

Mark Scheme (Results)

June 2011

GCE Decision D1 (6689) Paper 1

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EDEXCEL GCE MATHEMATICS

General Instructions for Marking

1. The total number of marks for the paper is 75.
2. The Edexcel Mathematics mark schemes use the following types of marks:
 - M marks: method marks are awarded for 'knowing a method and attempting to apply it', unless otherwise indicated.
 - A marks: Accuracy marks can only be awarded if the relevant method (M) marks have been earned.
 - B marks are unconditional accuracy marks (independent of M marks)
 - Marks should not be subdivided.

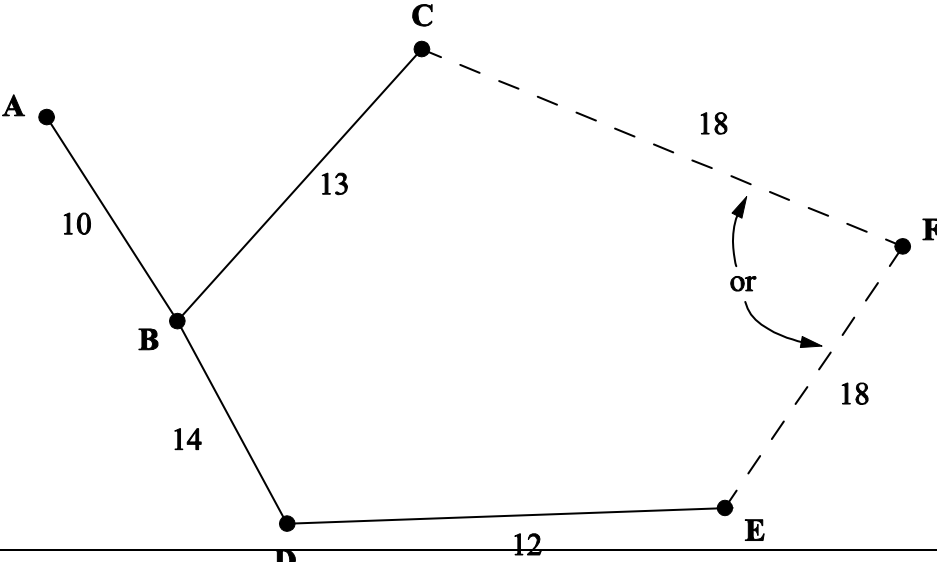
3. Abbreviations

These are some of the traditional marking abbreviations that will appear in the mark schemes and can be used if you are using the annotation facility on ePEN.

- bod – benefit of doubt
- ft – follow through
- the symbol \checkmark will be used for correct ft
- cao – correct answer only
- cso - correct solution only. There must be no errors in this part of the question to obtain this mark
- isw – ignore subsequent working
- awrt – answers which round to
- SC: special case
- oe – or equivalent (and appropriate)
- dep – dependent
- indep – independent
- dp decimal places
- sf significant figures
- * The answer is printed on the paper
- \square The second mark is dependent on gaining the first mark

June 2011
 Decision Mathematics D1 6689
 Mark Scheme

Question Number	Scheme	Marks
1. (a)	The list is not in alphabetical order.	B1 (1)
(b)	E.g. A Quick sort J M C B T H K R G F H C B G F H J M T K R G T C B F G H J M K R T B K B C F G H J K M R T F R B C F G H J K M R T F R Sort complete + named correctly	M1 A1 A1 A1=B1 (4)
(c)	$\text{Pivot 1} = \left[\frac{1+10}{2} \right] = 6 \text{ Jenny reject } 1 - 6$ $\text{Pivot 2} = \left[\frac{7+10}{2} \right] = 9 \text{ Richard reject } 9 - 10$ $\text{Pivot 3} = \left[\frac{7+8}{2} \right] = 8 \text{ Merry reject } 8$ Pivot 4 = 7 Kim - name found	M1 A1 A1ft A1 (4) 9
(a) B1 (b) M1 1A1 2A1 3A1=2B1 (c) M1 1A1 2A1 3A1	Notes: (a) B1 CAO – phonetically close (b) M1 Quick sort – pivots, p, selected and first pass gives <p, p, >p. 1A1 First two passes correct, pivots chosen consistently for third pass 2A1 CAO Sort completed correctly 3A1=2B1 ‘Stop’ + plus correct name for their sort – phonetically close (c) M1 Using their ‘sorted list’ + choosing middle right pivots+ discarding/retaining half the list. If their list is not in full alphabetical order M1 only. 1A1 First pass correct ie 6 th item for a correct list (no sticky pivots) 2A1 Second and third passes correct ie 9 th and 8 th items from a correct list (no sticky pivots) 3A1 CSO search complete + ‘found’	

Question Number	Scheme	Marks
2. (a)(i) (a)(ii)	A tree is a connected graph with no cycles/circuit A minimum spanning tree is a tree that contains all vertices and the total length of its arcs (weight of tree) is as small as possible.	B1 B1 B1 (3)
(b)	AB, DE, BC; $\left\{ \begin{array}{l} \text{reject AC} \\ \text{BD} \end{array} \right\}$ reject BE, reject CE, use either EF or CF	M1; A1 A1 (3)
(c)		B1 (1)
(d)	No, there are two solutions since either EF or CF should be used.	B1 (1) 8
(a)1B1 2B1 3B1 (b)M1 1A1 2A1 (c)B1 (d)B1	Notes Connected + no cycles Contains all vertices Total length of arcs used minimised or minimum weight. (Not shortest/smallest etc.) First four arcs selected correctly in correct order. Arcs selected correctly at correct time Rejections correct and at correct time CAO CAO - mark explanation must specify two arcs of 18 or two 18's or ref to EF and CF	

Question Number	Scheme	Marks
4. (a)	[Given $A - 3 = R - 4 = C - 5$] $A - 1 = H - 2$ $A - 1 = H - 3 = R - 4 = C - 5$	M1 A1 A1 (3)
(b)	$A = 3, C = 5, H = 1, (J \text{ unmatched}), R = 4$	B1 (1)
(c)	Alternating path : $J - 4 = R - 3 = A - 1 = H - 2$ Change status : $J = 4 - R = 3 - A = 1 - H = 2$ $A = 1, C = 5, H = 2, J = 4, R = 3$	M1 A1 A1 (3) 7
(a)M1 1A1 2A1 (b)B1 (c)M1 1A1 2A1	Notes Path from A to 2 or 5 - or vice versa One correct path selected OR tree showing the missing two paths only. Both correct paths listed separately CAO Path from J to 2 - or vice versa Correct path including change status CAO must follow through from stated path.	

Question Number	Scheme	Marks
5. (a)	$AC + DF = 9 + 13 = 22 \leftarrow$ $AD + CF = 16 + 8 = 24$ $AF + CD = 17 + 7 = 24$ Repeat arcs AC, DG and GF	M1 A1 A1 A1 A1ft (5)
(b)	E.g. ADCACGDGFGECBEFBA Length of route = $98 + 22 = 120$ (km)	B1 B1ft (2)
(c)	CF (8) is the shortest link between 2 odd nodes excluding D Repeat CF (8) since this is the shortest path excluding D. We finish at A Length of route = $98 + 8 = 106$ (km)	M1 A1ft A1ft (3) 10
(a)M1 1A1 2A1 3A1 4A1ft (b)1B1 2B1ft (c)M1 1A1ft 2A1ft	Notes Three pairings of their four odd nodes One row correct including pairing and total Two rows correct including pairing and total Three rows correct including pairing and total Their smallest repeated arcs stated accept DGF or arcs clear from selected row. Correct route any start point, 17 nodes, AC, DG and GF repeated CAO 98 + their least out of a choice of at least 2. Attempting just one repeated path excluding D; accept AC, AF and CF listed A and their least repeat [should be CF (CEF)] clearly stating this as least 98 + their least from their working in (a)	

Question Number	Scheme	Marks
<p>6. (a)</p>	<p>ACDFEGH Length 71 (km)</p>	<p>M1 A1 (ABCD)</p> <p>A1ft (EF)</p> <p>A1ft (GH)</p> <p>A1 A1ft (6)</p>
<p>(b)</p>	<p>E.g. $71 - 12 = 59$ GH $49 - 10 = 39$ FE $24 - 13 = 11$ CD $59 - 10 = 49$ EG $39 - 15 = 24$ DF $11 - 11 = 0$ AC Or Trace back from H including arc XY if (Y already lies on the path and) the difference of the final values of X and Y equals weight of arc XY.</p>	<p>B2,1,0 (2)</p>
<p>(c)</p>	<p>ACBEGH Length 72 (km)</p>	<p>B1 B1 (2) 10</p>
<p>(a)M1 1A1 2A1ft 3A1ft 4A1 5A1ft (b)1B1 2B1 (c)1B1 2B1</p>	<p>Notes Big replaced by smaller at least once at B or D or E or G or H A, B, C, D boxes all correct, condone lack of 0 in 's working value E and F ft correctly G and H ft correctly CAO ft on their final value. Attempting an explanation, at least 3 stages or one half of general explanation Correct explanation – all six stages, both halves of explanation CAO CAO</p>	

Question Number	Scheme	Marks																														
7. (a)	<table border="1"> <thead> <tr> <th>Activity</th> <th>Preceded by</th> <th>Activity</th> <th>Preceded by</th> <th>Activity</th> <th>Preceded by</th> </tr> </thead> <tbody> <tr> <td>(A)</td> <td>(-)</td> <td>E</td> <td>A B</td> <td>I</td> <td>C D E</td> </tr> <tr> <td>(B)</td> <td>(-)</td> <td>(F)</td> <td>(B)</td> <td>J</td> <td>C D E</td> </tr> <tr> <td>C</td> <td>A B</td> <td>(G)</td> <td>(B)</td> <td>K</td> <td>F H I</td> </tr> <tr> <td>(D)</td> <td>(B)</td> <td>H</td> <td>C D</td> <td>L</td> <td>F G H I</td> </tr> </tbody> </table>	Activity	Preceded by	Activity	Preceded by	Activity	Preceded by	(A)	(-)	E	A B	I	C D E	(B)	(-)	(F)	(B)	J	C D E	C	A B	(G)	(B)	K	F H I	(D)	(B)	H	C D	L	F G H I	B3,2,1,0 (3)
Activity	Preceded by	Activity	Preceded by	Activity	Preceded by																											
(A)	(-)	E	A B	I	C D E																											
(B)	(-)	(F)	(B)	J	C D E																											
C	A B	(G)	(B)	K	F H I																											
(D)	(B)	H	C D	L	F G H I																											
(b)		M1 A1 M1 A1 (4)																														
(c)	Critical activities are B D J H L	M1 A1 (2)																														
(d)		M1 A1 M1 A1 (4)																														

Question Number	Scheme	Marks
8.	Let x be the number of type A radios and y be the number of type B radios. (Maximise $P =$) $15x + 12y$ Subject to $x \geq 50$ $\frac{1}{5}(x + y) < x$ (accept \leq) [$y < 4x$] $\frac{2}{3}(x + y) > x$ (accept \geq) [$2y > 3x$] $3x + 2y \leq 200$ $y \geq 0$	B1 B1 B1 B1 B1 B1 7
1B1 2B1 3B1 4B1 5B1 6B1 7B1	Notes Defining x and y ; Must see 'number of' CAO objective function $15x + 12y$ CAO $x \geq 50$ CAO o.e $\frac{1}{5}(x + y) < x \Rightarrow y < 4x$ CAO o.e $\frac{2}{3}(x + y) > x \Rightarrow 2y > 3x$ CAO o.e $3x + 2y \leq 200$ CAO $y \geq 0$	

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