GCE 2005
January Series

ASSESSMENT and QUALIFICATIONS ALLIANCE

Mark Scheme

Mathematics A
(MAD1)

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

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Key to Mark Scheme

M ..... mark is for ..... method
m ..... 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
AWFW ..... anything which falls within
AWRT ..... anything which rounds to
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)

Abbreviations used in Marking

MC – *x* ..... deducted *x* marks for mis-copy
MR – *x* ..... deducted *x* marks for mis-read
ISW ..... ignored subsequent working
BOD ..... given benefit of doubt
WR ..... work replaced by candidate
FB ..... formulae booklet

Application of Mark Scheme

No method shown:
Correct answer without working ..... mark as in scheme
Incorrect answer without working ..... zero marks unless specified otherwise

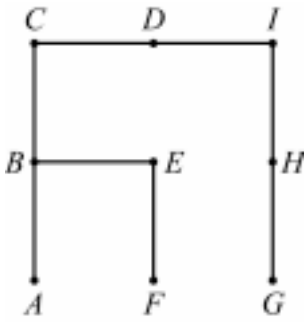
More than one method/choice of solution:

2 or more complete attempts, neither/none crossed out	mark both/all fully and award the mean mark rounded down
1 complete and 1 partial attempt, neither crossed out	award credit for the complete solution only

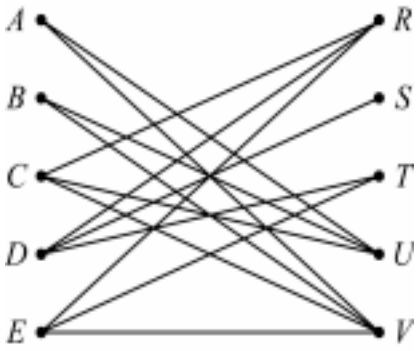
Crossed out work — do not mark unless it has not been replaced

Alternative solution using a correct or partially correct method — award method and accuracy marks as appropriate

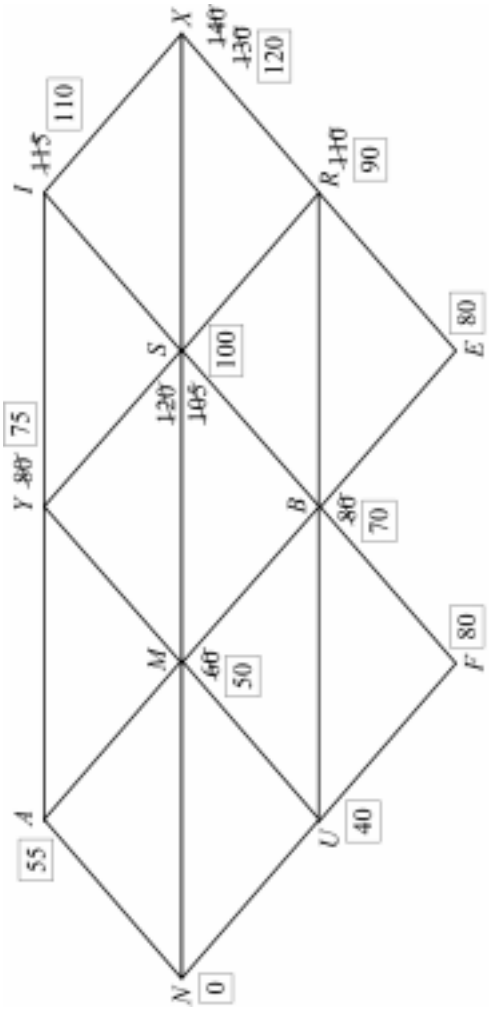
MAD1

Q	Solution	Marks	Total	Comments
1(a)	*AB* 8	M1		SCA
	IH 9	A1		HI second
	CD *10*			SC (Prims Max 3/6)
	EF 11			1(a) B1 8 edges
	BE 13			1(b) B1 107
	BC 14			1(c) B1 MST
	(not *AF)*			
	(not *DE*)	A1		May be implied
	DI 20			
	HG 22	A1	4	All correct
(b)	Total 107	B1	1	
(c)		B1F	1	(Must be 8 edges)
	Total		**6**	

MAD1 (cont)

Q	Solution	Marks	Total	Comments
2(a)		M1A1	2	
(b)	Initial Path			
	$A-U,\ B-V,\ D-R,\ E-T$	M1		Using initial match, starting from S or C
	$C-R+D\ -S$	A1		(or $S-D+R-C$)
	$\therefore$ Match			
	$(AU,\ BV,\ CR,\ DS,\ ET)$	B1	3	
(c)	S can only be with D			or 3 boys $ABC \neq$ 2 girls UV
	$\therefore$ Impossible	E1	1	
	Total		**6**	

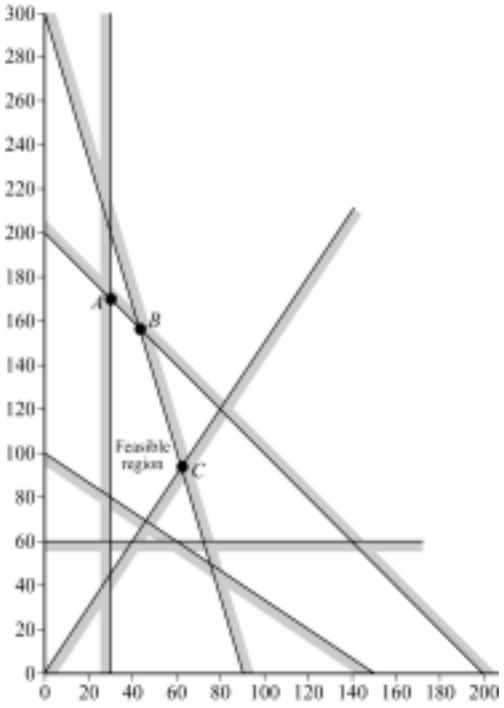
MAD1 (cont)

Q	Solution	Marks	Total	Comments
3(a)(i)		M1 A1 M1 M1 A1 B1	 6	SCA Correct at *M* 3 values at *S* 3 values at *X* *R* and *I* correct 120 at *X*
(ii)	Route *NUMBERSIX*	B1	1	or reverse order
(iii)	New min using *YIX* ∴ extra = 5	M1 A1	 2	Either route for 125 CAO
(b)	Odd vertices *N*, *A, I*, *X* Min *NA* + *IX* = 65 No other pairings quicker ∴ total time 790 (secs)	M1 A1 E1 B1	 4	
	Total		**13**	

MAD1 (cont)

Q	Solution	Marks	Total	Comments
4(a)(i)	*A G C V B A* = 13 + 5 + 4 + 9 + 11			
	= 42 (km)	B1	1	
(ii)	*A V C G B A*	M1		Tour
	8 4 5 11 11	M1		Visits all vertices
		A1		Correct order
	= 39(km)	B1	4	
(b)(i)	Delete *A*	M1		MST – 3 edges
	(4 + 5 + 9) (+ (8 + 10))	A1		Correct MST or (4 + 5 + 9) + 16 = 34
	= 36(km)	B1	3	
(ii)	Delete *G*	M1		MST – 3 edges
	(4 + 9 + 8) + (5 + 6)	A1		Correct MST or (4 + 9 + 8) + 10 = 31
	= 32(km)	B1	3	
(c)	$36 \leq T \leq 39$	B1FB1F	2	$34 \leq T \leq 39$ Their(max(b)) $\leq T \leq$ Their(min(a))
	Total		**13**	

MAD1 (cont)

Q	Solution	Marks	Total	Comments
5(a)	At least 30 & 60 In total $\leq$ 200	B1		
	Area $2x + 3y \geq 300$	B1		
	Cost $40x + 12y \leq 3600$ $10x + 3y \leq 900$	B1		
	y at least 150% x	B1	4	(strict)
(b)		B1 B1×4 B1	6	$x = 30$, $y = 60$ other lines region
(c)	$y \geq 60$	B1	1	
(d)	$P = 4x + 5y$ Max at A	M1		Considering extreme point(s)
	$x = 30$ $y = 170$	A1		
	$P = 970$	B1	3	
	Total		**14**	

MAD1 (cont)

Q	Solution	Marks	Total	Comments
6(a)	*N* *K* *A* (Print) 5 (10) 0 (20) 1 (30) 1 (40) (1) (50) 2 (60) 0 (30) 2 (40) (0) (50) 1 (60) 1 (30) 3 (40) (1) (50) 0 (60) Print 1, 0, 1	M1 A1 A1 A1	4	SCA 1st pass 2nd pass 3rd pass AG
(b)	*N* *K* *A* Print 11 0 1 1 1 5 Continues as above Print 1, 1, 0, 1	M1 A1	2	Trace starting with $N = 1$ CAO
(c)	$N = 40$ $K = 0, 1$ 20 $K = 2$ 10 $K = 3$ 5 $K = 4$ 2 $K = 5$ 1 $K = 6$	M1 A1	2	Trace starting with $N = 40$ CAO
	Total		**8**	
	Total		**60**	