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ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Education

Mathematics and Statistics 6320
Specification B

MBD1 Discrete 1

Mark Scheme

2005 examination – June series

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.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' 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.

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	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
sf		significant figure(s)
dp		decimal place(s)
A2,1		2 or 1 (or 0) accuracy marks
–*x* ee		deduct *x* marks for each error
pi		possibly implied
sca		substantially correct approach

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 book

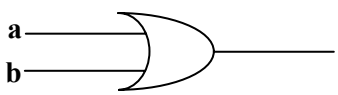
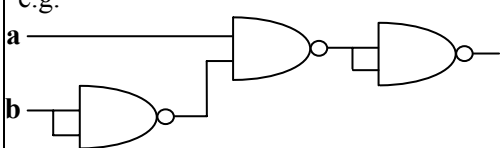
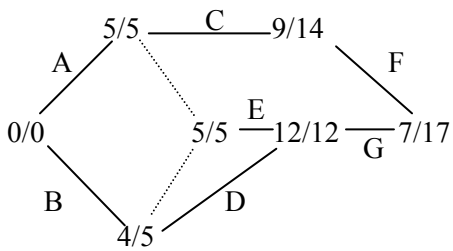
Application of Mark Scheme

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

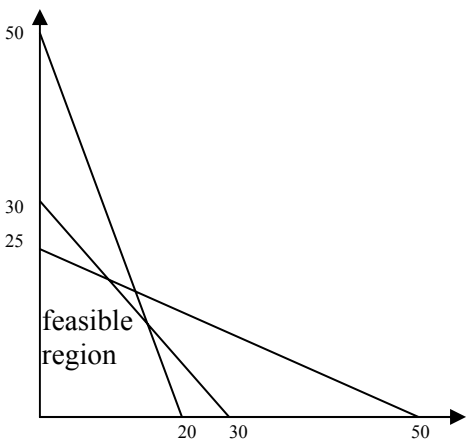
Mathematics and Statistics B Discrete 1 MBD1 June 2005

Q	Solution	Marks	Total	Comments
1(a)(i)	A: 0 *B*: 30 *C*: 100, 90 *D*: 150, 130 Minimum *E*: 50 cost = £150 *F*: 50 *G*: 60 *H*: 170, 150	 M1 A1 A1 A1 B1	 5	 Two final labels Remaining finals Temporary labels For £150
(ii)	Trace-back to route *ABGCH*	M1A1	2	
(b)	Cheapest *A* to *G* is £60 Easygo total *A* to *H* is £(150 – 10) So Easygo cost *G* to *H* is £80	M1 A1 A1	 3	
(c)(i)	*AB, BG, CG, DH* *FG, CD* *AE*	M1A1 A1A1 A1	 5	
(ii)	£(30+30+30+40+30) = £160	M1A1	2	
	Total		**17**	
2(a)(i)	$\mathbf{p \Rightarrow q}$	B1	1	
(ii)	$\mathbf{\sim p \Rightarrow \sim q}$	B1	1	
(b)	**p q** (i) **~p ~q** (ii) 0 0 1 1 1 1 0 1 1 1 0 0 1 0 0 0 1 1 1 1 1 1 1 1 not equivalent	M1 A1 A1√ B1	 4	 ft sensible (ii)
	Total		**6**	
3(a)	E and H	B2,1,0	2	Deduct 1 for each error or omission
(b)	F, G and H	B2,1,0	2	
(c)	E, F and G	B2,1,0	2	
(d)	F and G	B2 (or M1 A1)	2	2 cao, or sensible working towards wrong answer will earn 1/2
	Total		**8**	

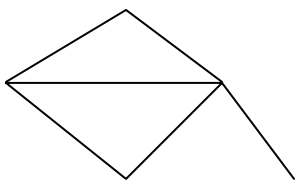
MBD1 (cont)

Q	Solution	Marks	Total	Comments
4(a)	**a** **b** **a↑b** 0 0 1 0 1 1 1 0 1 1 1 0	 M1 A1	 2	
(b)	From (a) an input of 0/0 gives output 1 and an input of 1/1 gives output 0.	B1	1	
(c)(i)	$\sim(\sim \mathbf{a} \wedge \sim \mathbf{b})$	M1A1	2	
(ii)		M1A1	2	
(d)	e.g. 	M1 A1 A1	 3	
	Total		**10**	
5(a)		M1		
(b)		A1 A1 M1 A1√ M1 A1√	3 4	C, D and E F and G Forward pass (ft) Backward pass (ft)
(c)	Critical path AEG Minimum completion time 17 hours	B1 B1	 2	
(d)(i)	Total time needed = 35 hours Larger than 2×17	M1 A1	 2	
(ii)	e.g. First worker: A(days 1-5 inc.) E(6-12) G(13-17) Second worker: B(1-4) D(5-11) C(12-15) F(16-18)	M1 A1 A1	 3	
(e)	For the path ACHG to have length ≤17 we need H to have length ≤ 3	M1 A1	 2	
	Total		**16**	

MBD1 (cont)

Q	Solution	Marks	Total	Comments
6(a)	Flour $\Rightarrow 150x + 300y \leq 7500$			
	$\Rightarrow \quad x + 2y \leq 50$	B1		
	Butter $\Rightarrow 5(0)x + 2(0)y \leq 100(0)$	B1		
	Eggs $\Rightarrow x + y \leq 30$	B1	3	
(b)		B1√ B1√ B1√		One per line (ft)
		B1√	4	Region (ft)
	The feasible region has vertices	M1		(or by profit lines)
	(0,0) (0,25) (10,20) ($13^1/_3$,$16^2/_3$) (20,0)	A1		
	The profit of $x + 1½y$ is maximised at (10,20) so they should make 10 Romanos and 20 Sardinos.	A1 B1	4	
(c)	With profit $2x + 1½y$ the maximum is reached at ($13^1/_3$,$16^2/_3$) but it is impractical to make a fraction of a pizza.	M1 A1		
(d)	Searching integer points nearby gives (13,17) as the best in the region, so make 13 Romanos and 17 Sardinos in this case.	M1 A1	4	
	Total		**15**	

MBD1 (cont)

Q	Solution	Marks	Total	Comments
7(a)(i)	Sum of degrees = $5d + 7$.	B1		
	This must be even and so d must be odd.	B1	2	
(ii)	d ≥ 3 makes d+3 too big, so d= 1:	B1		
	e.g. 	M1A1	3	
(b)(i)	each vertex is joined once to at most the other 9 vertices	B1	1	
(ii)	If all the degrees were different they would be 0 1 2 3 … 9.	M1		
	But that would give a vertex joined to none and another joined to them all – clearly impossible.	A1	2	
	Total		**8**	
	TOTAL		**80**	