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Examiners' Report/ Principal Examiner Feedback

January 2012

GCE Core Mathematics D1 (6689) Paper 1

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Introduction

This paper proved accessible to the candidates. The modal mark on each question being full 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. Questions 3, 6 and 7 were particularly good discriminators giving rise to a good spread of marks.

Candidates are also reminded that this is a ‘methods’ paper. They need to make their method clear, ‘spotting’ the correct answer, with no working, rarely gains any credit.

Time did not seem to be a problem with careful and neat solutions usually seen to all parts of all questions. The large majority of candidates are now using very efficient methods of presentation. The only exception to this was in question 5, where some candidates offered a 3 page solution to a 5 mark Bubble sort. The wording of the question and the marks allotted to each section should assist candidates in determining the amount of working they need to show.

Some very poorly presented work was also seen however, and some of the writing, particularly numbers, was very difficult to decipher. Some candidates misread their own figures causing errors.

Candidates should ensure that they use technical terms correctly. This was a particular problem in questions 3 and 7.

Arithmetic errors were seen in questions 2, 4, 5 and 7.

Report on individual questions

Question 1

This proved a good starter with 67% of the candidates gaining full marks and only 20% gaining 6 or fewer marks. The most efficient way of applying Kruskal's algorithm was to list all the arcs in order then use ticks and crosses to show the selection of the arcs used to form the tree. A few candidates rejected BE or DH and added EF or FG. Part (b) was similarly well done. However a number of candidates spent time (unnecessarily) constructing a matrix; others made reference to arcs being rejected (this should not happen if Prim's algorithm is applied correctly). It was noticeable the fewer candidates listed only the vertices. Most candidates were able to draw the tree and state the weight correctly. It is true that both algorithms should give rise to MST's that have the same weight. This could be a useful check for some candidates.

Question 2

Over two thirds of the candidates scored 6 or more marks on this question, with 31% gaining full marks and only 20% gaining 4 or fewer marks. The route inspection algorithm, described in the specification, requires candidates traverse each edge and to finish at the start vertex, a minority of the candidates did not fully understand this and chose two distinct vertices for their start and finish. Most candidates were able to correctly identify 3 pairings of their 4 odd nodes and completed part (a) efficiently and correctly, with most of these scoring at least 5 marks out of six. The most common errors were to state that the shortest route between D and E was 18 rather than 14, and to give BE as a repeated arc rather than BC + CE. Some went on to give an inspection route, which was not required. Part (b) was less well done with many candidates failing to include the new arc BF, or not explaining their reasoning, or assuming the problem could now start and finish at two different vertices. A number of candidates failed to write a conclusion.

Question 3

This gave rise to a good spread of marks, and was found challenging by some, with 17% of the candidates gaining 5 or fewer marks, but 58% still gained 8 or more marks. As with any definition questions part (a) and (b) caused problems for some, whilst others had memorised them correctly. Only a limited number were able to correctly use words such as 'set', 'one to one', 'vertex/node' and 'arc/edge'; others referred to 'columns', 'sides', 'axis', 'connections', etc. Few stated that there must be precisely two sets of nodes. Some described, at length, an application of a bipartite graph, confusing this with defining it. Part (b) was often rather better done, but some were not able to convey the idea of a one to one pairing of nodes. A few described an alternating path in (b). Parts (c) and (d) were a good source of marks for many. Most were able to find a path from J to 3 and then S to 5, though some then omitted the change status step or did not list the improved matching.

Question 4

This was well-answered by the majority, with 52% gaining 8 or more and 35% gaining full marks. Only 22% gained 5 or fewer marks. The order in which the working values are listed in part (a) is of paramount importance. They must be listed in the order in which they are generated in order to demonstrate that the algorithm is being applied properly. As each node receives its final label, a working value must be calculated, and entered, at any non-complete node directly connected to it. Common errors were: ordering H after either nodes B, D, E, F or G; the working values at D and F not in the correct order, or even in the order suggested by the candidates order of labelling; extra values at F, I and J; not picking up the shortcut to F (via H) and so gaining a 115 in the working value and sometime as the final value at J. A number of candidates did not state a route nor length for part (a) but went straight on to part (b). The correct answers to part (b) were often seen.

Question 5

This was the next well answered question after question 1 and a good source of marks for almost all candidates with 61% gaining at least 12 marks, 43% full marks and only 19% gaining 9 marks or fewer. Nearly all the candidates completed part (a) correctly, with transposing 12 and 10 the only commonly seen error. In part (b) candidates were asked to show the state of the list after each pass. Many candidates showed the list after each swap, and some after each comparison. This is very time consuming and candidates should be aware that they are not likely to be asked for such detail. The wording in the question will indicate the amount of detail required. Some candidates answered this question in the expected seven or eight lines others used over three pages. The most commonly seen errors arose from values being lost during the process, candidates misreading their own figures, errors in pass two or three and not indicating that their list was sorted. It is advised that candidates check their final list with the original list to ensure they have not lost/altered any items. Part (c) was often well done. Some candidates lost marks by misplacing the 1 and the 2, some used their incorrect list from part (b) and a few used first-fit ‘increasing’. Most candidates knew that they needed to calculate a lower bound, or a carefully reasoned numerical argument. Most did so correctly and drew a correct conclusion. A few calculated a lower bound in part (a) but did not reference this as their method choice in part (d) so it could not be credited.

Question 6

This question was well answered by most although it also proved a good discriminator. Over half the candidates gained 8 or more marks, with 34% gaining full marks. Only 22% gained 5 or fewer marks. The inequalities were usually correctly described in part (a), the most common error was to suggest strict inequalities. Part (b) was a little more varied. Most were able to draw $3x+4y=360$ accurately and the shading for this line was usually correct also, $x = 2y$ proved more challenging and many shaded incorrectly leading to an incorrect feasible region. It was encouraging to see that almost all candidates used a ruler. Part (c) was usually correct, although a few wrote $3x+y$. The great majority of candidates drew a correct objective line in part (d), although many drew the line with reciprocal gradient, $(P=20x+60y)$. The gradient of the objective line needs to be correct and a few candidates drew objective lines that were too short. Candidates are advised that objective lines must be plotted accurately and pass through sensible points on each axis, so, in this case, passing through (0, 30) and (10, 0) at minimum. Few candidates tried to read off the optimal point from their graph, some making errors, but most correctly used simultaneous equations to find the coordinates accurately. Those who found the correct optimal point were able to complete part (e) correctly.

Question 7

This question proved a good discriminator, leading to a good spread of marks... Over half the candidates scored 13 marks or more, only 17% scored full marks but only 20% scored 8 marks or fewer. Part (a) proved challenging for some but others completed it with ease. In (a) (i) some just wrote about the activities that K depended on and made no reference to I, candidates are advised to ensure that they reference all relevant activities. In (a) (ii) some just wrote that G and H were unique, rather than saying that the activities must be able to be uniquely described in terms of their end events. Part (b) was usually well answered the most common errors being incorrect late finish times at the end of A, C and/or D. The floats in (c) were usually correctly calculated and the numbers used to find them clear. Part (d) was usually well done, but a few divided by the number of activities rather than the finish time. Part (e) was well answered and generally carefully done, with no signs of candidates rushing. The most common error was the omission of one of the activities, often J or K. Candidates are advised to check that all activities are present. Very few scheduling diagrams were seen and most drew accurate diagrams however.

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