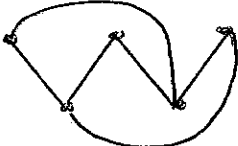
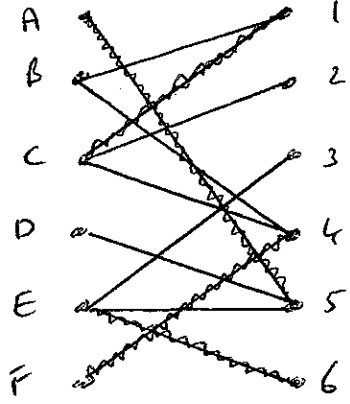


November 2004  
6689 Decision Mathematics D1  
Mark Scheme

Question Number	Scheme	Marks
1 (a)	<p>(By conservation of flow at B, C and D)</p> $\underline{x=11} \quad \underline{y=5} \quad \underline{z=12}$ $(\sqrt{x-6}) \quad (\sqrt{y+7})$	<p>B3, 2, 1, 0 (3)</p>
(b)	<p><u>Flow is 31</u> (Max flow = min cut), cut through <u>AB, AC and SD</u></p>	<p>B1 B1 (2) <u>5</u></p>
2 (a) (i)	<p>A graph is planar if it can be drawn so that <u>no arcs cross</u> - other than at vertices</p>	<p>B1</p>
(ii)	<p>A cycle that passes through <u>every</u> vertex of a graph <u>once</u> and <u>returns</u> to its starting vertex</p>	<p>B2, 1, 0 (3)</p>
(b) (i)	<p>e.g. </p>	<p>M1 A1</p>
(ii)	<p>It is not possible to find a Hamiltonian cycle</p>	<p>B1 (3) <u>6</u></p>

Question Number	Scheme	Marks
<p>3)</p> <p>(a)</p> <p>(b)</p>	 <p>(c) eg <math>B=1=C=2</math> c.s. <math>B=1-C=2</math>  <math>A=5, B=1, C=2, E=6, F=4</math></p> <p>(d) es. • Both A and D are only matched to 5, once one has been assigned the other can not be.          • E is the only person who can do 3, and the only person who can do 6. if they are assigned to one of these the other can not be done.</p>	<p>B1</p> <p>B1</p> <p>(2)</p> <p>M1A1 B1 (c.s.) A1A1 (4)</p> <p>B2,1,0 (2)</p> <p><b>8</b></p>

Question Number	Scheme	Marks
4) (a)	<p>e.g. 45 37 18 <span style="border: 1px solid black; padding: 2px;">46</span> 56 79 90 81 51            or 37 18 <span style="border: 1px solid black; padding: 2px;">45</span> 56 79 46 90 81 51            or 45 37 46 18 <span style="border: 1px solid black; padding: 2px;">51</span> 56 79 90 81</p> <p>(b) 56 45 79 46 37 90 81 51 18            or 90 45 56 37 79 46 18 81 51</p> <p>(c) <math>\left[ \frac{1+11}{2} \right] = 6</math> value 44 discarded top  <math>\left[ \frac{7+11}{2} \right] = 9</math> value 71 discarded top  <math>\left[ \frac{10+11}{2} \right] = 11</math> value 94 discarded bottom            List reduces to 10<sup>th</sup> value. This is 73 so  <u>73 has been selected as the 10<sup>th</sup> value</u></p>	<p>M1 A1 (2)</p> <p>M1 A1 (2)</p> <p>M1 A1 A1 A1 (4)</p> <p style="text-align: right;"><span style="border: 1px solid black; padding: 2px;">8</span></p>
5(a)	<p><math>B_1G + B_2E = 26 + 30 = 56</math>  <math>B_1B_2 + EG = 65 + 18 = 83</math>  <math>B_1E + B_2G = 41 + 42 = 83</math>            Repeat B<sub>1</sub>D, DG, B<sub>2</sub>A, AE            Route e.g. F A B<sub>2</sub> A C E A E F D B<sub>1</sub> D H G D G F            length = 129 + 56 = 185 km</p> <p>(b) now only E and G are odd - repeat EF, FG only            length = 129 + 18            = 147 km</p>	<p>M1 A1 A1 A1 (4) B1 M1 A1 (3) B1 M1 A1 (3)</p> <p style="text-align: right;"><span style="border: 1px solid black; padding: 2px;">10</span></p>

Question Number	Scheme	Marks
6 (a)	<p>Via A MEAG length <math>165 + 5x</math>  Via B MECBG length <math>265 + 2x</math></p> <p>(b) <math>165 + 5x &lt; 265 + 2x \implies x &lt; 33\frac{1}{3}</math>  So range is <math>0 \leq x &lt; 33\frac{1}{3}</math></p>	<p>m1  A1  A1✓  A1✓  (4)</p> <p>m1 A1  A1 (3)</p> <p>m1 A1✓  A1✓  (3)</p> <p>10</p>

Question Number	Scheme	Marks
7 (a)	maximum (P =) $0.4x + 0.2y$ (accept $40x + 20y$ ) subject to $x \leq 6.5$ $y \leq 8$ $x + y \leq 12$ $y \leq 4x$ $y \geq 0$	B1 B5, 4, 3, 3, 0 (6)
(b)	point testings or Profit Line $(6.5, 5.5) \Rightarrow 6500$ type x and $5500$ type y	M1 A1 A1 (3)
(c)	$P = 0.4(6500) + 0.2(5500)$ $= \pounds 3700$	M1 A1 (2) 11

Question Number	Scheme	Marks
8(a)	$x = 12$ $y = 24$ $z = 19$	B3, 2, 1, 0 (3)
(b)	Allow J and K to be given a unique representation using events	B1 (1)
(c)	$F - E - I - J$ $G - H$	M1A1 (2)
(d)	No effect, B has a total float of 2	M1A1 (2)
(e)	eg. • Total of activities = 54, $54 \div 24 = 2.25$ so 2 workers not enough • $54 \div 2 = 27$ hours per worker, so 2 workers can not finish in 24 hours • Argument about the activities that need to be completed by E = 7 or 10	B2, 1, 0 (2)
(f)		M1A1 A1 A1 A1 (5)
(g)	10 extra hours $\therefore$ £280	M1A1 (2)
		<div style="border: 1px solid black; padding: 5px; display: inline-block;">17</div>