

Mark Scheme (Results) January 2010

GCE

Decision Mathematics D1 (6689)

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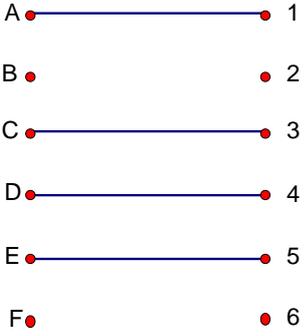
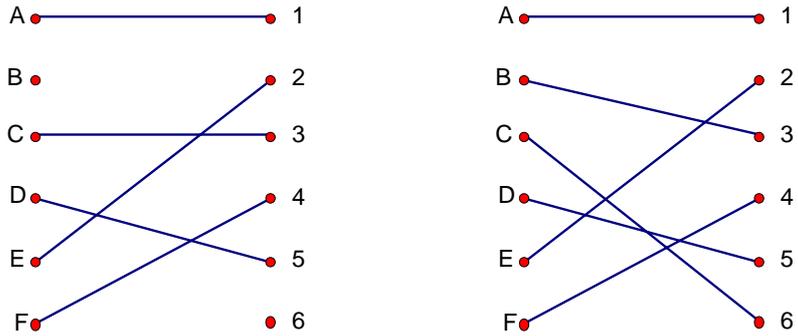
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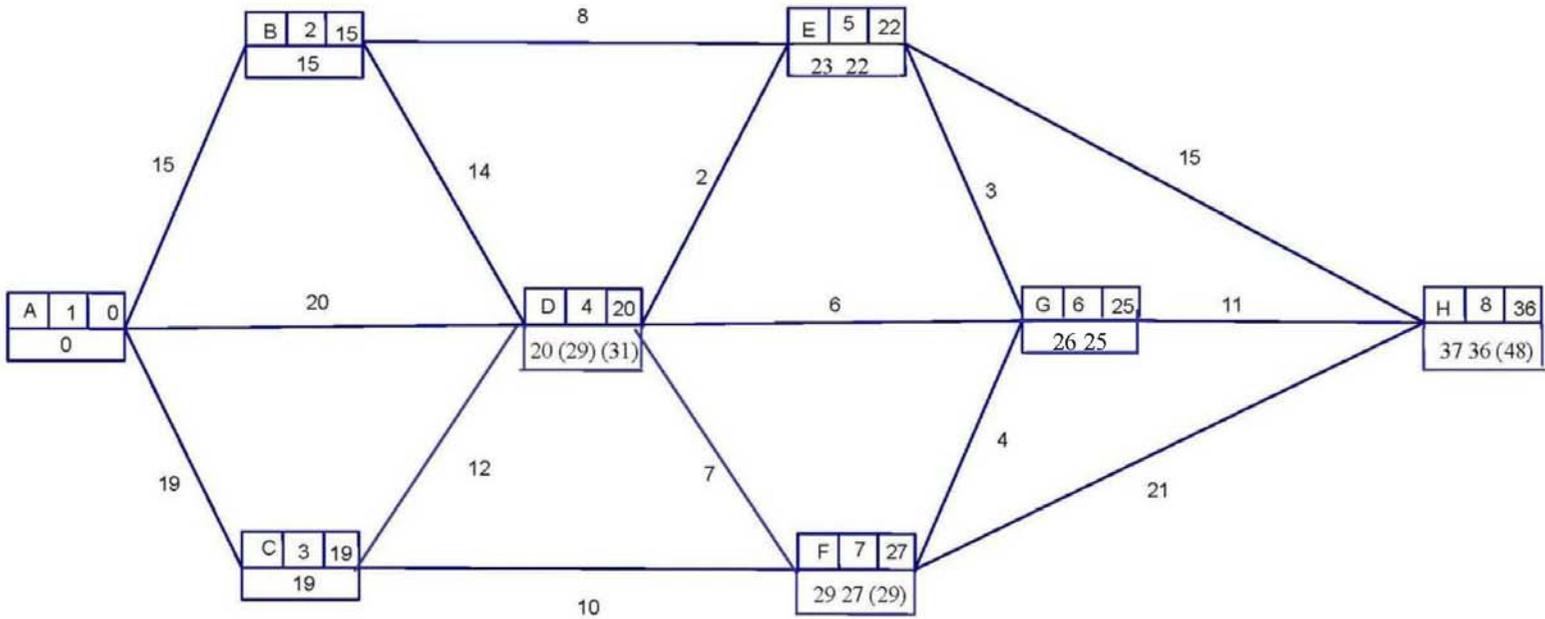
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January 2010
6689 Decision Mathematics D1
Mark Scheme

Question Number	Scheme	Marks												
Q1(a)	 <p style="text-align: right; margin-right: 50px;">Initial map</p>	B1 (1)												
Q1(b)		<p>E.g.</p> <table style="width: 100%; border: none;"> <tr> <td style="width: 30%; text-align: center;">Path 1</td> <td style="text-align: center;">F-4-D-5-E-2</td> <td style="width: 30%;"></td> <td style="width: 10%;"></td> </tr> <tr> <td style="text-align: center;">Path 2</td> <td style="text-align: center;">B-3-C-6</td> <td></td> <td></td> </tr> <tr> <td style="text-align: center;">Matching</td> <td style="text-align: center;">A : 1, B : 3, C : 6, D : 5, E : 2, F : 4</td> <td></td> <td></td> </tr> </table>	Path 1	F-4-D-5-E-2			Path 2	B-3-C-6			Matching	A : 1, B : 3, C : 6, D : 5, E : 2, F : 4		
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		M1 A1 M1 A1 A1 (5) [6]												

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	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th rowspan="2" style="width: 5%;">1</th> <th rowspan="2" style="width: 25%;">Path 1</th> <th rowspan="2" style="width: 25%;">Path 2</th> <th colspan="6" style="text-align: center;">Matching</th> </tr> <tr> <th style="width: 5%;">A</th> <th style="width: 5%;">B</th> <th style="width: 5%;">C</th> <th style="width: 5%;">D</th> <th style="width: 5%;">E</th> <th style="width: 5%;">F</th> </tr> </thead> <tbody> <tr><td>1</td><td>B-3-C-1-A-2</td><td>F-3-B-4-D-5-E-1-C-6</td><td>2</td><td>4</td><td>6</td><td>5</td><td>1</td><td>3</td></tr> <tr><td>2</td><td>B-3-C-1-A-2</td><td>F-3-B-4-D-5-E-2-A-1-C-6</td><td>1</td><td>4</td><td>6</td><td>5</td><td>2</td><td>3</td></tr> <tr><td>3</td><td>B-3-C-1-A-2</td><td>F-4-D-5-E-1-C-6</td><td>2</td><td>3</td><td>6</td><td>5</td><td>1</td><td>4</td></tr> <tr><td>4</td><td>B-3-C-1-A-2</td><td>F-4-D-5-E-2-A-1-C-6</td><td>1</td><td>3</td><td>6</td><td>5</td><td>2</td><td>4</td></tr> <tr><td>5</td><td>B-3-C-4-D-5-E-1-A-2</td><td>F-3-B-4-C-6</td><td>2</td><td>4</td><td>6</td><td>5</td><td>1</td><td>3</td></tr> <tr><td>6</td><td>B-3-C-4-D-5-E-1-A-2</td><td>F-4-C-6</td><td>2</td><td>3</td><td>6</td><td>5</td><td>1</td><td>4</td></tr> <tr><td>7</td><td>B-3-C-6</td><td>F-3-B-4-D-5-E-1-A-2</td><td>2</td><td>4</td><td>6</td><td>5</td><td>1</td><td>3</td></tr> <tr><td>8</td><td>B-3-C-6</td><td>F-3-B-4-D-5-E-2</td><td>1</td><td>4</td><td>6</td><td>5</td><td>2</td><td>3</td></tr> <tr><td>9</td><td>B-3-C-6</td><td>F-4-D-5-E-1-A-2</td><td>2</td><td>3</td><td>6</td><td>5</td><td>1</td><td>4</td></tr> <tr><td>10</td><td>B-3-C-6</td><td>F-4-D-5-E-2</td><td>1</td><td>3</td><td>6</td><td>5</td><td>2</td><td>4</td></tr> <tr><td>11</td><td>B-4-D-5-E-2</td><td>F-3-C-6</td><td>1</td><td>4</td><td>6</td><td>5</td><td>2</td><td>3</td></tr> <tr><td>12</td><td>B-4-D-5-E-2</td><td>F-4-B-3-C-6</td><td>1</td><td>3</td><td>6</td><td>5</td><td>2</td><td>4</td></tr> <tr><td>13</td><td>B-4-D-5-E-1-A-2</td><td>F-3-C-6</td><td>2</td><td>4</td><td>6</td><td>5</td><td>1</td><td>3</td></tr> <tr><td>14</td><td>B-4-D-5-E-1-A-2</td><td>F-4-B-3-C-6</td><td>2</td><td>3</td><td>6</td><td>5</td><td>1</td><td>4</td></tr> <tr><td>15</td><td>F-3-C-1-A-2</td><td>B-3-F-4-D-5-E-1-C-6</td><td>2</td><td>3</td><td>6</td><td>5</td><td>1</td><td>4</td></tr> <tr><td>16</td><td>F-3-C-1-A-2</td><td>B-3-F-4-D-5-E-2-A-1-C-6</td><td>1</td><td>3</td><td>6</td><td>5</td><td>2</td><td>4</td></tr> <tr><td>17</td><td>F-3-C-1-A-2</td><td>B-4-D-5-E-1-C-6</td><td>2</td><td>4</td><td>6</td><td>5</td><td>1</td><td>3</td></tr> <tr><td>18</td><td>F-3-C-1-A-2</td><td>B-4-D-5-E-2-A-1-C-6</td><td>1</td><td>4</td><td>6</td><td>5</td><td>2</td><td>3</td></tr> <tr><td>19</td><td>F-3-C-4-D-5-E-1-A-2</td><td>B-3-F-4-C-6</td><td>2</td><td>3</td><td>6</td><td>5</td><td>1</td><td>4</td></tr> <tr><td>20</td><td>F-3-C-4-D-5-E-1-A-2</td><td>B-4-C-6</td><td>2</td><td>4</td><td>6</td><td>5</td><td>1</td><td>3</td></tr> <tr><td>21</td><td>F-3-C-6</td><td>B-3-F-4-D-5-E-1-A-2</td><td>2</td><td>3</td><td>6</td><td>5</td><td>1</td><td>4</td></tr> <tr><td>22</td><td>F-3-C-6</td><td>B-3-F-4-D-5-E-2</td><td>1</td><td>3</td><td>6</td><td>5</td><td>2</td><td>4</td></tr> <tr><td>23</td><td>F-3-C-6</td><td>B-4-D-5-E-1-A-2</td><td>2</td><td>4</td><td>6</td><td>5</td><td>1</td><td>3</td></tr> <tr><td>24</td><td>F-3-C-6</td><td>B-4-D-5-E-2</td><td>1</td><td>4</td><td>6</td><td>5</td><td>2</td><td>3</td></tr> <tr><td>25</td><td>F-4-D-5-E-2</td><td>B-3-C-6</td><td>1</td><td>3</td><td>6</td><td>5</td><td>2</td><td>4</td></tr> <tr><td>26</td><td>F-4-D-5-E-2</td><td>B-4-F-3-C-6</td><td>1</td><td>4</td><td>6</td><td>5</td><td>2</td><td>3</td></tr> <tr><td>27</td><td>F-4-D-5-E-1-A-2</td><td>B-3-C-6</td><td>2</td><td>3</td><td>6</td><td>5</td><td>1</td><td>4</td></tr> <tr><td>28</td><td>F-4-D-5-E-1-A-2</td><td>B-4-F-3-C-6</td><td>2</td><td>4</td><td>6</td><td>5</td><td>1</td><td>3</td></tr> </tbody> </table> <p data-bbox="209 1590 303 1624">Notes</p> <p data-bbox="209 1657 1324 1870">(a) B1 cao preferably just 4 lines, but accept if unambiguous. (b) M1 attempt at a path from B or F to 2 or 6 A1 correct path - including change status M1 attempt at a second path from F or B to 6 or 2 A1 correct path - including change status (do not penalise change status twice) A1 correct matching; must follow from 2 correct paths</p>	1	Path 1	Path 2	Matching						A	B	C	D	E	F	1	B-3-C-1-A-2	F-3-B-4-D-5-E-1-C-6	2	4	6	5	1	3	2	B-3-C-1-A-2	F-3-B-4-D-5-E-2-A-1-C-6	1	4	6	5	2	3	3	B-3-C-1-A-2	F-4-D-5-E-1-C-6	2	3	6	5	1	4	4	B-3-C-1-A-2	F-4-D-5-E-2-A-1-C-6	1	3	6	5	2	4	5	B-3-C-4-D-5-E-1-A-2	F-3-B-4-C-6	2	4	6	5	1	3	6	B-3-C-4-D-5-E-1-A-2	F-4-C-6	2	3	6	5	1	4	7	B-3-C-6	F-3-B-4-D-5-E-1-A-2	2	4	6	5	1	3	8	B-3-C-6	F-3-B-4-D-5-E-2	1	4	6	5	2	3	9	B-3-C-6	F-4-D-5-E-1-A-2	2	3	6	5	1	4	10	B-3-C-6	F-4-D-5-E-2	1	3	6	5	2	4	11	B-4-D-5-E-2	F-3-C-6	1	4	6	5	2	3	12	B-4-D-5-E-2	F-4-B-3-C-6	1	3	6	5	2	4	13	B-4-D-5-E-1-A-2	F-3-C-6	2	4	6	5	1	3	14	B-4-D-5-E-1-A-2	F-4-B-3-C-6	2	3	6	5	1	4	15	F-3-C-1-A-2	B-3-F-4-D-5-E-1-C-6	2	3	6	5	1	4	16	F-3-C-1-A-2	B-3-F-4-D-5-E-2-A-1-C-6	1	3	6	5	2	4	17	F-3-C-1-A-2	B-4-D-5-E-1-C-6	2	4	6	5	1	3	18	F-3-C-1-A-2	B-4-D-5-E-2-A-1-C-6	1	4	6	5	2	3	19	F-3-C-4-D-5-E-1-A-2	B-3-F-4-C-6	2	3	6	5	1	4	20	F-3-C-4-D-5-E-1-A-2	B-4-C-6	2	4	6	5	1	3	21	F-3-C-6	B-3-F-4-D-5-E-1-A-2	2	3	6	5	1	4	22	F-3-C-6	B-3-F-4-D-5-E-2	1	3	6	5	2	4	23	F-3-C-6	B-4-D-5-E-1-A-2	2	4	6	5	1	3	24	F-3-C-6	B-4-D-5-E-2	1	4	6	5	2	3	25	F-4-D-5-E-2	B-3-C-6	1	3	6	5	2	4	26	F-4-D-5-E-2	B-4-F-3-C-6	1	4	6	5	2	3	27	F-4-D-5-E-1-A-2	B-3-C-6	2	3	6	5	1	4	28	F-4-D-5-E-1-A-2	B-4-F-3-C-6	2	4	6	5	1	3		
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Q3(a)



Clear method to include at least 1 update

(look at E, F, G or H)

BCDE correct

FGH correct

Route ADEGH

Total time 36 Minutes

M1

A1

A1ft

A1

A1ft (5)

Question Number	Scheme	Marks
Q3(b)	<p>Odd nodes are A, B, C, H</p> <p>$AB + CH = 15 + 25 = 40$</p> <p>$AC + BH = 19 + 22 = 41$</p> <p>$AH + BC = 36 + 22 = 58$</p> <p>(40 is the shortest, repeating AB and CF + FG + GH)</p> <p>Must be choosing from at least two pairings for this last mark</p> <p>Shortest time = $167 + 40 = 207$ minutes. $167 +$ their shortest</p>	<p>M1</p> <p>A1</p> <p>A1</p> <p>A1</p> <p>A1ft</p> <p>(5)</p> <p>[10]</p>

Alternate solutions for Question 4

Choosing middle left

0.6	4.0	2.5	3.2	<u>0.5</u>	2.6	0.4	0.3	4.0	1.0	(pivot 0.5)
0.6	4.0	2.5	<u>3.2</u>	2.6	4.0	1.0	0.5	<u>0.4</u>	0.3	(pivots 3.2, 0.4)
<u>4.0</u>	4.0	3.2	0.6	<u>2.5</u>	2.6	1.0	0.5	0.4	<u>0.3</u>	(pivots 4.0, 2.5)
4.0	<u>4.0</u>	3.2	<u>2.6</u>	2.5	<u>0.6</u>	1.0	0.5	0.4	0.3	(pivots 0.6)
4.0	4.0	3.2	2.6	2.5	<u>1.0</u>	0.6	0.5	0.4	0.3	
4.0	4.0	3.2	2.6	2.5	1.0	0.6	0.5	0.4	0.3	

Choosing first

<u>0.6</u>	4.0	2.5	3.2	0.5	2.6	0.4	0.3	4.0	1.0	(pivot 0.6)
<u>4.0</u>	2.5	3.2	2.6	4.0	1.0	0.6	<u>0.5</u>	0.4	0.3	(pivots 4.0, 0.5)
4.0	<u>2.5</u>	3.2	2.6	4.0	1.0	0.6	0.5	<u>0.4</u>	0.3	(pivots 2.5, 0.4)
4.0	<u>3.2</u>	2.6	4.0	2.5	<u>1.0</u>	0.6	0.5	0.4	<u>0.3</u>	(pivots 3.2)
4.0	<u>4.0</u>	3.2	<u>2.6</u>	2.5	1.0	0.6	0.5	0.4	0.3	
4.0	4.0	3.2	2.6	2.5	1.0	0.6	0.5	0.4	0.3	

OR (alternate choosing first)

<u>0.6</u>	4.0	2.5	3.2	0.5	2.6	0.4	0.3	4.0	1.0	(pivot 0.6)
<u>4.0</u>	2.5	3.2	2.6	4.0	1.0	0.6	<u>0.5</u>	0.4	0.3	(pivots 4.0, 0.5)
<u>4.0</u>	4.0	<u>2.5</u>	3.2	2.6	1.0	0.6	0.5	<u>0.4</u>	0.3	(pivots 2.5, 0.4)
4.0	4.0	<u>3.2</u>	2.6	2.5	<u>1.0</u>	0.6	0.5	0.4	<u>0.3</u>	(pivots 3.2)
4.0	4.0	3.2	<u>2.6</u>	2.5	1.0	0.6	0.5	0.4	0.3	
4.0	4.0	3.2	2.6	2.5	1.0	0.6	0.5	0.4	0.3	

Question 4 sorting into ASCENDING order (full marks if then reversed, otherwise MISREAD)

Middle left

0.6	4.0	2.5	3.2	<u>0.5</u>	2.6	0.4	0.3	4.0	1.0	(pivot 0.5)
<u>0.4</u>	0.3	0.5	0.6	4.0	2.5	<u>3.2</u>	2.6	4.0	1.0	(pivot 0.4, 3.2)
<u>0.3</u>	0.4	0.5	0.6	<u>2.5</u>	2.6	1.0	3.2	<u>4.0</u>	4.0	(pivot 2.5, 4.0)
0.3	0.4	0.5	<u>0.6</u>	1.0	2.5	<u>2.6</u>	3.2	4.0	4.0	(pivot 0.6)
0.3	0.4	0.5	0.6	1.0	2.5	2.6	3.2	4.0	4.0	

Middle right

0.6	4.0	2.5	3.2	0.5	<u>2.6</u>	0.4	0.3	4.0	1.0	(pivot 2.6)
0.6	2.5	0.5	<u>0.4</u>	0.3	1.0	2.6	4.0	<u>3.2</u>	4.0	(pivot 0.4, 3.2)
0.3	0.4	0.6	2.5	<u>0.5</u>	1.0	2.6	3.2	<u>4.0</u>	<u>4.0</u>	(pivot 0.5, 4.0)
0.3	0.4	0.5	0.6	<u>2.5</u>	1.0	2.6	3.2	4.0	4.0	(pivot 2.5)
0.3	0.4	0.5	0.6	<u>1.0</u>	2.5	2.6	3.2	4.0	4.0	(pivot 1.0)

First (1)

<u>0.6</u>	4.0	2.5	3.2	0.5	2.6	0.4	0.3	4.0	1.0	(pivot 0.6)
<u>0.5</u>	0.4	0.3	0.6	<u>4.0</u>	2.5	3.2	2.6	4.0	1.0	(pivot 0.5, 4.0)
<u>0.4</u>	0.3	0.5	0.6	<u>2.5</u>	3.2	2.6	1.0	4.0	4.0	(pivots 0.4, 2.5)
0.3	0.4	0.5	0.6	1.0	2.5	<u>3.2</u>	2.6	4.0	4.0	(pivots 3.2)
0.3	0.4	0.5	0.6	1.0	2.5	2.6	3.2	4.0	4.0	

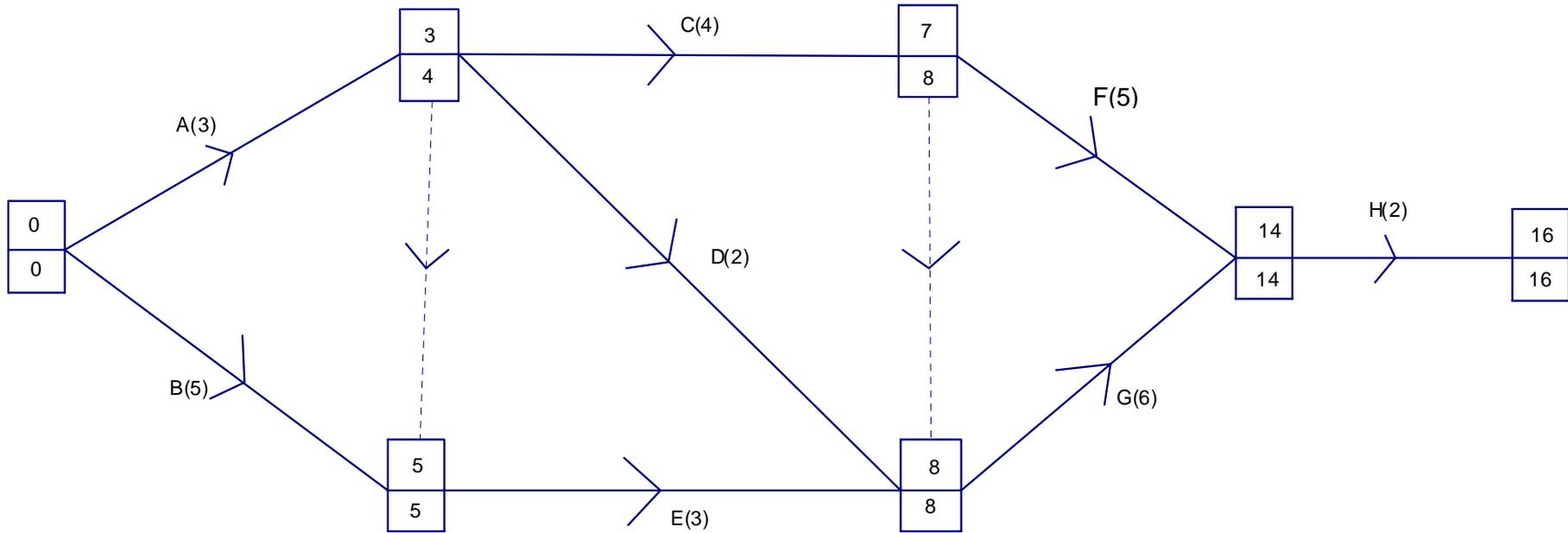
First (2)

<u>0.6</u>	4.0	2.5	3.2	0.5	2.6	0.4	0.3	4.0	1.0	(pivot 0.6)
<u>0.5</u>	0.4	0.3	0.6	<u>4.0</u>	2.5	3.2	2.6	4.0	1.0	(pivot 0.5, 4.0)
<u>0.4</u>	0.3	0.5	0.6	<u>2.5</u>	3.2	2.6	1.0	4.0	4.0	(pivots 0.4, 2.5)
0.3	0.4	0.5	0.6	1.0	2.5	<u>3.2</u>	2.6	4.0	4.0	(pivots 3.2)
0.3	0.4	0.5	0.6	1.0	2.5	2.6	3.2	4.0	4.0	

Question Number	Scheme						Marks	
Q5								
(a)	S	T	R	R>0?	Output			
	25000	0	17000	y		Line 1		
		3400				Line 2		
			7000			Line 3		
				y		Line 4		
		4450				Line 5		
			-5000			Line 6		
				n		Line 7		
					4450			
						Lines 1 & 2:	M1A1	
						Lines 3-7:	M1A1	
						Output correct:	A1	
							(5)	
(b)	Tax on £25 000 is £4450						B1ft	(1)
(c)	Tax free sum = £8000:						B1	(1)
							[7]	

Question Number	Scheme	Marks																		
Q6(a)	The dotted line represents a dummy activity. It is necessary because C and D depend only on A, but E depends on A and B.	B1 B1 (2)																		
Q6(b)	<table border="1" data-bbox="296 472 852 1359"> <thead> <tr> <th data-bbox="296 472 564 539">Activity</th> <th data-bbox="564 472 852 539">Immediately preceding activity</th> </tr> </thead> <tbody> <tr> <td data-bbox="296 539 564 645">A</td> <td data-bbox="564 539 852 645">-</td> </tr> <tr> <td data-bbox="296 645 564 750">B</td> <td data-bbox="564 645 852 750">-</td> </tr> <tr> <td data-bbox="296 750 564 855">C</td> <td data-bbox="564 750 852 855">A</td> </tr> <tr> <td data-bbox="296 855 564 960">D</td> <td data-bbox="564 855 852 960">A</td> </tr> <tr> <td data-bbox="296 960 564 1066">E</td> <td data-bbox="564 960 852 1066">A,B</td> </tr> <tr> <td data-bbox="296 1066 564 1171">F</td> <td data-bbox="564 1066 852 1171">C (A)</td> </tr> <tr> <td data-bbox="296 1171 564 1276">G</td> <td data-bbox="564 1171 852 1276">C, D, E</td> </tr> <tr> <td data-bbox="296 1276 564 1359">H</td> <td data-bbox="564 1276 852 1359">F, G</td> </tr> </tbody> </table> <p data-bbox="991 853 1145 887">To this point</p> <p data-bbox="863 1055 1206 1122">For E & F, accepting correct "extra"</p> <p data-bbox="863 1261 1198 1294">Last two rows, correct only,</p>	Activity	Immediately preceding activity	A	-	B	-	C	A	D	A	E	A,B	F	C (A)	G	C, D, E	H	F, G	B1 B1 B1 (3)
Activity	Immediately preceding activity																			
A	-																			
B	-																			
C	A																			
D	A																			
E	A,B																			
F	C (A)																			
G	C, D, E																			
H	F, G																			

Q6(c)



Early times
Late times

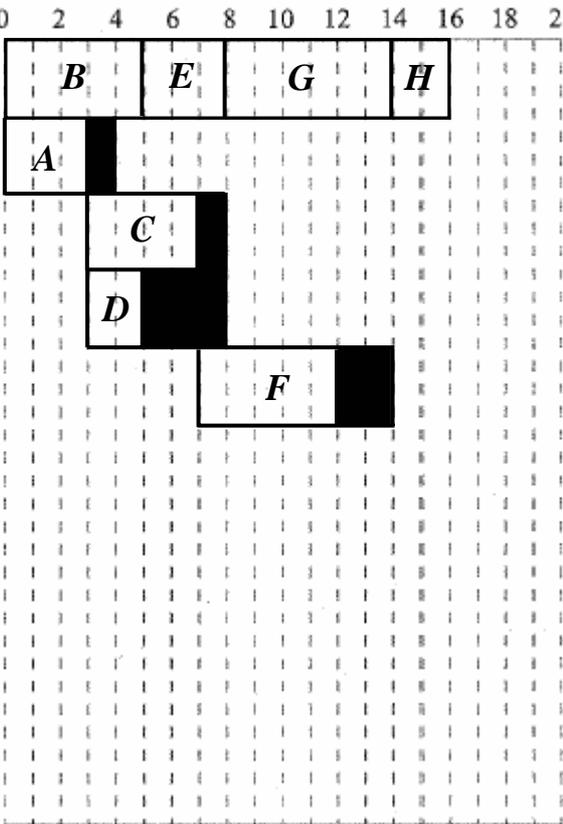
M1A1
M1A1 (4)

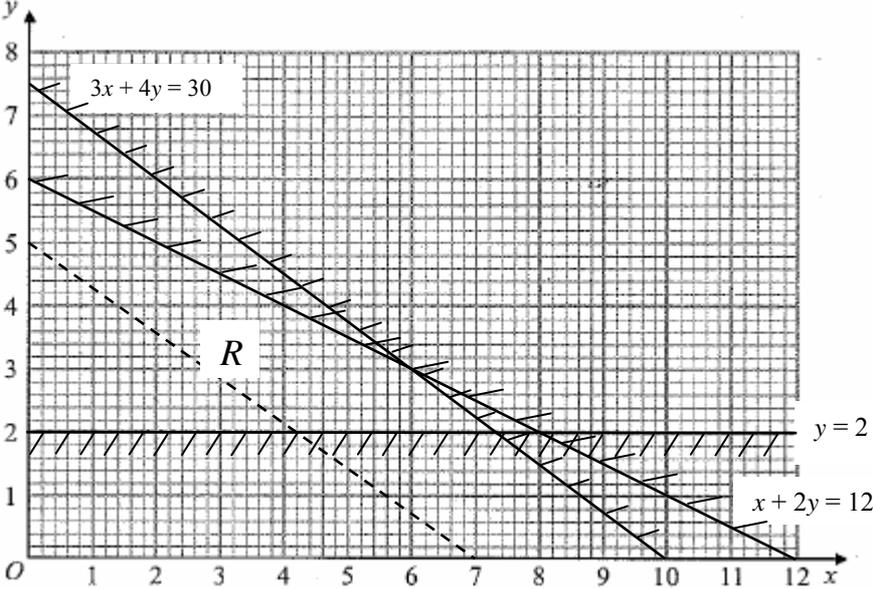
Q6(d) Critical activities: B, E, G, H

B1

Critical path: 16 days

B1ft (2)

Question Number	Scheme	Marks
Q6(e)	 <p data-bbox="660 1272 1337 1308">At least 6 activities placed including at least 3 floats</p> <p data-bbox="1102 1346 1337 1382">Critical Activities</p> <p data-bbox="1254 1420 1337 1456">A + C</p> <p data-bbox="1254 1494 1337 1529">D + F</p>	<p data-bbox="1361 1272 1398 1308">M1</p> <p data-bbox="1361 1346 1398 1382">A1</p> <p data-bbox="1361 1420 1398 1456">A1</p> <p data-bbox="1361 1494 1398 1529">A1</p> <p data-bbox="1481 1525 1517 1561">(4)</p> <p data-bbox="1465 1637 1517 1673">[15]</p>

Question Number	Scheme	Marks
Q7(a)	$x + 2y \leq 12$ ($150x + 300y \leq 1800$)	M1A1 (2)
Q7(b)	$0.9x + 1.2y \leq 9$ $\rightarrow 3x + 4y \leq 30$ (*)	M1 A1 cso (2)
Q7(c)	(You need to buy) at least 2 large cupboards.	B1 (1)
Q7(d)	Capacity C and $140\%C$ So total is $Cx + \frac{140}{100}Cy$ Simplify to $7y + 5x$ (*)	M1 A1cso (2)
Q7(e)	 <p>Graph: $y \geq 2$ $0.9x + 1.2y \leq 12$ ($3x + 4y \leq 30$) $x + 2y \leq 12$ ($150x + 300y \leq 1800$) Lines labelled & drawn with a ruler</p> <p>Shading, Region identified</p>	B1 B1 B1 B1 B1, B1 (6)
Q7(f)	Consider points and value of $5x + 7y$: Or draw a clear profit line $(7,2) \rightarrow 49$ or $(7 \frac{1}{3}, 2) \rightarrow 50 \frac{2}{3}$, or $(7.3, 2) \rightarrow 50.5$ $(6,3) \rightarrow 51$ $(0,6) \rightarrow 42$ $(0,2) \rightarrow 14$ Best option is to buy 6 standard cupboards and 3 large cupboards.	M1A1 A1 A1 (4)

[17]

Question 7 notes

- (a) 1M1 – correct terms, accept = here, accept swapped coefficients.
1A1 – cao does not need to be simplified.
- (b) 1M1 – correct terms, must deal with cm/m correctly, accept = here.
1A1 – cso **answer given**.
- (c) 1B1 – cao ‘at least’ and ‘2’ and ‘large’.
- (d) 1M1 – ‘1.4’ or ‘5 x 40%’ maybe ‘5+2’ seen, they **must** be **seen** to engage with 140% in some way.
1A1 – cso **answer given**.

Lines should be within 1 small square of correct point at axes.

- (e) 1B1 – correctly drawing $y = 2$.
2B1 – correctly drawing $3x + 4y = 30$ [$0.9x + 1.2y = 12$]
3B1 – correctly drawing $x + 2y = 12$ [$150x + 300y = 1800$], **ft only** if swapped coefficients in (a) (6,0) (2,8).

These next 3 marks are only available for candidates who have drawn at least 2 lines, including at least one ‘diagonal’ line with negative gradient.

- 4B1 – Ruler used. At least 2 lines labelled including one ‘diagonal’ line.
5B1 – Shading, or R correct, b.o.d. on their lines.
6B1 – all lines and R correct.
- (f) 1M1 At least 2 points tested **or** objective line drawn with correct m or 1/m, minimum intercepts 3.5 and 2.5.
1A1 – 2 points correctly tested **or** objective line correct.
2A1 – 3 points correctly tested **or** objective line correct and distinct/labelled.
3A1 – 6 standard and 3 large, accept (6,3) if very clearly selected in some way.

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