Examiners' Report
Principal Examiner Feedback

Summer 2025

Pearson Edexcel International Advanced Level
In Decision Mathematics (WDM11) Paper 01

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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 four questions differentiated well, challenging the most able candidates and producing a good spread of marks.

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 remember that this is a methods paper, and they must use the correct algorithm, showing all their working.

Candidates, in general, appeared to be better prepared for this series, when compared to other recent WDM11 papers.

Question 1

This question was extremely accessible, with both parts of the question generally being answered correctly by the vast majority of candidates, who clearly understood the processes required. The two errors that did occur in part (a) were omitting one of the values from the sum or dividing by the number of items i.e. 9. It might be worth noting that obtaining a lower bound of 248 bins and then packing into 4 bins in part (b) should indicate an error. In part (b) common errors were omitting one of the values or incorrectly starting a new bin, most commonly 190 in a bin 5. Some candidates made errors where candidates calculated a cumulative total for a bin instead of listing one of the values.

Question 2

This question was also accessible to the majority of candidates. Most candidates were able to complete Prim's algorithm, with very few rejections seen. However, some candidates made an error by adding an additional arc to return to the first node P. Most applications of Prim's algorithm listed the arcs as required, although the method mark could be gained for the first four nodes or correct numbering at the top of the matrix table. Most candidates calculated the correct weight for their MST and then doubled this to calculate an initial upper bound. Those candidates who added an additional arc were penalised here.

Most candidates were able to apply the nearest neighbour algorithm to find both the route and its length, although some made errors by not returning to P and therefore not including the final arc in the calculation of the length. Some candidates made an arithmetic slip, giving the length as 850 instead of 880. A small number of candidates failed to state the route (either in terms of nodes or arcs) and therefore scored no marks on this section.

Part (d) proved slightly more challenging although a lot of succinct correct solutions were seen. Many candidates chose to delete T and calculate a new MST and add the two shortest from T, while it was rarer to recognise that they could subtract ST from their original MST and add the two shortest from T. Some candidates made errors by adding an incorrect arc to their RMST.

Question 3

This was an accessible question that most candidates scored well on. In part (a) most candidates did a quick sort successfully and scored at least three marks. Very few incorrectly used a bubble sort and only a few sorted into descending order. A very high majority selected the correct pivot for the first pass and then wrote the list as numbers less than the pivot, pivot, numbers greater than the pivot. Whilst most went onto complete the sort correctly, a small number of candidates accidently wrote a number, for example 5 rather than 56 which altered the question. The two most common mistakes were either changing the pivot from MR to ML or using a combination of MR and ML even within the same pass or altering the order of the numbers, while correctly writing 'numbers less than the pivot, pivot, numbers greater than the pivot' e.g. 18, 8, 12 became 8, 12, 18.

Part (b) was attempted by most candidates but not performed as well as the quick sort. There were a significant minority who only gained one mark due to not rejecting clearly or keeping the pivot. Another significant minority gained no marks as they chose the 6th value as the pivot. Most of those who completed the first pass successfully then continued with the second and third passes correctly, but a significant number did not compare 33 with 40 to gain full marks in this part of the question. A small number of candidates tried the search with the unsorted list and scored no marks. Further, a large number of candidates did not actually identify their pivot

or clearly show the rejected items. All of this suggests that candidates are, as a whole, less proficient at this standard algorithm than ideal.

Part (c) was done very well and on the whole candidates gained both marks. There were a small number who only had one side of the inequality, and some who incorrectly included 15 and 19. A very small number of candidates failed to combine the results to form a range of values.

Question 4

The majority of candidates gained at least six of the eight marks for this question. In part (a) it was rare for candidates to fail to show the working values and replace a larger one with a smaller one. Overwhelmingly candidates scored full or close to full marks applying Dijkstra's algorithm. There was some evidence of careless errors, with slips calculating working values or writing them down in an incorrect order. Where the first or second accuracy marks were lost some candidates at least recovered on the third follow through accuracy mark. Most then correctly found the fastest route and time, reading the latter off from their final value at H.

Part (b) was not well answered, often with no attempt made. The correct length of the new fastest route was 57, but 58 was a common incorrect answer. Candidates would be well advised to read the question carefully, as some of those who successfully found 57 stopped there, for just one mark, failing to get the second mark for comparing it with their answer from part (a) and calculating the difference.

Question 5

This proved to be quite a challenging question for many candidates, and completely correct solutions were quite rare. In part (a), maximise was sometimes omitted (this error seemed more prevalent than in previous series) or candidates tried to express this in words instead of algebra.

Part (b) was often completed correctly, with candidates taking care to show the steps in their working to achieve the given result.

In the first part of part (c) students who attempted it were usually able to write down an appropriate inequality using either a fraction or decimal, although this was not always simplified fully with integer coefficients. The second part was often completed successfully by those who attempted it, although there were some errors around the inequality sign and the coefficient of y and z with candidates confusing the 2 and 3.

Candidates with an appropriate inequality, even if not fully simplified, from the first part of part (c) usually scored the marks in part (d) rearranging their inequality to arrive at the given result. Some candidates did not make the substitution of $z = 30$ explicitly clear here and they must remember that, if a result is given in the question, they must show full clear working to demonstrate how this is obtained.

In part (e) attempting to draw the graph allowed most candidates to score at least one mark and often two marks as they managed to draw two correct lines, but often the third line lacked accuracy or was simply wrong. Apart from a few non-attempts, most students successfully drew $y = 20$ and made an attempt at some other line, obtaining the method mark. Getting both diagonal lines correct was rarer although still fairly common - probably the most frequent error was where $3x + 2y = 60$ was drawn instead of $3x – 2y = 60$. The final mark was fairly rare to see obtained: from candidates who had drawn the three lines correctly there were frequent errors both in identifying the correct feasible region and in giving the final answer in context.

Question 6

The route inspection in part (a) yielded surprisingly few full marks for candidates and also some blank pages. Although this variant has been examined previously a substantial minority of candidates failed to recognise the significance of starting from an even node, so incorrectly considered pairings from A, F, K and M. This was, as before, marked as a special case, but causing the loss of at least three of the five available marks. Of those with the correct three pairings of F, J, K and M, many lost one or more marks due to a wrongly calculated total, failing to write the necessary repeated sections of the route as individual arcs, or omitting them altogether, or failing to state their route length.

In part (b) many did attempt to find a new route but either did not add the length of the new road (18) to the total or incorrectly calculated KM (14). Of those who found the correct length

(370) or the new added length (32) many then omitted to find the difference from their earlier answer.

Question 7

This long Critical Path Analysis question proved to be accessible to the majority of candidates, with the exception of the final part.

In part (a) the first 2 marks were generally awarded, with most errors being for Activity L, where candidates only gave two IPA.

In part (b) many candidates were awarded either 3 or 4 marks. A frequent error was after B the late time was given as 13 not 12. On the whole values generally increased in the direction of the arrows, and decreasing in the opposite direction of the arrows, so it was very rare to lose the M marks.

Part (c) was mainly answered correctly. There were a few examples where candidates divided by an incorrect value, but most summed the duration of the activities to obtain 96 and then divided by their finishing time. A small number then did not give 4 as the lower bound for the minimum number of workers. Some candidates seemed to try do a short scheduling of activities with no diagram and achieved no marks.

In part (d) most candidates attempted to draw a Gantt chart and, despite the common error in part (b) of 13 instead of 12, many candidates who had made this error recovered here and most candidates scored at least two marks. Common errors were having A in the critical path (and losing two marks) or omitting an activity out (commonly H) or getting one or two floats wrong (and usually losing one mark). There were a small number of candidates who drew a schedule rather than a Gantt chart, but this was rare.

Part (e) was extremely demanding as a twist on the typical "how many workers" question, with a fully correct answer requiring consideration of two time intervals. Candidates very rarely

achieved a fully correct response, and the modal score was zero with only a small proportion even scoring one mark. Most candidates thought four workers were sufficient and frequently chose a time between $14 < t < 16$ for this. A small proportion gave the correct 5 workers, scoring 1 mark, but almost no candidates found a correct time for either of these instances, much less both. It was surprising that the mark allocation did not make candidates realise there was more to this part than the normal type of question.

Question 8

As this was the final question it was pleasing to see most candidates making an attempt, often with some degree of success, especially in parts (a) and (b). However, examiners saw some evidence of candidates running out of time, indicated by answers stopping abruptly in the middle of a partial correct solution.

Part (a) was generally well done, with many candidates scoring both marks for four correct constraints. However, it was not uncommon to see a mistake in the direction of one inequality, usually either $y \leq 2x + 5$ or $2x + y \leq 70$. It was rare to see the loss of a mark due to strict inequalities. Some candidates unnecessarily rearranged inequalities, which sometimes resulted in the introduction of sign errors.

Many candidates successfully solved the correct pairs of simultaneous equations in (b) to determine the coordinates of the maximum and minimum points. They then went on to set up simultaneous equations to determine the coefficients in the objective function. Candidates should ideally be able to confidently use calculators with functionality to solve simultaneous equations. Many did so, producing neat concise solutions, simply writing down the equations to be solved and their exact solutions. It must be emphasised that there is no longer any requirement to show full written working, and those who did so wasted time and often made mistakes in their calculations.

Only the more able candidates were able to attempt (c) and only the most able gained all four marks. Credit was given through method marks, to those who demonstrated an appropriate method of comparison, but confused the direction of their inequality. Perhaps due to time pressures, some solutions were muddled and contradictory. Candidates who found the coordinates for further points and compared the objective function, at A & E and C & D, were more likely to score full marks then those who attempted to compare k or -1/k. However, a

good many irrelevant pairings were often seen, in particular A & C. Those who compared k or -1/k with coefficient of *y* or the gradient, respectively, in the relevant line equation, more often than not had their inequality sign(s) in the wrong direction. Many struggled with poor algebraic manipulation of the inequalities involving negatives and reciprocals. However a pleasing number of candidates did achieve the correct range of values.

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