation in terms of V, p_1. p_2 and p_3 although some used rows instead of columns. A good number of candidates then correctly set up the initial tableau. In (c), candidates generally wrote down the correct probabilities, with most giving these in context. A good number were then able to correctly calculate the value of the game for B. Part (d) was more challenging and was not attempted by some candidates, while others struggled to form a correct set of equations. Those candidates who did form the correct equations generally gave the solution in context.

Question 8

The first part of this question was answered well by a significant number of candidates. Many formed and solved the correct auxiliary equation, leading to the complementary function. Many then went on to consider the correct form of the particular solution, substituting into the original recurrence relation and forming equations which enable them to calculate the correct

coefficients. Some candidates failed to make any progress beyond this stage, any many that did attempt the final part of the question, struggled to make any real progress. Those candidates who were successful here either used good algebra skills to obtain expressions for A and B just in terms of k or realised that the value of B must be 0 and used this with the initial conditions to obtain the correct value of k.

Pearson Education Limited. Registered company number 872828
with its registered office at 80 Strand, London, WC2R 0RL, United Kingdom