GCE 2004
June Series

ASSESSMENT and QUALIFICATIONS ALLIANCE

Mark Scheme

Mathematics and Statistics B
MBD1

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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	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

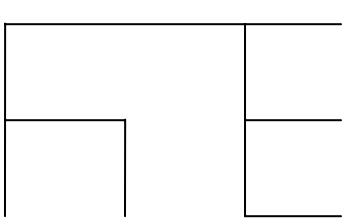
Abbreviations used in Marking

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**

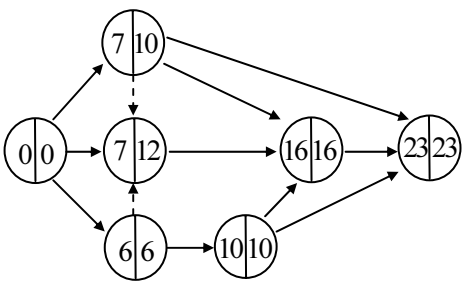
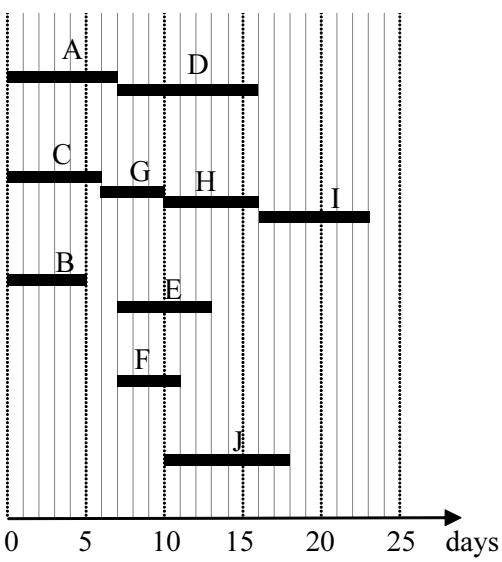
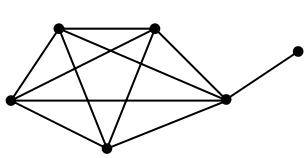
Mathematics and Statistics B Discrete 1 MBD1 June 2004

Question Number and Part	Solution	Marks	Total	Comments
1 (a)	**A B C flow** 0 0 0 0 0 0 1 0 0 1 0 0 0 1 1 1 1 0 0 0 1 0 1 0 1 1 0 1 1 1 1 1	 B1 B1 B1 B1	 4	 Second entry Third & fourth Fifth & sixth Seventh & eighth
(b)	The three missing labels must be A/B in the first row and B in the second	M1 A1 A1	3	
	Total		**7**	
2 (a)	*CADEBFMLKJC*	M1 A1	2	
(b)	Neither More than two odd vertices	B1 B1	2	
(c) (i)	*KL*	B1	1	
(ii)	Starting at *A*, say, we can only get to *B* along *DE*, but then we cannot get back.	M1 A1	2	(any sensible focus on the 'isthmus' *DE*)
	Total		**7**	
3 (a)	Essential labels: *B*: 4 *E:* 5 I: 9 *F:* 10,9 *C:*10 *J: (14 poss),*13 *G:* 16,14 *D*: 15 *K*: 20,19 *H:* 20 *L*: 24 Traceback to *ABCGKL* of length 24	M1 A1 A1 A1 M1 A1	 6	 One temporary label Six permanent labels Remaining permanent labels
(b)(i)	Kruskal gives *AB CG EF EI FJ* (@ 4) *AE CD GK KL* (@ 5) *BC GH* (@6) Total length = 52 km	M1 A1 A1 A1 B1	 5	 **sc** For correct tree only, with order of choice not given: 2 marks
(ii)		B1√	1	ft
(c)(i)	4 + 4 + 5 + 4 + 6 + 4 + 5 + 5 = 37	B1	1	
(ii)	Longest route on gritted paths = 37, so original distance ≤ 9. Obvious contenders *J* & *K* give distances 7 and 32.	M1 A1	 2	(any sensible approach)
	Total		**15**	

MBD1 (cont)

Question Number and Part	Solution	Marks	Total	Comments
4 (a)	**j** $\Rightarrow$ **u** false (June) **t** $\Rightarrow$ ~**y** true (30-days end in L/E/R/R) (**j** $\wedge$ **y**) $\Rightarrow$ **u** true (January/July)	B1 B1 B1 B1 B1	5	
(b)(i)	**p q r I p∧q II I⇒II** 0 0 0 1 0 1 1 0 0 1 1 0 1 1 0 1 0 1 0 1 1 0 1 1 1 0 1 1 1 0 0 0* 0 1* 1 1 0 1 1 0 1 1 1 1 0 0 1 0 1 1 1 1 1 1 1 1	 M1 M1 A1 A1 A1	 5	 8 rows appropriate columns $\wedge$ correct any $\Rightarrow$ correct all correct
(ii)	For II true and I false we need case * e.g. **p**: June begins with a J **q**: June ends in a Y **r**: June has 31 days	M1 A1	 2	
	Total		**12**	
5 (a)	Line 1: $3x + 2y = 42$ Line 2: $x + 2y = 30$ Line 3: $x + y = 16$	B1 B1	 2	For one For other two
(b)	$3x + 2y = 42$, $x + y = 16$ $\Rightarrow$ $x = 10, y = 6$ Hence C is (10,6)	M1 A1 A1	 3	 For either coordinate
(c)	Trying all vertices leads to $P = 2x + 3y$ maximised at (2,14) So maximum of P is 46 by making 2 Xtremes and 14 Yltras	M1 A1 A1 A1	 4	(or by lines/gradients)
(d)(i)	New contraint is $y \le 0.2(x + y)$ and so $4y \le x$.	M1 A1	 2	
(ii)	This crosses the boundary of the feasible region at (12,3). In new region maximum of P is at (12,3) so they should make 12 Xtremes and 3 Yltras	M1 A1 M1 A1	 4	
	Total		**15**	

MBD1 (cont)

Question Number and Part	Solution	Marks	Total	Comments
6 (a)	A,B and C	B1	1	
(b)		M1 A1 M1 A1 A1	5	
(c)	Minimum completion 23 days Critical activities C G H I	B1√ B1√	2	ft ft
6(d)		M1 A1 A1 A1	4	
(e)	e.g. move D (and J) to end	M1 A1	2	
	Total		**14**	
7 (a)(i)	Sum = $7d - 6$ = even, so d is even	M1 A1	2	
(ii)	$3 \le d$ since there is a degree $d - 3$; $d \le 5$ since the graph is simple	B1 B1	2	
(b)		M1 A1	2	
(c)	Not planar Contains K_5	B1 B1	2	
(d)	All are isomorphic All = K_5 + single edge	B1 B1	2	
	Total		**10**	
	TOTAL		**80**	