

EDEXCEL 6689 DECISION MATHEMATICS D1 JANUARY 2004 MARK SCHEME

Question	Mark Scheme	Marks
<p><b>1. (a)</b></p> <p><b>(b)</b></p> <p><b>(c)</b></p> <p><b>(d)</b></p>	<p>A graph consisting of <u>two distinct sets of vertices</u> X and Y in which... <u>arcs can only join a vertex in X to a vertex in Y.</u></p> <p>A path <u>from an unmatched vertex in X to an unmatched vertex</u> in Y... ..which <u>alternately uses arcs in/not in the matching.</u></p> <p>The (1-1) matching / pairing of <u>some</u> elements of X with elements of Y.</p> <p>A <u>1-1</u> matching between <u>all</u> elements of X onto Y</p>	<p>B1 B1 (2)</p> <p>B1 B1 (2)</p> <p>B1</p> <p>B1 (2) <b>(6)</b></p>
<p><b>2. (a)</b></p> <p><b>(b)</b></p> <p><b>(c)</b></p>	<p><u>Yes,</u> there are <u>no negative</u> values in the <u>profit row</u></p> <p><math>p = 63, x = 0, y = 7, z = 0, r = \frac{9}{2}, s = \frac{2}{3}, t = 0</math></p> <p><math>\frac{63}{7} = 9</math></p>	<p>B1 (1)</p> <p>M1, A1, A1, (3)</p> <p>M1, A1 (2) <b>(6)</b></p>

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<p>3. (a)</p> <p>(b)</p> <p>(c)</p>	<p><math>C_1 = 7 + 14 + 0 + 14 = 35</math></p> <p><math>C_2 = 7 + 14 + 5 = 26</math></p> <p><math>C_3 = 8 + 9 + 6 + 8 = 31</math></p> <p>Either Min cut = Max flow and we have a flow of 26 and a cut of 26 or C2 is through saturated arcs</p> <p>Using EJ (capacity 5) e. g – will increase flow by 1– ie increase it to 27 since only one more unit can leave E. - BEJL - 1</p> <p>Using FH (capacity 3) e. g.– will increase flow by 2 – ie increase it to 28 since only two more units can leave F. - BFHJL - 2</p> <p>Thus choose option 2 add FH capacity 3.</p>	<p>B1</p> <p>B1</p> <p>B1 (3)</p> <p>B1 (1)</p> <p>M1 A1</p> <p>A1 (3)</p> <p>(7)</p>
<p>4. (a)</p> <p>(b)</p>	<p><math>BD + FG = 1.3 + 0.9 = 2.2^*</math></p> <p><math>BF + DG = 1.5 + (1.3 + 0.7) = 3.5</math></p> <p><math>BG + DF = 0.7 + (0.9 + 0.8) = 2.4</math></p> <p>Repeat BD and FG</p> <p>Route e.g. <u>G</u>ABC<u>D</u>BFED<u>B</u>G<u>F</u>G</p> <p>Length = <math>8.9 + 2.2 = 11.1</math> km</p> <p>Only now need to repeat BF of length <math>1.5 &lt; 2.2</math></p> <p>Length = <math>8.9 + 1.5 = 10.4</math> km saving 0.7 (km )</p>	<p>M1</p> <p>A1</p> <p>A1</p> <p>(3)</p> <p>B1</p> <p>M1 A1 (3)</p> <p>M1 A1 <math>\checkmark</math></p> <p>A1 <math>\checkmark</math> (3)</p> <p>(9)</p>

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<p>5. (a)</p> <table border="1"> <thead> <tr> <th>a</th> <th>b</th> <th>c</th> <th>Integer?</th> <th>Output list</th> <th>a = b?</th> </tr> </thead> <tbody> <tr> <td>90</td> <td>2</td> <td>45</td> <td>Yes</td> <td>2</td> <td>No</td> </tr> <tr> <td>45</td> <td>2</td> <td>22.5</td> <td>No</td> <td></td> <td></td> </tr> <tr> <td>45</td> <td>3</td> <td>15</td> <td>Yes</td> <td>3</td> <td>No</td> </tr> <tr> <td>15</td> <td>2</td> <td>7.5</td> <td>No</td> <td></td> <td></td> </tr> <tr> <td>15</td> <td>3</td> <td>5</td> <td>Yes</td> <td>3</td> <td>No</td> </tr> <tr> <td>5</td> <td>2</td> <td>2.5</td> <td>No</td> <td></td> <td></td> </tr> <tr> <td>5</td> <td>3</td> <td><math>1\frac{2}{3}</math></td> <td>No</td> <td></td> <td></td> </tr> <tr> <td>5</td> <td>5</td> <td>1</td> <td>Yes</td> <td>5</td> <td>Yes</td> </tr> </tbody> </table> <p style="text-align: center;">Output list: 2,3,3,5</p> <p>(b) Gives the prime factorisation of a</p> <p>(c) C = 1</p>	a	b	c	Integer?	Output list	a = b?	90	2	45	Yes	2	No	45	2	22.5	No			45	3	15	Yes	3	No	15	2	7.5	No			15	3	5	Yes	3	No	5	2	2.5	No			5	3	$1\frac{2}{3}$	No			5	5	1	Yes	5	Yes	<p>M1 A1 A1 <math>\checkmark</math> M1 A1 M1 A1 <math>\checkmark</math> (7) B2, 1, 0 (2) B1 (1) <b>(10)</b></p>
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<p>6. (a)</p> <p>(b)</p> <p>(c)</p>	<p><u>See overlay</u></p> <p>BD, <math>\left(\frac{AC}{DF}\right)</math>, BC, Not CD, DE</p> <p>Length = 18 km</p> <p>DB, DF, BC, CA, DE [5,2,4,1,6,3,]</p> <div style="text-align: center;"> </div>	<p>B1 B1 (2) M1 A1, A1 B1 B1 (5) M1 A1 A1 (3) <b>(10)</b></p>																																																					

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<p>7. (a)</p> <p>(b)</p> <p>(c)</p>	<p><u>See overlay</u></p> <p>Either point testing or profit line</p> <p>A <math>(3\frac{5}{6}, 3\frac{1}{2}) \rightarrow 25\frac{1}{6}</math>, B <math>(8\frac{1}{2}, 3\frac{1}{2}) \rightarrow 34\frac{1}{2}</math>,            Accept C (4,8) <math>\rightarrow</math> 48 and D (3,6) <math>\rightarrow</math> 36</p> <p>Profit line gradient <math>-\frac{2}{5}</math></p> <p>Identifies A <math>(3\frac{5}{6}, 3\frac{1}{2})</math> cost <math>25\frac{1}{6}</math></p> <p>Either point testing or profit line</p> <p>A <math>(3\frac{5}{6}, 3\frac{1}{2}) \rightarrow</math> not integer so try (4,4) <math>\rightarrow</math> 20 Profit line            B <math>(8\frac{1}{2}, 3\frac{1}{2}) \rightarrow</math> not integer so try (8,4) <math>\rightarrow</math> 32  <math>\rightarrow</math> try (7,5) <math>\rightarrow</math> 31 gradient -  <math>\frac{3}{2}</math></p> <p>Accept C (4,8) <math>\rightarrow</math> 28 and D (3,6) <math>\rightarrow</math> 21</p> <p>Identifies (8,4) profit 32.</p>	<p>B5, 4, 3, 2, 1, 0 (5)</p> <p>M1</p> <p>A1</p> <p>A1, A1 (4)</p> <p>M1</p> <p>A1</p> <p>A1 A1 (4)</p> <p><b>(13)</b></p>
<p>8. (a)</p> <p>(b)</p> <p>(c) (i)</p> <p>(ii)</p> <p>(d)</p> <p>(e)</p>	<p><math>x = 0, y = 7, z = 9</math></p> <p>Length = 22, critical activities B D E L</p> <p>Float on N = <math>22 - 14 - 3 = 5</math></p> <p>Float on H = <math>16 - 5 - 3 = 8</math></p> <p><u>See overlay</u></p> <p>Attempt at 1. e.t. and e.e.t. 22 hours</p>	<p>B1, B1, B1, (3)</p> <p>B1, B1, (2)</p> <p>B1</p> <p>M1 A1 (3)</p> <p>B4, 3,2,1,0 (4)</p> <p>M1 A1 (2)</p> <p><b>(14)</b></p>