AQA

**Free-Standing Mathematics Qualification
June 2011**

Mathematics Advanced Level 6994

(Specification 6994)

Using and Applying Decision Mathematics

Mark Scheme

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 events which all examiners participate in and is the scheme which was used by them in this examination. The standardisation process 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 standardisation each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, examiners encounter unusual answers which have not been raised 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 and abbreviations used in marking

M	mark is for method		
m or dM	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 method and accuracy		
E	mark is for explanation		
√ or ft or F	follow through from previous incorrect result	MC	mis-copy
CAO	correct answer only	MR	mis-read
CSO	correct solution only	RA	required accuracy
AWFW	anything which falls within	FW	further work
AWRT	anything which rounds to	ISW	ignore subsequent work
ACF	any correct form	FIW	from incorrect work
AG	answer given	BOD	given benefit of doubt
SC	special case	WR	work replaced by candidate
OE	OE	FB	formulae book
A2,1	2 or 1 (or 0) accuracy marks	NOS	not on scheme
$-x$ EE	deduct x marks for each error	G	graph
NMS	no method shown	c	candidate
PI	possibly implied	sf	significant figure(s)
SCA	substantially correct approach	dp	decimal place(s)

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

Free-Standing Mathematics Qualification
Using and Applying Decision Mathematics (6994/2)
Answers and Marking Scheme - June 2011

Question 1

(a)
(b)
(c)

Network diagram (activity-on-node), with each node showing early time, duration, late time:

Node	Early	Duration	Late
M	18	2	20
K	15	3	18
L	15	2	18
J	9	6	15
G	5	4	9
E	3	1	9
F	3	2	5
H	1	2	9
I	1	3	9
A	0	3	3
B	0	1	3
C	0	1	7
D	0	1	6

M1	Network diagram.
A3,2,1,0	− 1each independent error
M1	Early times (any correct from E)
A1	All correct
M1	Late times (any correct before M)
A3,2,1,0	−1 each independent error

Question 1 continued)

(d)	A F G J K M	**B1**	
(e)	B 2 I 5	**B1** **B1**	2,5 unlabelled 2/2 5,2 unlabelled SC1
(f)		**M1** **A1** **A1** **A1**	Gantt diagram. 10 + activities 8+ correct (ignore floats) 3+ correct floats All correct
(g)	D delayed by 7 days I starts (day 8) delayed (J starts day 11) ∴ new finish 20 + 2 = 22	**E1** **B1**	Their max +2 scores 1/2
	TOTAL	**19**	

Question 2

(a)	TA 70 AC 40 CH 36 FH 32 CE 40 CD 44 GH 52 DB 56	**M1** **B1** **A1** **A1** **A1**	Prims (mst, no cycles, edges not vertices) 8 edges CE 5th CD 6th all correct
(b)	370	**B1**	
(c)		**M1** **A1**	Spanning trees 6 + edges Including labels
(d)	CD, GH	**B1 B1**	
(e)	Minus CD + DB = 100 Add BA/BC, BE, BH = 60 Total 330	**M1** **A1**	Removing their CD,DB and adding edge(s)
	TOTAL	**12**	
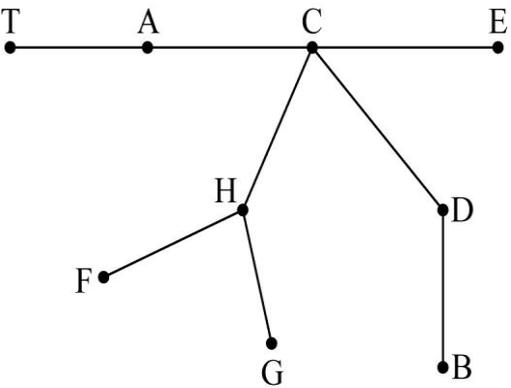
Question 3

	Route H Be Mw D B	**M1**	Dijkstra (cancelling, PI)
		m1	2 values at MW or D or R
		A1	correct at MW **and** D **and** R
		m1	3 values at B
		A1	correct at B
		A1	All correct including boxes/ cancelling (excluding H)
		B1	62 at B
		B1	Or reverse
	TOTAL	**8**	

Question 4

	Odds G, B, E, I	**E1**	PI
	GB + EI = 43+23 = 66	**M1**	3 sets of pairs (of their odds)
	GE + BI = 45+25 = 70	**A2**	3 correct values
	GI + BE = 68+22 = 90	**A1**	2 correct values
	Total = 186 + 66	**A0**	1/0 correct value
	= 252	**B1**	
	TOTAL	**5**	

Question 5

(a)	R A F D C G R	**M1**	tour
		M1	visits all vertices
		A1	correct order
	= 153	**B1**	
(b)	G A F R D C G	**M1**	as above
		M1	
		A1	
	= 138	**B1**	
(c)	R D C G A F R	**B1**	or reverse
(d)		**M1**	Either edges or values. mst + 2 edges from G
		B1	mst 4 edges or values
		A1	correct, either AD or FD (edges or values)
		A1	correct edges (or values)
	= 130	**B1**	
(e)	130 ≤₍₎ T ≤ 138	**B1F** **B1F**	Their 130 ≤ T ≤ their min (a) and (b) if their (e) > min (a), (b)B0
	TOTAL	**16**	
	TOTAL MARK FOR PAPER	**60**	