

Mark Scheme (Results)

June 2011

GCE Decision D1 (6689) Paper 1

Edexcel is one of the leading examining and awarding bodies in the UK and throughout the world. We provide a wide range of qualifications including academic, vocational, occupational and specific programmes for employers.

Through a network of UK and overseas offices, Edexcel's centres receive the support they need to help them deliver their education and training programmes to learners.

For further information, please call our GCE line on 0844 576 0025, our GCSE team on 0844 576 0027, or visit our website at www.edexcel.com.

If you have any subject specific questions about the content of this Mark Scheme that require the help of a subject specialist, you may find our Ask The Expert email service helpful.

Ask The Expert can be accessed online at the following link: http://www.edexcel.com/Aboutus/contact-us/

June 2011
Publications Code UA027669
All the material in this publication is copyright
© Edexcel Ltd 2011



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 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
- 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 C B G F H J M T K R G T C B F G H J M K R T B C F G H J K M R T Sort complete + named correctly	M1 A1 A1 A1 A1=B1 (4)
(c)	Pivot $1 = \left[\frac{1+10}{2}\right] = 6$ Jenny reject 1 - 6 Pivot $2 = \left[\frac{7+10}{2}\right] = 9$ Richard reject 9 - 10 Pivot $3 = \left[\frac{7+8}{2}\right] = 8$ Merry reject 8 Pivot $4 = 7$ Kim - name found	M1 A1 A1ft A1 (4)
(a) B1 (b) M1 1A1 2A1 3A1=2B1 (c) M1 1A1 2A1 3A1	Quick sort – pivots, p, selected and first pass gives <p, p,="">p. First two passes correct, pivots chosen consistently for third pass CAO Sort completed correctly</p,>	

1

GCE Decision Mathematics D1 (6689) June 2011



		changing lives
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; $\left\{ \begin{array}{c} \text{reject AC} \\ \text{BD} \end{array} \right\}$ reject BE, reject CE, use either EF or CF	M1; A1 A1 (3)
(c)	C 18 13 F or 18 14	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	



	advancing learning,	changing lives
Question Number	Scheme	Marks
3. (a)	$6x + 5y \le 60$ $2x + 3y \ge 12$ $3x \ge 2y$ $x \le 2y$	B2,1,0 (2)
(b)	Drawing objective line{ (0,3) (1,0)} Testing at least 2 points Calculating optimal point Testing at least 3 points $\left(7\frac{1}{17}, 3\frac{9}{17}\right) = \left(\frac{120}{17}, \frac{60}{17}\right) \approx (7.06, 3.53)$	M1 A1 DM1 A1 awrt
(c)	$24\frac{12}{17} = \frac{240}{17} \approx 24.7$ (awrt)	B1 (1)
(d)	(6,4)	B1 (1) 8
Notes:	$ (3\frac{3}{7}, 1\frac{5}{7}) = (\frac{24}{7}, \frac{12}{7}) \approx (3.43, 1.71) \to 12 $ $ (1\frac{11}{13}, 2\frac{10}{13}) = (\frac{24}{13}, \frac{36}{13}) \approx (1.85, 2.77) \to 8.3 \ 07692 \ (8\frac{4}{13} = \frac{108}{13}) $ $ (4\frac{4}{9}, 6\frac{2}{3}) = (\frac{40}{9}, \frac{20}{3}) \approx (4.44, 6.67) \to 20 $ $ (7\frac{1}{17}, 3\frac{9}{17}) = (\frac{120}{17}, \frac{60}{17}) \approx (7.06, 3.53) \to 24.705882 \ (24\frac{12}{17} = \frac{420}{17}) $	
(a)1B1 2B1 (b)1M1 1A1 2DM1 2A1 (c)B1 (d)B1	Notes Any two inequalities correct, accept < and > here (but not = of course). All four correct. Must be ≤ and ≥ here Drawing objective line or its reciprocal OR testing two vertices in the feasible region (see list above) points correct to 1 dp. Correct objective line OR two points correctly tested (1 dp ok) Calculating optimal point either answer to 2 dp or better or using S.E's (correct 2 equations for their point + attempt to eliminate one variable.); OR Testing three points correctly and optimal one to 2dp. CAO 2 dp or better. CAO CAO not (4,6).	



Scheme [Given $A - 3 = R - 4 = C - 5$]	Marks
[Given $A = 3 - P = 4 - C = 5.1$	
A-1=H-2 A-1=H-3=R-4=C-5	M1 A1 A1 (3)
A = 3, C = 5, H = 1, (J unmatched), R = 4	B1 (1)
Alternating path: $J-4=R-3=A-1=H-2$ Change status: $J=4-R=3-A=1-H=2$	M1 A1
$A = 1, C = 3, \Pi = 2, J = 4, R = 3$	(3)
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.	7
	A = 3,C = 5, H = 1, (J unmatched), R = 4 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 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



Question	dovations team	ling, changing lives
Number	Scheme	Marks
5. (a) (b)	$AC + DF = 9 + 13 = 22 \leftarrow$ $AD + CF = 16 + 8 = 24$ $AF + CD = 17 + 7 = 24$ Repeat arcs AC, DG and GF E.g. ADCACGDGFGECBEFBA Length of route = $98 + 22 = 120(km)$	M1 A1 A1 A1 A1ft (5) B1 B1ft
	Length of Toute = 76 + 22 = 120 (km)	(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)
(a)M1 1A1 2A1 3A1 4A1ft (b)1B1 2B1ft (c)M1 1A1ft 2A1ft	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	



Г	advancing learning	g, changing lives
Question Number	Scheme	Marks
6. (a)	B 3 21 43 G 7 59 25 21 A 1 0 C 2 11	M1 A1 (ABCD) A1ft (EF) A1ft (GH) A1 A1ft (GH)
(b)	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.	B2,1,0
(c)	ACBEGH Length 72 (km)	B1 B1 (2) 10
(a)M1 1A1 2A1ft 3A1ft 4A1 5A1ft (b)1B1 2B1 (c)1B1 2B1	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	



Question Number	Scheme	Marks
7. (a)	Activity Proceeded by Activity Proceeded by Activity Proceeded 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)
(b)	A (4) 8 C (4) I (3) J (10) 12 H (4) 16 C (5) B (7) T G (4) L (6)	M1 A1 M1 A1 (4)
(c)	Critical activities are B D J H L	M1 A1 (2)
(d)	0 2 4 6 8 10 12 14 16 18 20 22 24 B	M1 A1 M1 A1 (4)



Question Number	Scheme	Marks
(e)	E.g. Between time 7 and 16, 3 workers could do 3 x 9 = 27 days work. Activities C, D, E, F, G, H, I and 4 days of J need to be done This totals 31 days work. So it is not possible to complete the project with three workers. OR If three workers are used three activities H, J and I need to happen at time 13.5, this reduces the float on F and G, meaning that at 10.5 D, C, F and G need to be happening. Our initial assumption is incorrect hence four workers are needed.	B3,2,1,0 (3) 16
(a)1B1 2B1 3B1 (b)1M1 1A1 2M1 (c)M1 A1 (d)1M1 1A1 2M1 2A1 (e)1B1 3B1	Any four rows correct All seven rows correct All top boxes complete, values generally increasing left to right, condone one rogue CAO All bottom boxes complete, values generally decreasing R to L, condone one rogue CAO Accept dummies, repeats and condone one absence or one extra; or BDHL or BDJ CAO (dummies and repeats ok) At least 9 activities including at least 4 floats. Do not accept scheduling diagram. Critical activities dealt with correctly All 12 activities including at least 7 floats Non-critical activities dealt with correctly. Attempt at explanation – one correct idea. Good explanation, some imprecise or vague statements – give bod	



Number 8.	Let <i>x</i> be the number of type A radios and y be the number of type B radios.	D1
		B1
	(Maximise $P = 15x + 12y$	B1
	Subject to	
	$x \ge 50$	B1
	$\frac{1}{5}(x+y) < x (\text{accept } \le) \left[y < 4x \right]$	B1
	$\frac{2}{5}(x+y) > x (\text{accept } \ge) \left[2y > 3x\right]$	B1
	$3x + 2y \le 200$	B1
	$y \ge 0$	B1
		7
	Notes	
1B1	Defining x and y; Must see 'number of'	
2B1	CAO objective function $15x+12y$	
3B1 4B1	CAO $x \ge 50$ CAO o.e $\frac{1}{5}(x+y) < x \Rightarrow y < 4x$	
	CAO o.e $\frac{2}{3}(x+y) > x \Rightarrow 2y > 3x$	
6B1	CAO o.e $3x + 2y \le 200$	
7B1	CAO $y \ge 0$	



Question Number	Scheme	Marks
Q1 b	Additional solutions Quick sort middle left	
	J M C B T H K R G F T H K R G F T H	M1
	CBGFHJMKRT BM BCGFHJKMRT GJ	A1
	B C F G H J K M R T B C F G H J K M R T Quick sort complete	A1 A1
	Bubble sort left to right	
	J M C B T H K R G F J C B M H K R G F T Tin place, consistent direction	M1
	C B J H K M G F R T B C H J K G F M R T B C H J G F K M R T B C H G F J K M R T	A1
	B C G F H J K M R T B C F G H J K M R T Bubble sort complete Sort named correctly + 'stop'	A1 A1
	Bubble right to left	
	J M C B T H K R G F B J M C F T H K R G B C J M F G T H K R	M1
	B C F J M G H T K R B C F G J M H K T R Passes 1 and 2 correct	A1
	B C F G H J M K R T B C F G H J K M R T Sort correct Bubble sort complete sort named correctly + 'stop'	A1 A1
	Sorting into reverse alphabetical order – this is acceptable	
	e.g. Quick sort middle right	
	JMCBTHKRGF JMTKRHCBGFTG	M1
	J M T K R H C B G F T G T J M K R H G C B F K B T M R K J H G C F B R F T R M K J H G F C B	A1
	T R M K J H G F C B Quick sort complete	A1 A1

Further copies of this publication are available from Edexcel Publications, Adamsway, Mansfield, Notts, NG18 4FN

Telephone 01623 467467

Fax 01623 450481

Email <u>publication.orders@edexcel.com</u>

Order Code UA027669 June 2011

For more information on Edexcel qualifications, please visit www.edexcel.com/guals

Pearson Education Limited. Registered company number 872828 with its registered office at Edinburgh Gate, Harlow, Essex CM20 2JE





