Examiners' Report

Summer 2014

Pearson Edexcel International Advanced Level
in Decision Mathematics D1
(WDM01/01)

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Mathematics Unit Decision Mathematics 1

Specification WDM01/01

General Introduction

The paper proved accessible to the majority of students. The questions differentiated well, with most giving rise to a good spread of marks.

Report on Individual Questions

Question 1

Many correct solutions were seen in Q01(a), but a number of students did not choose their pivots consistently, switching between middle-left and middle-right pivots during the course of the quick sort algorithm. A very small number of students lost an item or changed one, and very few cases were seen where only one pivot was chosen per iteration. Some students did not indicate that their sort was complete. This could have been achieved either by having at the end a ‘list sorted’ statement, or every item in the original list being used as a pivot or the final list being rewritten at the end. A common error was items B and C being interchanged in the 1st pass; students should be reminded that items should remain in the order from the previous pass as they move into sub-lists.

Q01(b) was undertaken well by nearly all students and a large proportion scored full marks in this part. The vast majority of students 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). In some cases, students wrote ‘reject 1 – 5’ in the first pass but then had, in the second pass, a list which included 5. Many students, throughout this part, did set out their work in a very logical manner by adopting one (or more) of the following approaches:

- explicitly writing out, at each stage, their calculation for the pivot and circling or making their pivot clear;
- writing out their reduced list after each pass;
- renumbering their reduced list (from 1) before each new pass.

It is advised that in this type of problem it is essential that the choice of pivot is made clear at each stage as should the new sublist which is to be used in the next pass. Finally, when the search is complete it is important that the student provides a clear statement to the effect that the name being searched for has been found. Many students did not differentiate that Patel was the name 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 Patel had been found or was, in fact, a name in a sublist with only one value.

Q01(c) provided to be an excellent discriminator. Common incorrect answers included:

- stating a number of required iterations without any justification;
- incorrect calculations such as $\frac{641}{2} = 320.5$ (therefore 321 iterations) or $\sqrt{641} = 25.3$ (so 26 iterations);

A number of students considered the maximum number of names that would remain at either the start or the end of each iteration. It was, however, common to see errors in this approach as many students failed to engage with the requirement of the maximum number of names remaining after each iteration and so it was common for students to retain their pivots when moving from one pass to the next.

Question 2

Few students were able to score full marks in Q02(a) because they were unable to describe the terms fully and accurately.

Q02(b) and Q02(c) were answered extremely well but there was the loss of marks for some students due to lack of change of status being stated or shown, or for failing to state the improved and/or complete matching. In some cases students may have drawn these matchings on a diagram which was not clear due to multiple lines being drawn from individual vertices.

Question 3

Q03(a) was usually very well done with most students applying Dijkstra's algorithm correctly. The boxes at each node in Q03(a) were usually completed correctly. When errors were made it was either an order of labelling error (some students repeated the same labelling at two different nodes) or working values were either missing, not in the correct order or simply incorrect (usually these errors occurred at G, H and/or T). The quickest route was usually given correctly and most students realised that whatever their final value was at T this was therefore the value that they should give for their route.

For those students who obtained a (nearly) correct solution to Q03(a), Q03(b) was also well answered, although not all students used their quickest route from A to F. Only the more able students were able to score the first mark in Q03(c), with both marks only being scored by a small minority students who were able to think more laterally about the context of the question and how this might alter the network. A considerable number of students began to engage with the context, but were unable to apply this back to how the network might need to be altered, instead saying how their answer to Q03(a) might need to be altered.

Question 4

Q04(a) was found to be challenging to students. Others gave one or two correct differences but often repeated themselves perhaps when they had run out of differences. There was unfortunately significant use of non-technical language which was penalised, for example, point (for vertex) and line (for arc). Some students even appeared to confuse Kruskal's algorithm with Prim's algorithm. For the majority of students 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 part exposed a clear lack of understanding of the two minimum connector algorithms.

Q04(b) was generally well answered with the majority applying Prim's algorithm correctly starting correctly from vertex D. A few students attempted to construct a table to perform Prim, clearly believing that Prim can only be performed when expressed in matrix form.

Q04(c) was well answered with the majority of students scoring full marks here by correctly applying the Route Inspection algorithm and stating that EL and LG should be repeated. However, only the most able students were able to score full marks in Q04(d) by correctly providing reasons for why the caretaker should finish at vertex S.

Question 5

This was the most challenging question on the paper for many students, with very few scoring full marks. Q05(a) was almost always answered correctly and most students were able to draw the required lines correctly in Q05(b) although some were unable to draw lines sufficiently accurately (some drew lines without a ruler) or sufficiently long enough. The following general principle should always be adopted by students:

- lines should always be drawn which cover the entire graph paper supplied in the answer book and therefore,
- lines with negative gradient should always be drawn from axis to axis.

The rationale behind this is that until all the lines are drawn (and shaded accordingly) it is unclear which lines (or parts of lines) will define the boundary of the feasible region. If students only draw the line segments that they believe define the boundary of the feasible region then examiners are unaware of the order in which the lines were drawn and therefore it is unclear to examiners why some parts of the lines have been omitted. In general the lines $3x+5y=1000$ and $y=2x$ were correctly drawn and were errors occurred they tended to be with the line $4y-x=210$. Furthermore, a significant number of students were unable to select the correct feasible region.

A significant minority of students omitted Q05(c).

For Q05(d), it is clear that many students are using graphical calculators to find the exact co-ordinates, and therefore are not scoring full marks as they are not showing sufficient working as to how these co-ordinates are being obtained. Another common error was to round the exact answers either to 1 decimal place or to the nearest integer answer, and to use these approximate answers when evaluating the objective function, without considering whether these new points are still in the feasible region. Only the most able students engaged correctly with finding an integer solution which satisfied the relevant inequalities.

Question 6

The majority of students made a reasonable attempt at this question, with only a few students attempting activity on node. Those students who scored full marks most easily in Q06(b) were those who used their diagram from Q06(a) as an example for where dummies might be needed. A few students were able to accurately describe why dummies are needed in the general sense, but whilst most students used the correct terms of dependency and uniqueness, many were then unable to go on to accurately describe what these words meant in the context of dummies on activity networks.

Question 7

Even though this was the last question on the paper, this was well attempted by most students. Q07(a), Q07(b) and Q07(d) were generally well answered with many students scoring full marks, with perhaps the most common error in Q07(a) being to have incorrect values in the late event times at the end of activities B or C. For students who knew what a Gantt chart was, Q07(c) was generally well answered, although students should be reminded to check that they include all activities in the network and that the activities have the correct lengths and corresponding floats. In Q07(e) many students did not include all 11 activities, or they scheduled using three workers rather than the correct two workers. Some students made a good attempt but failed to fully check the precedences for each activity. There were some good solutions seen to this part, with a number of different but valid solutions seen.

Grade Boundaries

Grade boundaries for this, and all other papers, can be found on the website on this link:

http://www.edexcel.com/iwantto/Pages/grade-boundaries.aspx

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