A-LEVEL
MATHEMATICS
Decision 1 – MD01
Mark scheme

6360
June 2014

Version/Stage: 1.0 Final

Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all associates participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every associate understands and applies it in the same correct way. As preparation for standardisation each associate analyses a number of students' scripts: alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Assessment Writer.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

Further copies of this Mark Scheme are available from aqa.org.uk

Key to mark scheme abbreviations

M	mark is for method
m or dM	mark is dependent on one or more M marks and is for method
A	mark is dependent on M or m marks and is for accuracy
B	mark is independent of M or m marks and is for method and accuracy
E	mark is for explanation
√or ft or F	follow through from previous incorrect result
CAO	correct answer only
CSO	correct solution only
AWFW	anything which falls within
AWRT	anything which rounds to
ACF	any correct form
AG	answer given
SC	special case
OE	or equivalent
A2,1	2 or 1 (or 0) accuracy marks
–*x* EE	deduct *x* marks for each error
NMS	no method shown
PI	possibly implied
SCA	substantially correct approach
c	candidate
sf	significant figure(s)
dp	decimal place(s)

No Method Shown

Where the question specifically requires a particular method to be used, we must usually see evidence of use of this method for any marks to be awarded.

Where the answer can be reasonably obtained without showing working and it is very unlikely that the correct answer can be obtained by using an incorrect method, we must award **full marks**. However, the obvious penalty to candidates showing no working is that incorrect answers, however close, earn **no marks**.

Where a question asks the candidate to state or write down a result, no method need be shown for full marks.

Where the permitted calculator has functions which reasonably allow the solution of the question directly, the correct answer without working earns **full marks**, unless it is given to less than the degree of accuracy accepted in the mark scheme, when it gains **no marks**.

Otherwise we require evidence of a correct method for any marks to be awarded.

<table>
<tr><th>Q</th><th>Solution</th><th>Mark</th><th>Total</th><th>Comment</th></tr>
<tr><td>1(a)</td><td>
<table>
<tr><td></td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr>
<tr><td>A</td><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td></tr>
<tr><td>B</td><td>1</td><td>1</td><td>1</td><td>0</td><td>0</td></tr>
<tr><td>C</td><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td>D</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td></tr>
<tr><td>E</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td></tr>
</table>
</td><td>M1

A1</td><td>

2</td><td>5x5 matrix with some 0's, 1's oe
(or transpose)

This diagram (or transpose), including labelling.</td></tr>
<tr><td>(b)(i)</td><td>Ignore paths that do not lead to a complete match.
For all paths, the order may start from 1 and/or 5.
Initial path MUST have only 4 'terms'
Correct 4 term path
Correct pair of paths (order is only important if second path has 6 terms)
$D-2+B-1$ and $E-4+C-5$
$D-2+B-1$ then $E-2+D-4+C-5$
$E-4+C-5$ then $D-4+E-2+B-1$

Match - must be stated and not simply 'shown' on a diagram
A3, B1, C5, D2, E4
or
A3, B1, C5, D4, E2</td><td>M1
A1

B1</td><td>

3</td><td>Or,
$D-4+C-5$ and $E-2+B-1$
$D-4+C-5$ then $E-4+D-2+B-1$
$E-2+B-1$ then $D-2+E-4+C-5$

If a candidate works on diagrams, then the marks can be earned, BUT only one path per diagram (2 paths on 1 diagram scores M0).
The start vertex and path must be clear and correct to score M1.
The start vertex and path on a second diagram must be clear and correct to score A1.</td></tr>
<tr><td>(ii)</td><td>Match - must be stated and not simply 'shown' on a diagram
Match A3, B1, C5, D4, E2
or
A3, B1, C5, D2, E4</td><td>B1</td><td>1</td><td></td></tr>
<tr><td></td><td>Total</td><td></td><td>6</td><td></td></tr>
</table>

<table>
<tr><th>Q</th><th>Solution</th><th>Mark</th><th>Total</th><th>Comment</th></tr>
<tr><td>2(a)(i)</td><td>

	4	1	2	3	(7)	5	6
	D	*E*	*F*	*G*	*H*	*I*	*S*
D	-	120	140	80	170	140	140
E	120	-	70	80	130	130	110
F	140	70	-	90	190	85	90
G	80	80	90	-	110	100	100
H	170	130	190	110	-	140	150
I	140	130	85	100	140	-	60
S	140	110	90	100	150	60	-

</td><td>M1

A1

A1

A1

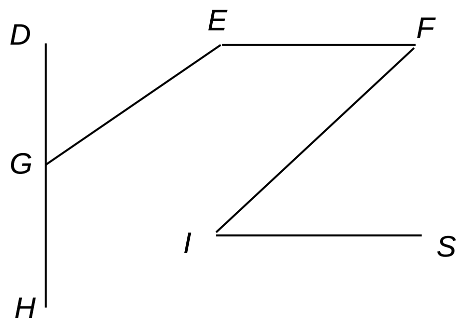
B1</td><td>

5</td><td>Some (just) rows or (just) cols crossed out, with some values circled/highlighted

Any 6 values circled/highlighted/listed seen either in table or body of script

First 3 correct,
EF or FE, EG or GE, GD or DG, identified
AND E, F, G numbered (1, 2, 3 or (0), 1, 2)
(if <u>no</u> numbering on table, accept order if clearly shown by a correct list)

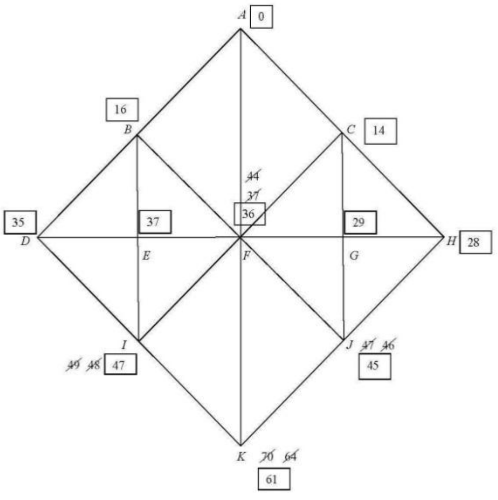
All correct or fully correct transpose (numbering may be as first A mark, if <u>no</u> numbering on table, accept order if clearly shown by a correct list, condone omission of 7 at H. Condone row (or col) H not crossed out.)

Correct edges (not lengths), either listed or values circled/highlighted seen either in table or body of script</td></tr>
<tr><td>(ii)</td><td>485</td><td>B1</td><td>1</td><td></td></tr>
<tr><td>(iii)</td><td>
</td><td>M1

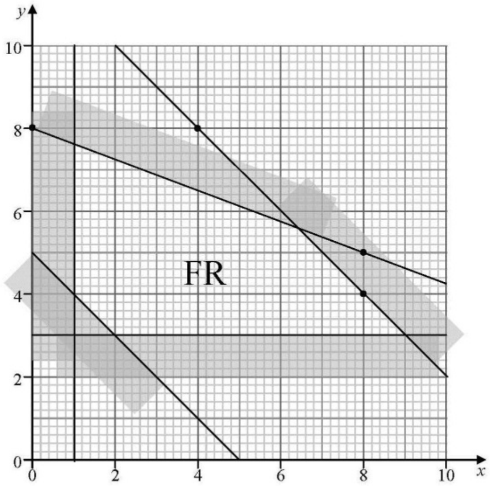
A1</td><td>

2</td><td>ST with 7 vertices and 6 edges

Correct including labelling</td></tr>
<tr><td>(b)(i)</td><td>IF (FI), IS (SI)</td><td>B1, B1</td><td></td><td>Must be in this order
If only 1 edge given then ‘last/2nd last’ must be clearly stated</td></tr>
<tr><td>(ii)</td><td>IF (FI), GH(HG)</td><td>B1</td><td>3</td><td>Must be in this order
(SC1 if B0 scored in part (i) and (ii), and ONLY IS given for part(i) and GH for part (ii).)</td></tr>
<tr><td></td><td>Total</td><td></td><td>11</td><td></td></tr>
</table>

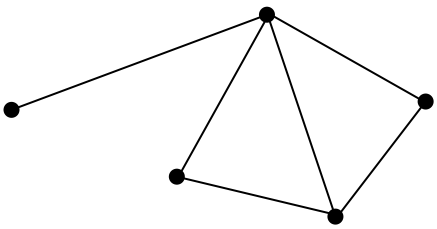
Q	Solution	Mark	Total	Comment
3 (a)(i)		M1 A1 m1 m1 A1 B1	 **6**	Use of Dijkstra, 2+ values at *F* Values of 44, 37, 36 only at *F* 3 values at *I* 3 values at *J* All correct, including cancelling and boxing. (condone omission of 0 at *A*) Final value at *K* is 61 (diagram takes precedence over value in body of script) (**Notation:** accept correct alternative notation eg 3 ‘box’ method etc) *If working from K to A:* M1 2 values at *F* A1 values of 34 and 26 at *F* m1 2 values at *A* m1 only one value at every other vertex A1 as above, B1 final value at *A* is 61
(ii)	*ABEIK*	B1	**1**	Or reverse Condone *AB*, *BE*, *EI*, *IK*
(b)	63 (mins) oe	B1	**1**	
(c)	64 (mins) oe *ABFJK*	B1 B1	 **2**	 Or reverse
	Total		**10**	

Q	Solution	Mark	Total	Comment
4(a)	AC + EG = (6 +9.5) = 15.5 AE + CG = 11 + 12.5 or 23.5 AG + CE = (7 + 8) = 15 79.5 + their min total = 94.5	M1 A2,1,0 m1 A1 cso	 **5**	These 3 sets of pairs stated All 3 correct, 2 correct PI by their final answer (if M0 scored then 94.5 scores SC2)
(b)(i)	2	B1		
(ii)	3	B1	**2**	
(c)(i)	79.5 + their min edge = 85.5	M1 A1		PI by their final answer (must have 6 ‘values’ in part (a)) If M0 scored then 85.5 scores 2/2
(ii)	*E*,*G*	B1	**3**	
	Total		**10**	

Q	Solution	Mark	Total	Comment
5				Accuracy: All lines must be ruled, correct to within ½ small square both horizontally and vertically, at 'key' vertices, stated below. Ignore objective lines in part (a)
(a)	$x = 1,\ y = 3$ **and** $x + y = 5$ $x + y = 12$ $3x + 8y = 64$ Correct feasible region	B1 B1 M1 A1 B1	5	$x + y = 5$, correct at (0, 5) and (5, 0) Correct at (4, 8) and (8, 4) Line with 'correct' gradient (-0.5 to -0.3) passing through (0, 8). Correct at (8, 5) F.R. (a pentagon) **clearly identified** and labelled, must have scored previous 4 marks
(b)				If multiple vertices are listed then final answer must be clearly identified. For the second B1, the coordinates must be stated explicitly. (allow x=9, y=3 etc)
(i)	30, (9, 3)	B1, B1		
(ii)	29.6, (6.4, 5.6) oe	B1, B1		SC1 for 29 - 31, **AND** (6 - 7, 5 - 6)
(iii)	-15, (9, 3)	B1, B1	6	
	Total		11	

Q	Solution	Mark	Total	Comment
6(a)(i)	30	B1		
(ii)	20	B1	2	
(b)(i)	Quicker going via *L* oe	E1	1	*MLN* (= 236), allow 126 + 110
(ii)	932 (mins) isw	B1	1	
(iii)	*MLNLBLELM*	M1 A1	2	Any correct 'expansion' eg *MLN*, *NLB* or *BLE*
(iv)	Script takes precedence over working on table. *MBLNEM* or *MBLNLEM* 796 (mins)	 M1 m1 A1 A1 cso	 4	 Any tour starting and finishing at *M* Visits all vertices Correct order If M0 scored, then 796 scores SC2 If a candidate works only on a table M1 for 4 or 5 values circled m1 for 5 values circled, one per row/col A1 for correct values circled and order shown A1 for 796
	Total		10	

Q	Solution	Mark	Total	Comment
7	$4x+10y+10z \le 240$	M1		One correct inequality, PI by correct simplified inequalities
	$7x+14y+14z \le 210$ $14x+21y+28z \le 420$	A1		All 3 correct,(PI by correct simplified inequalities)
	(Leading to) $2x+5y+5z \le 120$ ISW $x+2y+2z \le 30$ ISW $2x+3y+4z \le 60$ ISW	 m1 A1		 Correctly simplifying one inequality All correct
	$x > y+z$ ISW $y \ge z$ ISW	B1 B1		OE, must have all coefficients as ±1 OE, must have all coefficients as ±1
	$y \ge \frac{15}{100}(x+y+z)$	M1		OE (but not 15%)
	(Leading to) $17y \ge 3x+3z$ ISW	 A1		 Any correct rearrangement involving integer coefficients eg $17y-3x-3z \ge 0$
	Total		8	

Q	Solution	Mark	Total	Comment
8(a)(i)	If x is even, there would be three odds Hence x is odd.	**M1** **A1**	 **2**	Or, Sum = $5x + 7$, must be even, M1 (so $5x$ must be odd), so x must be odd A1
(ii)	$x = 1$ (if only seen in part (i), this mark can be awarded if a correct graph is given in part (ii)) Graph **clearly having** 5 vertices and 5 or 6 edges Correct graph must **clearly** have 5 vertices, 6 edges and degree of vertices as 1, 2, 2, 3, 4	**B1** **B1** **B1**	 **3**	**eg** 
(b)(i)	(Min =) 0 (Max =) 9	**B1** **B1**	 **2**	
(ii)	(the degrees of the vertices must be 0, 1, 2…9) There would be an odd number of odds Impossible	 **E1** **E1**	 **2**	Or, If all different, then sum = 45 Impossible, as sum must be even Or, Degrees of 0 and 9 would occur, Impossible as ‘9’ would connect to the ‘0’
	Total		**9**	