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Principal Examiner Feedback

Summer 2013

GCE Decision D1 (6689)
Paper 01R

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Decision Mathematics D1 (6689R)

Introduction

The paper proved accessible to the majority of candidates and there was little evidence of there not being enough time to complete the paper. The questions differentiated well, with most giving rise to a good spread of marks. All questions contained marks available to the E grade candidate and there also seemed to be sufficient material to challenge the A grade candidates also.

Candidates are advised to make their method clear; 'spotting' the correct answer, with no working, rarely gains any credit.

Candidates should ensure that they use technical terms correctly. This was a particular problem in question 2.

Report on individual questions

Question 1

This question provided an excellent start to the paper for the vast majority of candidates with 62.3% scoring full marks and only 20.8% scoring 5 marks or fewer. Candidates were clearly very well prepared for this topic and were familiar with all of the components required for a complete solution.

There was nonetheless the usual loss of marks for some candidates due to lack of change of status being stated or shown and/or failing to state the improved matching – in some cases candidates may have drawn the improved matching on diagrams which were not clear due to multiple lines being drawn from individual vertices. Change of status errors and lack of improved matching errors seemed to be occurring less each session but are unfortunately still evident.

There were some candidates who gave additional incorrect 'mini alternating paths' in part (a) e.g. "C – 5 = F – 2 = D – 6 and A – 1". This often led to subsequent loss of marks in part (c) as there was no path from A to 3 provided.

The demand of part (b) was familiar to most candidates and many gave clear, succinct and precise reasoning. However there were a number of candidates who did not gain this mark either through leaving this part unanswered or through lack of precision in their explanation e.g. 'B can only do 3 and 4' or for other incomplete or incorrect reasoning e.g. "3 can only be done by B and A can only do 1".

Question 2

This question, especially part (d), proved to be an excellent discriminator with the modal mark being 5 (out of 8) and only 17.1% of candidates scoring full marks.

Candidates found parts (a), (b) and (c) to be relatively straightforward and there was a high level of success here. Nonetheless there were the usual errors in converting the application of the algorithm to the matrix into the correct order of nodes.

In part (b), surprisingly and perhaps worryingly there were some candidates who drew diagrams which were neither correct nor even trees. In some cases the candidate drew the graph representing the distance matrix and others drew subgraphs but not trees.

Part (d) caused more problems. Some candidates were very well prepared and gave textbook answers. Others gave one or two correct ones but often repeated themselves perhaps when they had run out of differences e.g. “Kruskal’s adds arcs and Prim’s add nodes” together with “Kruskal’s starts with an arc and Prim’s starts with a node”. There was unfortunately significant use of non-technical language which was penalised – e.g. point (for vertex), line (for arc), etc. Some candidates even appeared to confuse Kruskal’s algorithm with Prim’s algorithm. For the majority of candidates it was clear that they had a grasp of some of the differences between the two algorithms but struggled to articulate these accurately. For others however, this question exposed a clear lack of understanding of the two minimum connector algorithms.

Question 3

This question gave rise to a good spread of marks and proved a good discriminator. The mode was 10 marks (out of 12) gained by 23.4% of the candidates, full marks was gained by 20.6% and 20.9% of the candidates scored 7 or fewer marks.

The early and late event times were successfully completed by the vast majority of candidates. Errors where they arose included at the late time at the end of C, the late time at the end of A and/or the end of D.

The float calculation is clearly well understood by the majority of candidates and very many got at least one mark in part (b). The lower bound question in part (c) had more variable success; some did not do a calculation and tried to argue for a lower bound based on scheduling despite the question asking for a calculation. Others made either basic arithmetical errors or conceptual errors (the most common being calculating the ratio of the earliest possible finish time to the number of activities) in their calculation.
Part (d) in which the candidates were asked to schedule the activities was often well attempted although full marks were reasonably rare. Usually candidates were able to plot the critical activities correctly. Common errors included: not plotting all 11 activities, drawing a cascade chart rather than a scheduling diagram, too many workers being used, the length of activity B (and occasionally L and J) being too long, errors in precedence of activities, errors in the start times of certain activities, e.g. D.

Question 4

This question was done extremely well by many candidates with the mode being full marks obtained by 49.2% of candidates and only 21.9% obtaining 5 marks or fewer.
In part (a) candidates had the option of choosing which sorting algorithm to use and the majority seemed to favour quick sort over bubble sort. Those that opted for quick sort the majority of these candidates then used ‘middle right’ as their choice of consistent pivot throughout the sort. The usual reordering errors and incorrect or inconsistent choice of pivot arose but in the main there were a large number of fully correct attempts. The minority that opted for a bubble sort usually produced a fully correct solution. It was surprising to note that a significant number of candidates, however, did not name the sort they were using (or named it incorrectly) and also did not ‘complete’ their sort.

Part (b) was undertaken well by nearly all candidates and a large proportion scored full marks in this part. The vast majority of candidates were able to carry out the identification of middle right pivots correctly and very few selected middle left pivots. Most were then able to reject the correct sublist (including the pivot). Many candidates, throughout this part, did set out their work in a very logical manner. Finally, when the search is complete it is important that the candidate provides a clear statement to the effect that the letter being searched for has been found. A number of candidates did not differentiate that Lydia was the item they were searching for and in many cases it seemed to be stated as a pivot and not the target value. It was sometimes unclear if at the end of the search that L (or Lydia) had been found or was, in fact, a letter in a sublist with only one value.

Question 5

This question proved to be a good source of marks for nearly all candidates. The mode was full marks, gained by 28.1% of the candidates, only 21.3% of candidates scored 4 marks or fewer.

Parts (a) and (b) on the application of the Route Inspection algorithm was generally done extremely well by nearly all candidates. Unfortunately though there were a few candidates who only gave two pairings of the four odd nodes or who gave several pairings but not three distinct pairings. However, most candidates stated the correct three distinct pairings of the four odd nodes. It was relatively common though to see errors in some of the totals as candidates did not always find the shortest route between their pairings. Most stated the repeated arcs as requested and most gave the correct length. A significant number however, did not state a route. Those who had the correct repeated arcs in part (a), and who attempted to write down a route, were in most cases correct.

Part (c) proved to be far more discriminating. Some candidates succinctly stated ‘repeat AF as it is the least, start and finish at G, H’. Others wrote reams but never quite stated the key points. It is important that candidates understand the need to explain their reasoning and the need to highlight the salient points. Some candidates misunderstood the reasoning that was required here and focused on the fact that AG had the greatest weight and therefore should be avoided and so FH should be repeated. Others still said that ‘FH is the least therefore start and end at F and H’.

Question 6

Although part (a), in which candidates were asked to draw an activity network, has not been examined in recent sessions this part was, in the main, done well by the candidates. Overall, the mode mark was full marks obtained by 27.6% of candidates and 75.6% obtained 4 marks or more.

A large majority of candidates were able to pick up at least some of the marks in part (a) and most completed perfect or near perfect diagrams. There were a range of reasons for the loss of marks in this part, for example, missing labelling/missing arrows on the arcs, occasional missing activities (the most common seemed to be activity K) and some candidates were unclear on how to deal with the dummy activities and drew diagrams with three or more dummies. Some only drew arrows on the dummy activities. Even though the question explicitly stated that candidates should consider activity on arc there were a handful of candidates who drew activity on node diagrams.

In part (b), some candidates were clearly very well prepared and knew exactly what reasons needed to be given for the existence of dummies in an activity network. However others had a vague sense of the kind of reasoning that was required i.e. precedence and uniqueness, but were unable to give correct explanations involving the required activities for precedence or a correct explanation of the 'uniqueness dummy.' The most success came with the first dummy, although some didn't quite give enough of an explanation, e.g. 'because F depends on C and D' without mentioning activity G. There was less success with the second dummy. A number of candidates continued to talk about precedence for this mark.

Question 7

This question discriminated well leading to a good spread of marks. The modal mark was 6, 10.1% of the candidates scored full marks and 61.6% gained 5 or more marks.

Part (a) proved to be far too difficult for the majority of the candidates – most either stated 'you can't have two starting points' or 'because it is easier' or spurious arguments based on the valency of the nodes or 'because J is in common'. It was relatively rare to have a correct response to this part as few gave an acceptable answer to the question why J rather than C_1 or C_2 should be chosen.

In part (b), those who followed the advice in part (a) (of starting at J) were mainly successful in part (b). There were the usual errors associated with order of working values and very occasional order of labelling errors. The vast majority could correctly give the route and length when they had the correct chart.

It was extremely unfortunate that a significant number of candidates ignored the advice in part (a) and started at either C_1, C_2 or even both simultaneously in this part – this approach of not starting at J could only score a maximum of three marks (out of a possible six). A very small number of candidates drew out a second diagram and started at each of C_1 and C_2 in turn.

Question 8

This question proved to be a good source of marks for nearly all candidates. The mode was full marks, gained by 19.9% of the candidates, only 21.1% of candidates scored 7 marks or fewer.

In part (a), an alarmingly high number of candidates read the line $y = 16$ to be $y = 15$. Although this lost only the one mark in part (a) it unfortunately gave rise to a loss of marks later in the question in most cases. Many candidates were able to complete parts (a) to part (c) correctly although with some reversed inequalities creeping into the constraints. Part (c) in particular was better attempted than in recent sessions. Plotting the lines was done relatively well in part (d) although there were a number of candidates who had drawn two lines correctly but then went on to choose the incorrect region.
Part (e), in which the candidates were asked to state the objective function, was almost always answered correctly even by those candidates who scored very few marks in this question.

In part (f), there were a great many candidates who unfortunately did not read the question and used the objective line method rather than point testing. Of those that did find the vertices of the critical region, a number of candidates did not test any of the points using the objective function. In many cases this did not seem to be due to lack of time but rather a misunderstanding of what was required. The question stated: 'determine the coordinates of each of the vertices of the feasible region and hence use the vertex method to determine the optimal point.' This meant that no marks in part (f) were far too very common. It should also be noted that if candidates are asked to point test then they must test all the vertices of the feasible region for full marks.

In part (g), those candidates who had proceeded correctly up to this point were almost always able to finish off the question correctly. Even those who had made errors in the choice of method to apply were able to pick up a mark here.

Grade Boundaries

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