

Version



**Free-Standing Mathematics Qualification  
June 2012**

**Mathematics Advanced Level                      6994**

**(Specification 6994)**

**Using and Applying Decision Mathematics**

**Final**

***Mark Scheme***

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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 students' 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 students' 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.

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## Key to mark scheme abbreviations

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
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
A2,1	2 or 1 (or 0) accuracy marks
-x EE	deduct x marks for each error
NMS	no method shown
PI	possibly implied
SCA	substantially correct approach
c	candidate
sf	significant figure(s)
dp	decimal place(s)

## No Method Shown

Where the question specifically requires a particular method to be used, we must usually see evidence of use of this method for any marks to be awarded.

Where the answer can be reasonably obtained without showing working and it is very unlikely that the correct answer can be obtained by using an incorrect method, we must award **full marks**. However, the obvious penalty to candidates showing no working is that incorrect answers, however close, earn **no marks**.

Where a question asks the candidate to state or write down a result, no method need be shown for full marks.

Where the permitted calculator has functions which reasonably allow the solution of the question directly, the correct answer without working earns **full marks**, unless it is given to less than the degree of accuracy accepted in the mark scheme, when it gains **no marks**.

**Otherwise we require evidence of a correct method for any marks to be awarded.**

**Free-Standing Mathematics Qualification**  
**Advanced Level – Using and Applying Decision Mathematics (6994)**  
**Answers and Marking Scheme - June 2012**

Q	Solution	Marks	Total	Comments																																				
1(a)		M1 A4, 3, 2, 1, 0	5	Network diagram, or activity on arc																																				
(b)		M1 A1	2	Forward pass																																				
(c)	<table border="1"> <tbody> <tr><td>A</td><td>0</td><td>3</td></tr> <tr><td>B</td><td>3</td><td>9</td></tr> <tr><td>C</td><td>3</td><td>9</td></tr> <tr><td>D</td><td>9</td><td>25</td></tr> <tr><td>E</td><td>9</td><td>13</td></tr> <tr><td>F</td><td>9</td><td>19</td></tr> <tr><td>G</td><td>9</td><td>25</td></tr> <tr><td>H</td><td>3</td><td>25</td></tr> <tr><td>I</td><td>6</td><td>25</td></tr> <tr><td>J</td><td>11</td><td>25</td></tr> <tr><td>K</td><td>13</td><td>25</td></tr> <tr><td>L</td><td>25</td><td>27</td></tr> </tbody> </table>	A	0	3	B	3	9	C	3	9	D	9	25	E	9	13	F	9	19	G	9	25	H	3	25	I	6	25	J	11	25	K	13	25	L	25	27	M1 A1 A1	3	Backward pass Correct at least two of G, H, I, J and K All correct
A	0	3																																						
B	3	9																																						
C	3	9																																						
D	9	25																																						
E	9	13																																						
F	9	19																																						
G	9	25																																						
H	3	25																																						
I	6	25																																						
J	11	25																																						
K	13	25																																						
L	25	27																																						
(d)	A, C, E, K, L	B1	1																																					
(e)	53 HRS	B1	1																																					

1(f)	L		M1 A2, 1, 0 B1	4	Diagram  Floats
	K				
	J				
	I				
	H				
	G				
	F				
	E				
	D				
	C				
	B				
A					
<b>Total</b>				<b>16</b>	

<b>2(a)</b>	$W \rightarrow G \rightarrow F = 16$ 9 7	E1	1	
<b>(b)(i)</b>	F S G W O R D F  = 168	M1 M1 A2, 1, 0 B1	5	Tour Visits all places All correct, 1 slip
<b>(ii)</b>	F S G W O R W D S F	M1 A1	2	Any 'expansion' All correct, 1 slip
<b>(iii)</b>	S F G W O R D S  = 161	M1 A2, 1, 0 B1	4	Tour or visits all places then as (i)
<b>(c)(i)</b>	$FG = 7$ $GW = 9$ $FD = 17$ $OW = 21$ $WR = 39$ $\quad = 93$	M1  A1 A1 B1 B1	5	Prims – on matrix  FD 3 <sup>rd</sup> OW 4 <sup>th</sup>  All correct
<b>(ii)</b>	$93 + 5 + 9 = 107$ $(93 + SF + SG)$	M1 A1F B1	3	Their MST + 2 edges from S Their 93 + 14
<b>(d)</b>	$134 < T \leq 161$ (-)	B1F B1F B1	3	Either correct  All correct, written as interval SC1 134, 161 written scores 1/3
<b>Total</b>			<b>23</b>	



<b>4(a)</b>	ODDS K, C, O, W $KC + OW = 800 + 800 = 1600$ $KW + OC = 800 + 810 = 1610$ $KO + CW = 800 + 810 = 1610$ $3240 + 1600 = 4840$	E1 M1 A2, 1, 0  m1 A1	6	These 3 pairs of odds  3240 + 'their' min CSO
<b>(b)(i)</b>	$M - 3$	B1	1	
<b>(ii)</b>	$R - 3$	B1	1	
<b>(c)(i)</b>	$3240 + 800 = 4040$	M1 A1 A1	3	3240 + 'their' min Using 800
<b>(ii)</b>	Any correct pair e.g. O/C C/W K/C O/W	B2	2	B1 wrong combination of odds
	<b>Total</b>		<b>13</b>	
	<b>TOTAL MARK FOR PAPER</b>		<b>60</b>	