

**GCE**

**Quantitative Methods (MEI)**

Unit **G246**: Decision Mathematics 1

Advanced Subsidiary GCE

**Mark Scheme for June 2017**

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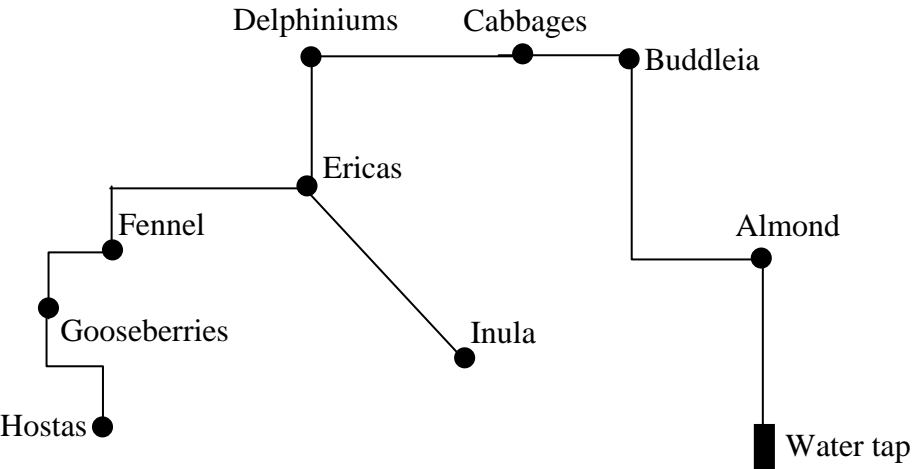
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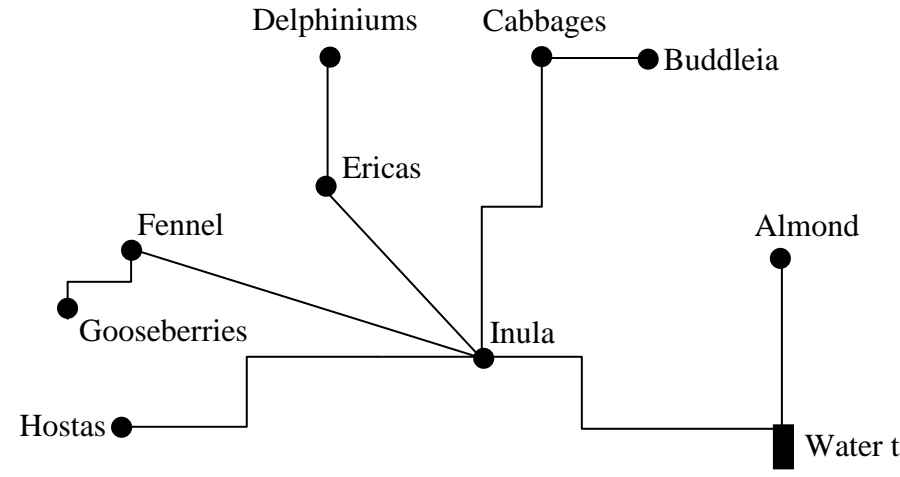
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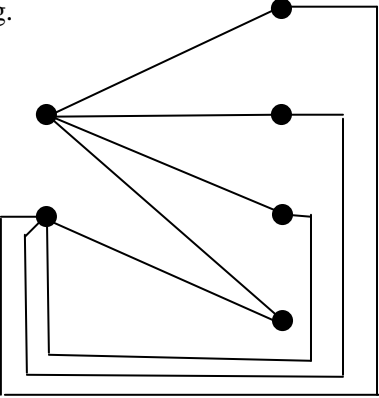
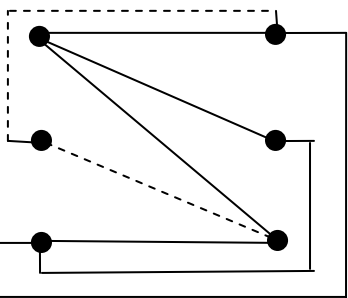
## Annotations and abbreviations

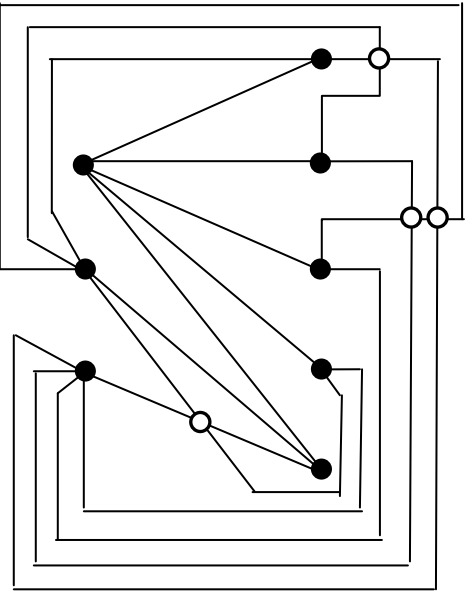
<b>Annotation in scoris</b>	<b>Meaning</b>
✓ and *	
BOD	Benefit of doubt
FT	Follow through
ISW	Ignore subsequent working
M0, M1	Method mark awarded 0, 1
A0, A1	Accuracy mark awarded 0, 1
B0, B1	Independent mark awarded 0, 1
SC	Special case
^	Omission sign
MR	Misread
Highlighting	
<b>Other abbreviations in mark scheme</b>	<b>Meaning</b>
E1	Mark for explaining
U1	Mark for correct units
G1	Mark for a correct feature on a graph
M1 dep*	Method mark dependent on a previous mark, indicated by *
cao	Correct answer only
oe	Or equivalent
rot	Rounded or truncated
soi	Seen or implied
www	Without wrong working

Question	Answer	Marks	Guidance																																																																																																																									
1 (i)	<table border="1"> <thead> <tr> <th></th> <th>W1</th> <th>A2</th> <th>B3</th> <th>C4</th> <th>D5</th> <th>E6</th> <th>F8</th> <th>G9</th> <th>H</th> <th>I7</th> </tr> </thead> <tbody> <tr> <th>W</th> <td></td> <td>10</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>40</td> <td>20</td> </tr> <tr> <th>A</th> <td>(10)</td> <td></td> <td>17</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <th>B</th> <td></td> <td>(17)</td> <td></td> <td>7</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <th>C</th> <td></td> <td></td> <td>(7)</td> <td></td> <td>12</td> <td></td> <td></td> <td></td> <td></td> <td>18</td> </tr> <tr> <th>D</th> <td></td> <td></td> <td></td> <td>(12)</td> <td></td> <td>8</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <th>E</th> <td></td> <td></td> <td></td> <td></td> <td>(8)</td> <td></td> <td>14</td> <td></td> <td></td> <td>11</td> </tr> <tr> <th>F</th> <td></td> <td></td> <td></td> <td></td> <td></td> <td>(14)</td> <td></td> <td>5</td> <td></td> <td>15</td> </tr> <tr> <th>G</th> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>(5)</td> <td></td> <td>6</td> <td></td> </tr> <tr> <th>H</th> <td>40</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>(6)</td> <td></td> <td>18</td> </tr> <tr> <th>I</th> <td>20</td> <td></td> <td></td> <td>18</td> <td></td> <td>(11)</td> <td>15</td> <td></td> <td>18</td> <td></td> </tr> </tbody> </table> <p>Length of pipe used = 90m</p> 		W1	A2	B3	C4	D5	E6	F8	G9	H	I7	W		10							40	20	A	(10)		17								B		(17)		7							C			(7)		12					18	D				(12)		8					E					(8)		14			11	F						(14)		5		15	G							(5)		6		H	40							(6)		18	I	20			18		(11)	15		18		<p>B1</p> <p>B1</p> <p>B1</p> <p>B1cao</p> <p>B1cao</p>	<p>indicating selections</p> <p>deleting in rows</p> <p>numbering columns</p>
	W1	A2	B3	C4	D5	E6	F8	G9	H	I7																																																																																																																		
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<p>(ii)</p>	 <p>112m Shorter runs, or less exposure to risk.</p>	<p>M1          A1 B1</p>	<p>3 out of 4 connections for A, B, D and G correct          cao</p>
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Question		Answer	Marks	Guidance
2	(i)	<p>P 112</p> <p>M 250</p> <p>C (0) 100 110 120 130 131 132 133 134 135 136 137 138</p> <p>The answer is 138</p>	<p>B1</p> <p>M1</p> <p>A1</p> <p>B1</p>	<p>correct to statement 100 (i.e. 130)</p>
	(ii)	<p>e.g. add</p> <p>34 If <math>P + C + 1000 &gt; M</math> then goto 40</p> <p>35 Let <math>C = C + 1000</math></p> <p>36 Goto 34</p>	<p>B1</p> <p>B1</p> <p>B1</p>	<p>(ignore “34” and “40”)</p> <p>(ignore “35”)</p> <p>logic all OK</p>
	(iii)	e.g. P = price, M = money tendered, C = change	B1	No need to consider note denominations instead of powers of 10.

Question	Answer	Marks	Guidance
3 (i)	<p>e.g.</p> 	B1	
(ii)	<p>e.g. as per the above, with top left connected directly and bottom left connected around the back.</p>	B1	
(iii)	<p>e.g.</p>  <p>e.g. (Dotted connections not needed.) The middle left cannot access the middle right.</p>	<p>B1</p> <p>M1</p> <p>E1</p>	<p><math>K_{2,3}</math> seen</p> <p>choice of just two points that cannot be connected on the candidate's graph.</p> <p>dependent on the M1</p>

(iv)	<p><math>(5-1) \times (5-1) / 4 = 4</math> crossings</p> <p>e.g.</p> 	B1	can be implied
(v)	e.g. They inform about how many layers will be needed.	B1	



Question		Answer	Marks	Guidance
4	(i)	£9 and £6 respectively	B1	
	(ii)	Let $x$ be the number of deciduous trees and $y$ the number of evergreens. Max $9x+6y$ st $8x+6y<9000$ $16x+16y<20000$ $x<800$ $y<1000$	B1 B1 B1 B1 B1	
	(iii)	e.g. $(800, 433\frac{1}{3}) \rightarrow 9800$ $((800, 0) \rightarrow 7200)$ $(750, 500) \rightarrow 9750$  Profit is £9800	B1 B1 B1 B1 B1 B1 B1	labelling and scaling axes line for space constraint line for finance constraint lines for availability constraints feasible region indicated (with 6 or 5 lines correct) for profit at $(800, 433\frac{1}{3})$ and $(750, 500)$ or gradient method with gradient $-1.5$  9800 indicated
	(iv)	£100 (at $(800, 450)$ ) £100 (also at $(800, 450)$ )	B1 B1	
	(v)	$(750, 500)$ or 15 and 10 bundles (giving £9750 - but this not required)	B1	

Question		Answer	Marks	Guidance																																																																																					
5	(i)	stating 0000 gives a score of 0 stating 1111 gives a score of 15 all equally likely	B1 B1 B1	or 16 (B1) distinct numbers generated (B1)																																																																																					
	(ii)	1 10	B1 B1	penultimate last SC1 ... 8, 5																																																																																					
	(iii)	The ball will not have an equal probability of landing in each jar	B1																																																																																						
	(iv)	<table border="0"> <tr> <td>e.g. 00, 01 → 00</td> <td>e.g. corner</td> <td>00</td> <td>00-01</td> <td>2</td> </tr> <tr> <td>02, 03 → 03</td> <td>edge</td> <td>01</td> <td>02-05</td> <td>4</td> </tr> <tr> <td>04, 05 → 12</td> <td>edge</td> <td>02</td> <td>06-09</td> <td>4</td> </tr> <tr> <td>06, 07 → 15</td> <td>corner</td> <td>03</td> <td>10-11</td> <td>2</td> </tr> <tr> <td>08 – 11 → 01</td> <td>edge</td> <td>04</td> <td>12-15</td> <td>4</td> </tr> <tr> <td>12 – 15 → 02</td> <td>inside</td> <td>05</td> <td>16-23</td> <td>8</td> </tr> <tr> <td>16 – 19 → 04</td> <td>inside</td> <td>06</td> <td>24-31</td> <td>8</td> </tr> <tr> <td>20 – 23 → 07</td> <td>edge</td> <td>07</td> <td>32-35</td> <td>4</td> </tr> <tr> <td>24 – 27 → 08</td> <td>edge</td> <td>08</td> <td>36-39</td> <td>4</td> </tr> <tr> <td>28 – 31 → 11</td> <td>inside</td> <td>09</td> <td>40-47</td> <td>8</td> </tr> <tr> <td>32 – 35 → 13</td> <td>inside</td> <td>10</td> <td>48-55</td> <td>8</td> </tr> <tr> <td>36 – 39 → 14</td> <td>edge</td> <td>11</td> <td>56-59</td> <td>4</td> </tr> <tr> <td>40 – 47 → 05</td> <td>corner</td> <td>12</td> <td>60-61</td> <td>2</td> </tr> <tr> <td>48 – 55 → 06</td> <td>edge</td> <td>13</td> <td>62-65</td> <td>4</td> </tr> <tr> <td>56 – 63 → 09</td> <td>edge</td> <td>14</td> <td>66-69</td> <td>4</td> </tr> <tr> <td>64 – 71 → 10</td> <td>corner</td> <td>15</td> <td>70-71</td> <td>2</td> </tr> <tr> <td>72 – 99 → reject and repeat</td> <td>reject</td> <td></td> <td>72-99</td> <td>28</td> </tr> </table>	e.g. 00, 01 → 00	e.g. corner	00	00-01	2	02, 03 → 03	edge	01	02-05	4	04, 05 → 12	edge	02	06-09	4	06, 07 → 15	corner	03	10-11	2	08 – 11 → 01	edge	04	12-15	4	12 – 15 → 02	inside	05	16-23	8	16 – 19 → 04	inside	06	24-31	8	20 – 23 → 07	edge	07	32-35	4	24 – 27 → 08	edge	08	36-39	4	28 – 31 → 11	inside	09	40-47	8	32 – 35 → 13	inside	10	48-55	8	36 – 39 → 14	edge	11	56-59	4	40 – 47 → 05	corner	12	60-61	2	48 – 55 → 06	edge	13	62-65	4	56 – 63 → 09	edge	14	66-69	4	64 – 71 → 10	corner	15	70-71	2	72 – 99 → reject and repeat	reject		72-99	28	M1 A1  M1 A1  M1 A1  M1 A1	reject some efficient – numbers stated  rule for corner jars  rule for edge jars  rule for inside jars
e.g. 00, 01 → 00	e.g. corner	00	00-01	2																																																																																					
02, 03 → 03	edge	01	02-05	4																																																																																					
04, 05 → 12	edge	02	06-09	4																																																																																					
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08 – 11 → 01	edge	04	12-15	4																																																																																					
12 – 15 → 02	inside	05	16-23	8																																																																																					
16 – 19 → 04	inside	06	24-31	8																																																																																					
20 – 23 → 07	edge	07	32-35	4																																																																																					
24 – 27 → 08	edge	08	36-39	4																																																																																					
28 – 31 → 11	inside	09	40-47	8																																																																																					
32 – 35 → 13	inside	10	48-55	8																																																																																					
36 – 39 → 14	edge	11	56-59	4																																																																																					
40 – 47 → 05	corner	12	60-61	2																																																																																					
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56 – 63 → 09	edge	14	66-69	4																																																																																					
64 – 71 → 10	corner	15	70-71	2																																																																																					
72 – 99 → reject and repeat	reject		72-99	28																																																																																					
	(v)	e.g. Using the above rule(s), the first ball lands in jar 00 (00) and the second in jar 06 (10).	B1 B1	√ subject to last 3 M marks																																																																																					

Question	Answer	Marks	Guidance
<p>6 (i)</p>	<p>e.g.</p>	<p>M1 A1 A1 A1</p>	<p>activity-on-arc A, B, C D, E Rest</p>
<p>6 (ii)</p>	<p>e.g.</p> <p>minimum completion time – 12 days critical activities – A, C, D, F, H.</p>	<p>M1 A1 M1 A1 B1 B1</p>	<p>forward pass backward pass</p>

<p><b>6 (iii)</b></p>	<p>e.g.</p>	<p>Minimum completion time = 10.5 days Afzal needs to be employed for 6.5 days.</p>	<p>B1 B1 B1  B1 B1</p>	<p>A, B, C D, E F, G, H</p>
<p><b>6 (iv)</b></p>	<p>17 days</p>		<p>B1</p>	

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