

# GCE

# Mathematics (MEI)

Unit 4771: Decision Mathematics 1

Advanced Subsidiary GCE

## Mark Scheme for June 2018

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All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

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### Annotations and abbreviations

Annotation in scoris	Meaning
√and ×	
BOD	Benefit of doubt
FT	Follow through
ISW	Ignore subsequent working
M0, M1	Method mark awarded 0, 1
A0, A1	Accuracy mark awarded 0, 1
B0, B1	Independent mark awarded 0, 1
SC	Special case
^	Omission sign
MR	Misread
Highlighting	
Other abbreviations in	Meaning
Other abbreviations in mark scheme	Meaning
Other abbreviations in mark scheme E1	Meaning Mark for explaining
Other abbreviations in mark scheme E1 U1	Meaning   Mark for explaining   Mark for correct units
Other abbreviations in mark scheme E1 U1 G1	Meaning   Mark for explaining   Mark for correct units   Mark for a correct feature on a graph
Other abbreviations in mark scheme E1 U1 G1 M1 dep*	Meaning   Mark for explaining   Mark for correct units   Mark for a correct feature on a graph   Method mark dependent on a previous mark, indicated by *
Other abbreviations in mark scheme E1 U1 G1 M1 dep* cao	Meaning   Mark for explaining   Mark for correct units   Mark for a correct feature on a graph   Method mark dependent on a previous mark, indicated by *   Correct answer only
Other abbreviations in mark scheme E1 U1 G1 M1 dep* cao oe	Meaning   Mark for explaining   Mark for correct units   Mark for a correct feature on a graph   Method mark dependent on a previous mark, indicated by *   Correct answer only   Or equivalent
Other abbreviations in mark scheme E1 U1 G1 M1 dep* cao oe rot	Meaning   Mark for explaining   Mark for correct units   Mark for a correct feature on a graph   Method mark dependent on a previous mark, indicated by *   Correct answer only   Or equivalent   Rounded or truncated
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Q	Juestio	Answer	Marks	Guidance
1	(i)	BS C C C C C C C C C C C C C	B1 B1	10 vertices correct 17 arcs correct
	(ii)	4 odd vertices, C, SQ, M, and TS, so neither Eulerian nor semi-Eulerian,	M1 A1	odd vertices or neither Eulerian nor semiEulerian noting 4 or identifying 4.
	(iii)	Two adjacent odd nodes	B1	
	( <b>iv</b> )	Starting and finishing at odd nodes other than those in (iii).	B1	
	( <b>v</b> )	eg TS BS TS P ST CP P CT BS C SQ M SQ CT M CP M B C eg TS BS TS P ST CP M CP P CT BS C SQ CT M SQ C B M	M1 A1	18 arcs repeating only as per (iii) starting and finishing as per (iv)

Question							А	nswer					Marks	Guidance	
2	(a)	(i)		crate items	1 A, B, D	2 C, E	3 F	3 crate	es are needed.					M1 A1 B1	A, B, C, D correct (condone numbers) rest (letters needed)
		(ii)		crate items	1 A, B, E	2 C, D, F	or	1 B, C	2 A, D, E, F	or	1 B, F	2 A, D, E, 0	С	B1	condone numbers
	(b)	(i)	(i)	(i) (C78 G26 H35 S12) G26 H35 S12 C78 (3 comparisons and 3 swaps) G26 S12 H35 C78 (2 comparisons and 1 swap) S12 G26 H35 C78 (1 comparison and 1 swap)					M1 A1	first pass correct all passes correct					
		(ii)	(ii)	(ii) 6 comparisons and 5 swaps							B1 B1				

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	Question		Answer	Marks	Guidance
3	(a)	(i)	eg $0 \rightarrow \text{reject}$ $1 \rightarrow 1$ $2 \rightarrow 2$ $3 \rightarrow 3$ $4 \rightarrow 4$ $5 \rightarrow 5$ $6 \rightarrow 6$ $7 \rightarrow \text{reject}$ $8 \rightarrow \text{reject}$ $9 \rightarrow \text{reject}$	B1	Must be complete and explicit for all 6 numbers.
		(ii)	eg 12 1 10 4 5 11 2 8 2 4	M1 M1 A1	applying sim rule rejects ignored all correct
		(iii)	eg 5.9 (theoretical answer is $6 \dots$ Geometric <sub>1</sub> distribution )	B1 √	mark lost if answer rounded
	(b)	(i)	eg $00-15 \rightarrow 1$ $16-31 \rightarrow 2$ $32-47 \rightarrow 3$ $48-63 \rightarrow 4$ $64-79 \rightarrow 5$ $80-95 \rightarrow 6$ $96-99 \rightarrow \text{reject}$	B1	Must be explicit, complete and maximally efficient
		(ii)	4% rejection versus 40% rejection	B1	fewer rejections expected
		(iii)	More difficult for humans to apply.	B1	

Q	Question		Answer	Marks	Guidance
4	(i)		10 15 G	M1	activity on arc
	& (ii)			A1	A, B, C, D, E
	(11)		$B = 10 \ 10 \ F \ 30 \ 30$	A1	F and H
				A1	G, I, J
			$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	A1	К
				M1	forward pass
			15  15  30  15  45  45  45  60  60	A1	
				M1	backward pass
			5 40 5	A1	
			Minimum completion time = 60 mins	B1	
			Critical activities are E, F, J and K.	B1	
	(iii)		eg (earliest times)	B1	4 types indicated and used
	()			B1	timing of E. F. J and K
				B1	A, B, C and D correct
			D Person 1	B1	G, H, I correct
			E Person 2		
			F Both G Nobody		
			H		
	(iv)		Explanation in terms of nature of critical activities, which cannot be shortened.	B1	

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	Quest	ion	Answer	Marks	Guidance
6	(i)		Let H be the number of acres sold (for housing).	M1	identification of variables
			Let R be the number of acres developed (for recreational use).	A1	definition
			$H + R \le 50$	A1	
			$H \le 10$	A1	
			$0.015(200000H-5000R) \geq 500R$ (ie $H \geq (575/3000)R$ approximately $H \geq 0.192R)$	B1	LHS
				B1	RHS
6	(ii)		(0, 10) (0, 0) (0, 0)	B1 B1 B1 B1	axes labelled and scaled H = 10 cao H + R = 50 cao 3000H = 575R cao Correct shading for first two inequalities cao

Question		on	Answer	Marks	Guidance
6	(iii)		$\mathbf{R} = 0$ and $\mathbf{H} = 0$		
			R = 0 and $H = 10$	B1	for both points
			Sell to max amount and develop the rest. (R=40 and H=10)	B1	
			Develop to max with selling the rest. ( $R = 42$ and $H = 8$ (approx))	В1√	
6	( <b>iv</b> )		Intersection of $3000H = 575R$ and $H = 10$ (gives $R \approx 52.17$ )	M1	
			So sell 10 and develop 52 (approx) leaving 3 untouched.	A1cao	52

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