AQA

ASSESSMENT and
QUALIFICATIONS
ALLIANCE

GCE

Mathematics & Statistics B

Unit MBD1

Key to mark scheme

	mark is for	method
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

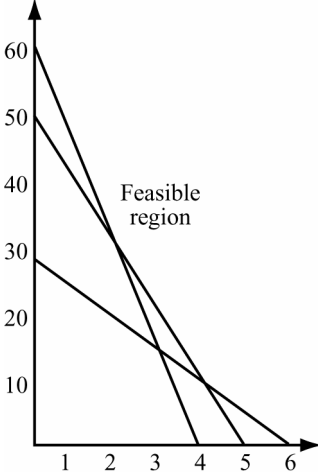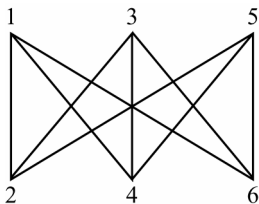|	
Correct answer without working	mark as in scheme
Incorrect answer without working	zero marks unless specified otherwise

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

Question number and part	Solution	Marks	Total marks	Comments
1	Two 1s into right-hand gate	B1		(or by table)
	Two 1s into previous AND-gate,	M1		
	leading to **b** = 1, **c** = 0	A1		
	For OR-gate to output 1 we need **a** = 1	M1 A1	5	
	Total		**5**	
2(a)	Labels	M1		
	R: 8 U: 16,15 Q: 14	A1 A1		3 labels + 2 labels
	S: 17 T: 19	A1		temp labels (U,V)
	V: 27,26	B1		for 26 at V
	Route $PRTV$	B1	6	
(b)	4 days	B1		
	$PRSTV$ only path P to V on arcs <10	B1	2	
	Total		**8**	
3(a)	AF 10	M1 A1		
	EF 10	A1		
	DE 15 AB 20	A1		
	CF 25	A1	5	
(b)		M1		
		A1	2	(numbers not needed until part (c))
(c)	All points are linked by edges in the spanning tree with maximal paths	M1		
	20+10+25, 20+10+10+15 and	A1		
	25+10+15 all less than 60 minutes	A1	3	
	Total		**10**	
4(a)	If a student is eligible for a grant then the student is married and under 18.	M1 A1	2	
(b)	$(\sim\!p\vee\sim\!q) \Rightarrow \sim\!r$	M1 A1	2	(missing brackets tolerated)

4(c)(i)

p	q	r	p∧q	(a)	~p	~q	~p∨~q	~r	(b)	Marks		Comments
0	0	0	0	1	1	1	1	1	1	M1		
0	0	1	0	0	1	1	1	0	0	A1		column 4
0	1	0	0	1	1	0	1	1	1	A1		(a)
0	1	1	0	0	1	0	1	0	0	A1		a ~ column
1	0	0	0	1	0	1	1	1	1	A1		column 8
1	0	1	0	0	0	1	1	0	0	A1	6	(b)
1	1	0	1	1	0	0	0	1	1			
1	1	1	1	1	0	0	0	0	1			

equivalent

Question number and part		Marks	Total marks	
(ii)		B1	1	
	Total		**11**	

Question number and part	Solution	Marks	Total marks	Comments
5				
(a)	I has 4 immediate predecessors. * is the only arc with 4 predecessors. Then E, A etc follow as shown above.	B1 M1 A1 A1	4	
(b)	Forward pass Backward pass	M1 A1 M1 A1 A1√	5	At least 3 correct (ft from (a))
(c)	minimum completion: 22 hours critical activities: CEI	B1 B1	2	
(d)	H's independent float = 22 – 12 – 8 = 2 hours	M1 A1	2	
(e)	If E's duration is 3 hours the new critical path is AI of length 20. So the minimum completion time is reduced by 2 hours.	M1 A1 A1	3	
	Total		**16**	

Question number and part	Solution	Marks	Total marks	Comments
6 (a)	enough nails $\Leftrightarrow 1000x + 100y \geq 5000$ enough screws $\Leftrightarrow 1500x + 100y \geq 6000$ $\Leftrightarrow \quad 15x + y \geq 60$ enough nails $\Leftrightarrow 500x + 100y \geq 3000$ $\Leftrightarrow \quad 5x + y \geq 30$	B1 M1 A1 A1	4	
(b)		B1 B1 B1 M1 A1	5	1 for each line feasible region
(c)	$C = 6x + y$ is minimised at $(4,10)$ (with a value of 34) Should buy 4 *X*-packs & 10 *Y*-packs	M1 A1 A1 B1	4	Vertex check or lines/gradients method **sc** B2 for cao
(d)	With '3 for the price of 2' again a vertex check gives minimum at $(6,0)$ (of £24) so buy 6 *X*-packs only.	M1 A1 B1	3	(strictly "²/₃ price" for linearity: but this does yield multiples of 3)
	Total		**16**	

Question number and part	Solution	Marks	Total marks	Comments
7(a)		M1 A1	2	
(b)(i)	e.g. 1234561	M1 A1	2	
(ii)	For even n ((and >2))	B2,1	2	B1 for "4 and 6" (the ">2" not expected)
(c) (i)	$\mathbf{G_6} = K_{3,3}$	B1	1	
(ii)	Planar for $n < 6$.	B1		
	For $n \geq 6$ $\mathbf{G_n}$ has $\mathbf{G_6}$ as a subgraph	B1		
	For $n < 6$ clearly no K_5 or $K_{3,3}$ (or simply draw them in the plane)	B1	3	
(d)	$\frac{1}{2} n$	B1	1	
(e)	Case n even: By (i) we need $\frac{1}{2} n$ even; i.e. n must be divisible by 4 Case n odd: Some vertices always have odd degree, so not Eulerian.	M1 A1 B1	3	
	Total		**14**	
	TOTAL		**80**	