ASSESSMENT and QUALIFICATIONS ALLIANCE

Mark scheme
January 2004

GCE

Mathematics A

Unit MAD1

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 mark 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		Perhaps implied
c		Candidate

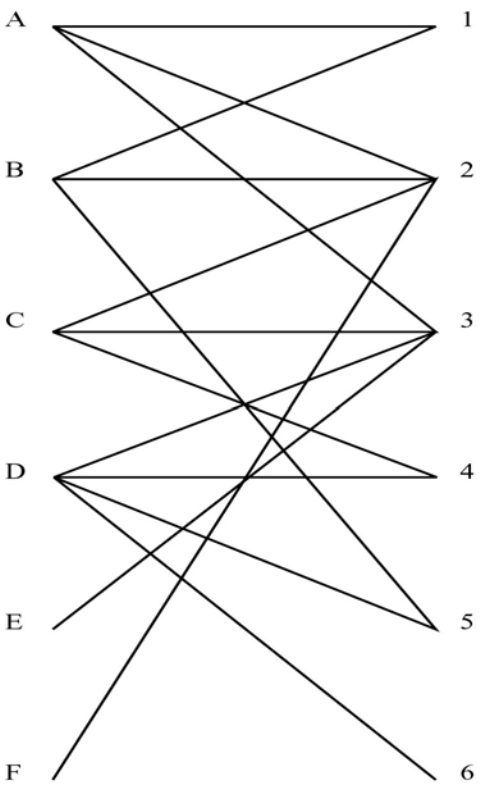
Abbreviations used in marking

MC – *x*	deducted *x* marks for miscopy
MR – *x*	deducted *x* marks for misread
ISW	ignored subsequent working
BOD	gave benefit of doubt
WR	work replaced by candidate

Application of mark scheme

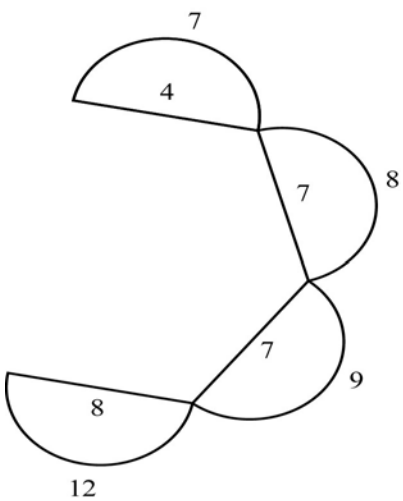
Correct answer without working	mark as in scheme
Incorrect answer without working	zero marks unless specified otherwise

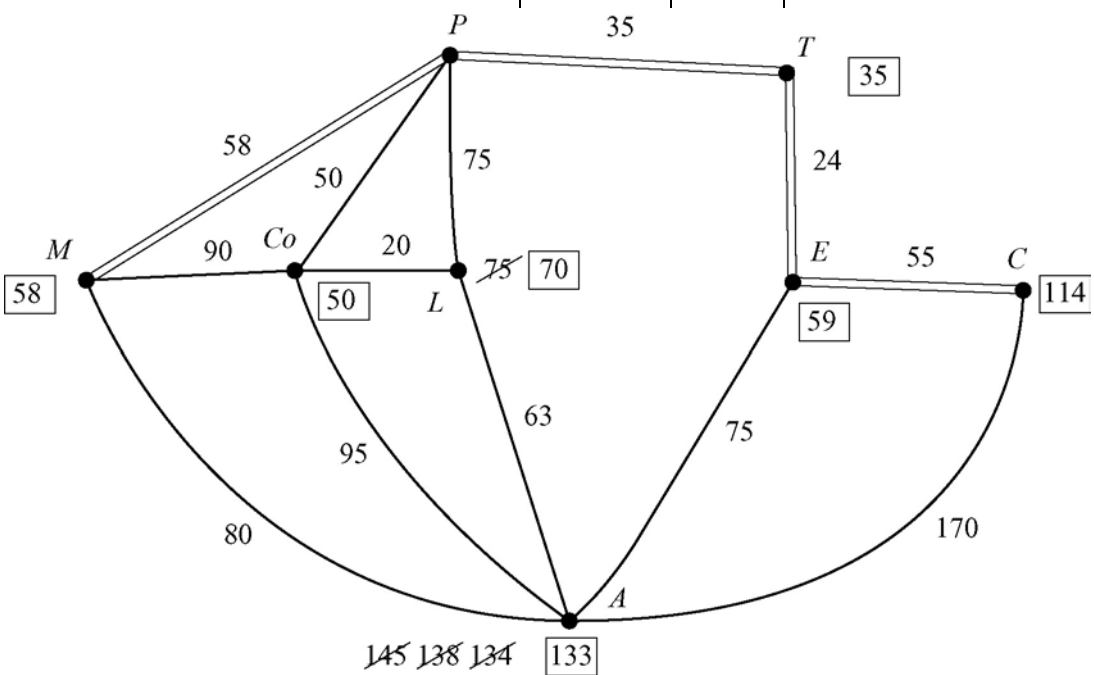
Award method and accuracy marks as appropriate to an alternative solution using a correct method or partially correct method.

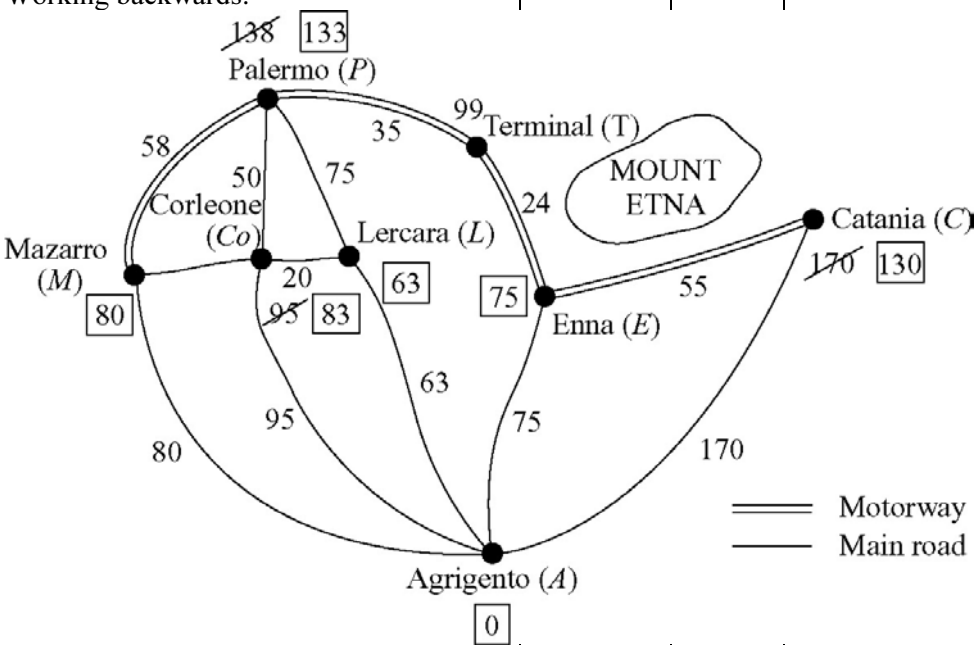
Q	Solution	Marks	Total	Comments
1 (a)		M1 A1	2	Bipartite graph
(b)	(Initial $A \to 2, B \to 1, C \to 3, D \to 4$)			
	$\left\{\begin{array}{l}\therefore\ E \to 3 \to C \to 2 \to A \to 1 \to B \to 5 \\ \quad \text{then}\ \ F \to 2 \to C \to 4\end{array}\right.$	M1A1 M1A1		1st path 2nd path
				or $\left\{\begin{array}{l}E \to 3 \to C \to 4 \to D \to 6 \quad \text{M1A1} \\ \text{then}\ F \to 2 \to A \to 1 \to B \to 5 \quad \text{M 1A1}\end{array}\right.$
				or $\left\{\begin{array}{l}F \to 2 \to A \to 3 \to C \to 4 \to D \to 6\ \text{M1A1} \\ \text{then}\ E \to 3 \to A \to 1 \to B \to 5 \quad \text{M1A1}\end{array}\right.$
	Match: A1, B5, C4, D6, E3, F2	B1	5	
		Total	**7**	
2	Odd vertices D and F	E1		} May be implied
	Repeat x or 13 (or DF)	B1		
	$\therefore 2x + 82 = 100$	M1		
	$x = 9$	A1	4	
		Total	**4**	

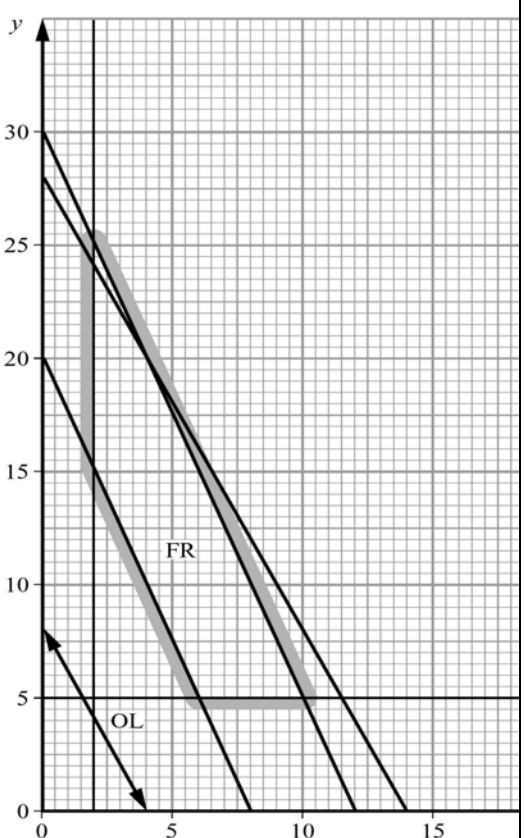
Q	Solution	Marks	Total	Comments
3 (a)(i)	$\begin{pmatrix} X & Y \\ 5 & 20 \end{pmatrix}$ A B 20 0 15 1 10 2 5 3 0 4	M1 A1	 2	 All correct
(ii)	$\begin{pmatrix} X & Y \\ 7 & 29 \end{pmatrix}$ A B 29 0 22 1 15 2 8 3 1 4	M1 A2, 1,0	 3	
(b)	Divides Y by X to give quotient and remainder	E2,1, 0	2	$y = Bx + A$
		Total	**7**	

Q	Solution	Marks	Total	Comments
4 (a)	L A → S B → L V → P S → S D → L A 90 140 180 150 185	M1		Tour
		M1		All visited } Independent
		A1		Correct order (must have both method marks)
	Total 745	B1	4	
(b)	Delete LA			
	MST: 140, 180, 150	M1		SCA
		A1		3 edges
	= 470	A1		
	LB = (their 470) + 90 +185	M1		or (their 470) + (2×90)
	= 745	A1	5	= 650
(c)	Tour = 745	B1F	1	(b) ≤ T ≤ (a) or 650 ≤ Tour ≤ 745
		Total	**10**	

Q	Solution	Marks	Total	Comments
5 (a)	Min = 4 + 7 + 7 + 7			
	= 25	B1	1	
(b)	Min (H) = 4 + 7 + 7 + 7 + 8			
	= 33	B1	1	
(c)	Min (E) = Σ = 62	B1	1	
(d)		M1		5 vertices
		m1		8 edges
		A1	3	All correct
		Total	**6**	

Q	Solution	Marks	Total	Comments
6 (a)	75 + 55 = 130	B1	1	
(b)(i)		M1 A1 M1 A1		SCA 2 values at L 3 or more values of A All correct at A
	Min = 133	B1	5	

Q	Solution	Marks	Total	Comments
6 b)(i)	**Alternative to part (b)(i)** Working backwards:  (*M1*) SCA (*A1*) 2 values at C_0 (*M1*) 2 values at C (*A1*) Correct at P (*B1*) 133			
(ii)	$P\ C_0\ L\ A$	B1	1	
(c)	$C\ E\ A$	M1		For either
	$\rightarrow\left(\frac{55}{60}\times 100\right)+\left(\frac{75}{60}\times 50\right)$			Allow $55\times 100+75\times 50$ M1
	$=154\ \frac{1}{6}$	A1		$(154.1\rightarrow 154.2)$
	$P\ C_0\ L\ A$			
	$\rightarrow\frac{133}{60}\times 50=110\frac{5}{6}$	A1		$(110.8\rightarrow 110.9)$
	Saved $43\frac{1}{3}$	B1	4	(In range $43.3\rightarrow 43.4$)
		Total	**11**	

Q	Solution	Marks	Total	Comments
7 (a)	$x \geq 2,\ y \geq 5,\ z \geq 2$	B1		All
	$x + y + z \leq 28$	B1		
	$40 \leq 3x + 2y + 2z \leq 60$	B1+1	4	
(b)(i)	$x = z$ $\therefore x \geq 2,\ y \geq 5$			
	$2x + y \leq 28$	B1		Must have shown $x + z = 2x$ etc
	$40 \leq 5x + 2y \leq 60$	B1	2	
(ii)		B1		$x \geq 2,\ y \geq 5$
		B1×3		other lines
		B1F		region (pentagon)
		M1		objective line
		A1	7	Correct
(iii)	Iron 28			
	$\therefore\ x = 2,\ \ y = 24$	M1		Attempt at a max extreme point on their graph
	or $x = 3,\ \ y = 22$ or $x = 4,\ \ y = 20$	A1	2	any pair or 2, 2, 24 3, 3, 22 4, 4, 20
	Total		**15**	
	Total		**60**	