

Examiners' Report/  
Principal Examiner Feedback

Summer 2012

GCE Decision D1 (6689) Paper 01

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## **Introduction**

This paper proved accessible to the candidates. 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 reminded that they should not use methods of presentation that depend on colour, but are advised to complete diagrams in (dark) pencil.

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.

Some candidates are using methods of presentation that are too time-consuming, this was particularly true in question 1(c), the bubble sort, where many candidates ran out of space (and possibly time) unnecessarily showing each comparison. The space provided in the answer booklet 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 seen and some of the writing, particularly numbers, was very difficult to decipher.

Candidates should ensure that they use technical terms correctly. This was a particular problem in questions 4(a).

## **Question 1**

This proved a good starter for most with only 11% of the candidates gaining 7 or fewer marks, and 49.8% of the candidates gained full marks. Part (a) was done well by almost all the candidates, although a few rounded down to 4 bins, or left it as 4.38 and there were some arithmetic slips seen. A few candidates made no attempt at this part or attempted a full bin solution at this stage rather than a lower bound. Most candidates completed part (b) correctly, other than those who over-filled bins due to poor arithmetic, the most common errors were to place the 19 in bin 3, and either the 22 or 18 in bin 5.

Part (c) was well attempted by most, though many omitted the 'stop'(or the more popular 'sorted') statement at the end. Errors were made by candidates misreading their own figures from line to line, so miscopying, omitting or changing numbers, and a surprisingly large number of candidates has 25 and 24 the wrong way round at the end. Even though the question asked for candidates only to show the result of each pass, many showed the result of each comparison and swap in the first pass and some for every pass, this is hugely time consuming, gives more opportunity for copying errors and often these candidates ran out of space. If examiners do need to see the comparisons and swaps this will be asked for. Part (d) was answered well but many had errors when completing first-fit decreasing, for example, the 24 appearing in bin 5, the 22 in bin 5, the 19 in bin 5 and the 18 in bin 3.

## Question 2

There were many excellent responses seen to this question with nearly 67% of candidates gaining full marks, however 11% gained zero marks so some poor work was also seen. A disappointing number of candidates attempted to construct paths between vertices other than G and 4, but most found at least one alternating path between G and 4, with the majority finding a second one too. It is important that examiners can clearly identify the alternating path so it should be listed (rather than drawn) separately (rather than left as part of a 'decision tree' of potential paths). A significant number did not make the change status step clear. This can be done either by writing 'change status' or, more popularly, by relisting the path with the alternating connective symbols swapped over, this latter has the additional advantage of making the path very clear for the examiners. Some candidates listed a correct alternating path and then 'attached' any unchanged matchings onto it, which meant that their path did not now finish at an unmatched vertex. It was rare to see an incorrect matching following a correct alternating path.

## Question 3

This question proved a good source of marks for many with 75.6% gaining full marks and only 9.6% getting 3 or fewer marks. In part (a) most candidates correctly added the four arcs from D, but it was not unusual to see DF rather than DG drawn, or for candidates to omit one or more arcs. Most candidates applied Kruskal's algorithm correctly, but some did demonstrate correct handling of rejected arcs. Rejecting arcs is a key feature of Kruskal's algorithm. On the other hand some candidates wrote lengthy over-elaborate explanations each time they rejected an arc. Candidates are advised to form a simple list of the arcs in order of increasing length and tick or cross to indicate their inclusion or otherwise (or write 'reject' next to the arcs that are being rejected, or make it clear in an unambiguous way which arcs are being selected and which are being rejected). The examiners need to see **when** the arcs are rejected as well as **which** arcs are rejected. Arc AF was often included as an extra arc, which of course leads to a cycle and should have been spotted as the 'tree' was drawn in part (c). If part (b) had been completed correctly parts (c) and (d) were usually correct.

## Question 4

This proved a challenging question and a very good discriminator leading to a good spread of marks. The modal mark was 8, only 7.8% of candidates gained full marks, 13.2% gained 11 or more marks, 30.5% gained 10 or more marks and 10% gained 3 or fewer marks. Most candidates knew that valency was something to do with arcs/edges and nodes/vertices, and there were many 'textbook' answers seen, however some simply defined valency as being 'degree' or 'order; without further explanation, others used non-technical terms and referred to lines and points, or inappropriate terms such as the number of routes or paths incident on a vertex, others said it was the weight of an arc, or the sum of the weights of the arcs leaving a vertex.

Most candidates completed part (b) very well, with only a few arithmetical errors, but a significant number did not correctly state the three arcs that needed to be traversed twice, usually giving DI instead of DF and FI. Most then gave the correct route length in part (c). Parts (d) and (e) proved much more challenging. In part (d) most candidates knew that they had to repeat the shortest route between DE, 131 and

added this to the given total weight of the network, 1436, most then acknowledged that HI was to be excluded but then did not subtract 75 from their answer, getting the frequently seen 1567 instead of 1492. Many candidates did not read part (e) carefully. A number of candidates just stated the length of the route rather than listing it and some gave routes starting and ending at A. Those who listed a route starting at D/E and finishing at E/D usually gave a correct route.

### **Question 5**

This gave rise to a good spread of marks and proved a good discriminator. The mode was full marks gained by 24.2% of the candidates, 12% of the candidates scored 3 or fewer marks. Part (a) was completed with varying degrees of success. The key to this algorithm lies in the working values, if the algorithm is applied correctly these will not only be correct but also in the correct order. Since these are so important in judging the candidate's proficiency it would be wise to avoid methods of presentation that require values to be crossed out. The relative position of vertex F caused most of the difficulty. Commonly seen errors included: an extra working value at F, often 33; the working values at B appearing in the wrong order; 24 being chosen as the final value at B which often led to an incorrect final value of 66 at T. The examiners gave follow through marks on the length of the route and those who obtained the correct length of 65 almost always gave the correct route. Most candidates attempted an explanation in part (b) and most were at least partially correct. Those who listed their arc calculations were usually more successful, than those who attempted the general explanation. Though even here some simply listed their calculations without linking them to the arcs they indicated. Part (c) was answered very well with many getting the correct answers of SCFBET and 68.

### **Question 6**

This question discriminated well, giving rise to a good spread of marks. The mode was 12 marks, 12.5% of the candidates gained full marks with nearly 21% getting 13 or more marks, 10.6% of the candidates gained 4 or fewer marks. Almost all the candidates were able to complete at least part of the precedence table, but many candidates omitted at least one immediately preceding activity for J, often C and/or D.

The early event times were often correctly calculated in part (b) but many candidates had more difficulty with the late event times with errors occurring at the ends of A and E. As is often the case the dummies caused the most confusion when working backwards to complete the late times. Most candidates knew how to calculate the total float in part (c) and showed their working. The lower bound required in part (d) proved more of a challenge with 28/11 being too frequently seen. The scheduling in part (e) caused difficulties for many, and was for many the most challenging part, with some not attempting it at all and many others producing a cascade chart, although a small number did use this as a precursor to a schedule. Those that did draw a schedule often included one or more errors particularly relating to precedence issues among activities D, E, F, G, I & J, rather than durations.

## Question 7

This question discriminated well leading to a good spread of marks. The modal mark was 8, 10.5% of the candidates scored full marks, 23.2% gained 11 or more marks and 12.3% gained one or fewer marks.

Part (a) was usually correct although  $y = x$  and  $y \geq x$  were often seen. Many candidates found part (b) demanding, only those who expressed the total as  $x + y$  were able to make progress. Almost all the candidates gained the mark in part (c) with just a few reversing the inequality or using an equals sign. Part (d) was often completed correctly, but candidates had more success drawing  $5x + 6y = 300$  than  $5y = x$ . A number of candidates drew  $6x + 5y = 300$  and  $y = 5x$ . Many candidates are using 15cm rulers, but many who do so draw a 'line' whose gradient changes mid way. It would be advisable for candidates to use a 30cm ruler for the exam. We do demand accuracy in the drawing of straight lines, some candidates are not drawing them with sufficient precision. Those who obtained the correct lines usually labelled the feasible region correctly.

Candidates were required to both draw an objective line and label their optimal vertex in part (f) and this was often well done. A significant minority did not attempt an objective line. Some candidates drew several parallel objective lines which is not necessary, some drew lines that were too short or too imprecise to check. The advice is that candidates should draw one objective line going from a sensible point (one that is easy to plot accurately) on one axis to a sensible point on the other axis. Some did not label their optimal vertex and some did not label any vertex. Part (g) was often poorly answered. Most candidates, but not all, realised that they were now seeking an integer coordinate solution. Many gave a point that was not in the feasible region often (48, 9) or (49, 10). Most who found the correct optimal point were able to calculate the correct profit.

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