Pearson Edexcel

Examiners' Report

Principal Examiner Feedback

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Introduction

The paper proved to be accessible to almost all candidates, with many able to gain high marks on at least three of the first four questions. The final three questions differentiated well, challenging the most able candidates and producing a good spread of marks. There was an indication that some candidates struggled to finish the paper in the time allowed, as a number of candidates did not complete the final question and, in some cases, failed to attempt this question.

A key piece of advice to candidates is to ensure that they read the demands of the question carefully and to ensure that they answer the question as set. Many candidates lost marks by attempting to answer a different question to the one that had actually been set. Candidates must also realise that if a question asks them to give to give a reason for their answer, then they are expected to write a brief explanation.

Question 1

This question proved to be accessible, with almost 70% of candidates scoring at least 9/13 marks. In part (a) most candidates correctly completed both the early and late boxes, although some made an error with the late time after activity I (19 instead of 18), which had consequences in part (d) and (e). A small number of candidates had late times which were less than the corresponding early time – they should have realised that this is not possible. In (b) most candidates correctly calculated the float of activity D and showed the numbers used in their working and in (c) many showed the correct calculation (67/24) and rounded this to the correct lower bound of 3. In (d) most candidates attempted to draw a Gantt chart, although a small number drew a schedule instead. Some candidates made errors in the length of one or more activities or their floats, or omitted one of the activities (typically H, I or L). One key piece of advice here is to ask candidates to shade the float of activities, as floats drawn with just a dashed line can be difficult to read on the preprinted grid lines. Many candidates struggled to answer part (e) and some of those that did either listed the incorrect activities or stated the wrong number of activities or incorrectly stated the time period (e.g. stating 12 – 13 instead of $12 < t < 13$).

Question 2

This question also proved to be accessible, with over 50% of candidates scoring at least 7/10 marks. In part (a) most candidates correctly used Prim's algorithm to find the minimum spanning tree, although a small number made an error with the choice of the final arc or failed

to list the arcs correctly. Very few explicit rejections were seen, which was pleasing. Most candidates also calculated the correct weight of the minimum spanning tree. Some candidates failed to answer part (c), but those that did so generally found the correct Nearest Neighbour route. A significant number of candidates listed the arcs used rather than the actual route, although they were not penalised for this. A small number of candidates failed to return to J and consequently stated an incorrect length for the route. In (d) many of those candidates who found the correct length of the route from J, compared this with the upper bound from E and concluded that, as it was shorter, it was a better upper bound. However, a number of candidates did not state a reason why their answer was better. In (e) many candidates set up an equation involving the weight of their MST and x and calculated a value of 31. However, they did not justify the use of x in the calculation by considering what happens if 33 and 28 are the two shortest arcs and consequently lost a mark here.

Question 3

Part (a) of this question was answered well by the majority of candidates, with many obtaining the correct route and length from A to J, although some made small errors, either in their working values or in one or more final value. Part (b) proved to be problematical for many candidates, who did not fully understand the demand of the question. While the network contained four nodes of odd order (A B F H), by starting the route from A and finishing at J, candidates actually needed to consider the possible pairings of B F H and J. Many candidates instead considered the possible pairings of A B F and H (which was marked as a misread) and were therefore penalised. In both cases, candidates made errors calculating the lengths of their pairings and some failed to list the correct arcs to be repeated or state the length of the route. In part (c) the question reverted to the original four odd nodes, with candidates needing to identify the shortest route between any pair of these nodes to be repeated. Many candidates failed to explicitly state that AB was the shortest between any pair of A B F and H and therefore start and finish at F and H. Many candidates also failed to state the correct length of 475 here.

Question 4

This question proved to be accessible, with over 60% of candidates scoring at least 4/7 marks. Most candidates made a good attempt at drawing the network in part (a), although a small number did draw their activities on nodes instead of arcs. Those candidates who drew activities on nodes generally completed the network correctly up to at least F and H and many also G I and J. Where errors occurred, this was usually in the placing of K L and M and the final two dummies, with candidates failing to realise that each of these activities needed to start from a different node. Some candidates omitted at least one of these activities. A number of candidates failed to draw arrows on all of their activities and dummies (these are best placed in the middle of the activity so as to be clearly seen), or included unnecessary additional dummies, or failed to ensure that their network had just one finish. Candidates should be advised to draw a final

version of their network, ensuring that they have removed any extra dummies and to check that all arrows are present. In part (b), some candidates did not attempt this and, of those who did attempt this, many candidates failed to correctly identify either those activities that could not be critical or which must be critical, and a great variety of responses were seen here.

Question 5

This question was extremely challenging, with over 65% of candidates scoring at most 2/5 marks and a significant number not even attempting this question. Those candidates who did attempt the question, generally identified the correct minimum and maximum points and either stated an objective function which was some multiple of $4x + 4.5y$ or that the gradient of the objective function was $-8/9$. Many candidates either stopped at this point or failed to make any further progress with their solution. Those candidates who did make further progress generally used the coordinates of the maximum point to obtain the correct objective function. A variety of correct algebraic approaches was seen to achieve this. The majority of candidates who obtained the correct objective function, then substituted the coordinates of the minimum point and obtained the correct value of k.

Question 6

In part (a) of this question, many candidates simply listed the values in each bin and concluded that $n \geqslant 72$ without providing any written justification for this statement and some wrote down an incorrect range of values (e.g. $72 \leqslant n < 76$) without explaining their reasoning. A number of candidates did realise that the 11 would not fit in bin 1 and concluded that $n < 75$, although again this was often stated without any explanation. A significant number of candidates used the values in the bins to state a maximum value for n instead of a minimum. In part (b), most candidates correctly used quick sort to sort the list into ascending order. A small number incorrectly sorted the list into descending order or used bubble sort. Some candidates made an error in their sort, either with 16 15 13 or 28 27 and were therefore penalised. Candidates must ensure that they clearly identify their pivots at the time that they are used. In part (c) some candidates just considered the totals of the new bins and incorrectly concluded that $n \geqslant 71$. A significant number of candidates did realise that 18 did not fit in bin 2 and used this to obtain the correct value for n, although, again, many candidates did not explain their reasoning.

Question 7

This proved to be a challenging question for many candidates and, as already noted, a significant number of candidates did not attempt this question. In part (a) most candidates who attempted this question were able to write down at least some of the constraints, even if these were not fully simplified. However, many attempts included some errors, such as omitting

$x + y + z \leqslant 100$ or writing $x \geqslant 25$ instead of $x \geqslant \frac{1}{4}(x + y + z)$ or did not correctly simplify their constraints. A significant number of candidates also failed to state maximise when writing down the objective function. A small number of candidates used A B C instead of x y and z in this part of the question. Many candidates did not attempt to answer part (b). Those who did attempt this, were generally able to substitute for z and simplify their expression. However, many were then unable to explain why maximising $7x - 10y$ is equivalent to minimising $-(7x - 10y)$. Many candidates attempted part (c) and drew at least three lines correctly. However, some lines were incorrectly plotted or poorly drawn, without using a ruler. Most candidates then attempted to identify the feasible region, although some chose an incorrect region of their graph. Relatively few candidates attempted part (d) of the question, but those who did generally found at least two pairs of coordinates. Only a small number of these candidates carried out point testing of their coordinates, but if they did, they were generally correct. However, some candidates then failed to interpret their solution in terms of the original problem, stating values for x y and z instead of A B and C.

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