

EDEXCEL FOUNDATION

Stewart House 32 Russell Square London WC1B 5DN

June 2001

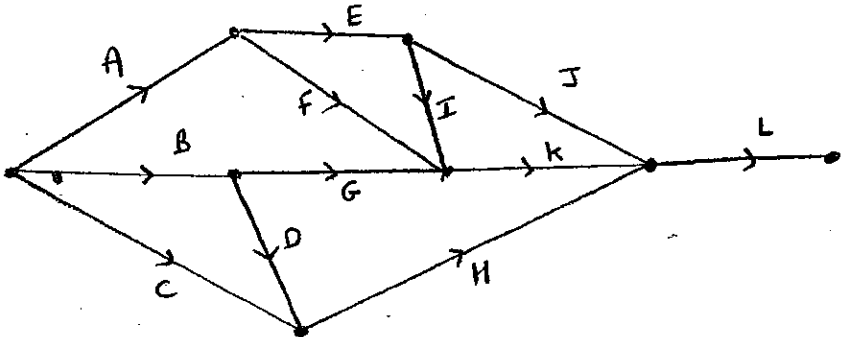
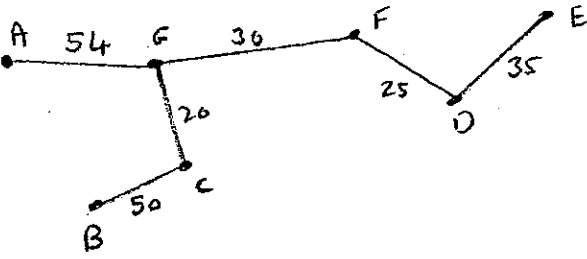
Advanced Supplementary/Advanced Level

General Certificate of Education

Final

Subject DECISION MATHEMATICS 6689

Paper No. D1

Question number	Scheme	Marks
1)		<p>M1 (A → G) A1 A1 ✓ (H → K) A1 (L) B1 arrows 5</p>
2) (a) (b)	<p>GC, FD, FG; DE, BC, GA</p>  <p>cost = $(20 + 25 + 30 + 35 + 50 + 54) \times 1000$ $= £214000$</p>	<p>M1 A1; M1 A1 (4) B1 ✓ M1 A1 (3) 7</p>
3)	<p>odd vertices B, C, F and G</p> <p>pairings</p> $BC + FG = 38 + 40 = 78$ $BF + CG = 66 + 68 = 134$ $BG + CF = 35 + 28 = 63 *$ <p>Repeat BG and CF</p> <p>Minimum distance = $440 + 63 = 503m$</p> <p>Route e.g. $A \underline{G} B C D E \underline{F} C \underline{F} G B A$</p>	<p>B1 M1 A1 A1 (BF + CG) (4) M1 A1 ✓ B1 (3) 7</p>

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4) (a)	<p>either e.s Trace back, Include an arc xy if y already included and weight of $xy = \text{final label of } y - \text{final label of } x$</p> <p>or e.g. $T \leftarrow F : 37 - 17 = 20$ (FT) $F \leftarrow C : 17 - 8 = 9$ (CF) $C \leftarrow S : 8 - 0 = 8$ (SC)</p> <p>shortest route : SCFT length 37 km</p> <p>(b) Need shortest path S to E plus ET shortest path S to E is SCFE length 30 km from above \therefore SCFET length 38 km</p>	<p>(M1) (Dijkstra)</p> <p>A1 (S, A, B, C)</p> <p>A1 (D, E)</p> <p>A1 (rest)</p> <p>A1 (order)</p> <p>(5)</p> <p>B 2, 1</p> <p>A1 (3)</p> <p>M1</p> <p>A1 ✓</p> <p>A1 ✓ (3)</p> <p>II</p>

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5) (a)	<p>either <u>Bubbling from left</u> or <u>Bubbling from right</u></p> <p>90 <u>50 55</u> 40 20 35 30 25 45 90 50 55 40 20 35 30 <u>25 45</u></p> <p>90 55 50 40 <u>20 35</u> 30 25 45 90 50 55 40 20 35 <u>30 45</u> 25</p> <p>90 55 50 40 35 <u>20 30</u> 25 45 90 50 55 40 20 <u>35 45</u> 30 25</p> <p>90 55 50 40 35 30 <u>20 25</u> 45 90 50 55 40 <u>20 45</u> 35 30 25</p> <p>90 55 50 40 35 30 25 <u>20 45</u> 90 50 55 <u>40 45</u> 20 35 30 25</p> <p>90 55 50 40 35 30 <u>25 45</u> 20 90 <u>50 55</u> 45 40 20 35 30 25</p> <p>90 55 50 40 35 <u>30 45</u> 25 20 90 55 50 45 40 <u>20 35</u> 30 25</p> <p>90 55 50 40 <u>35 45</u> 30 25 20 90 55 50 45 40 35 <u>20 30</u> 25</p> <p>90 55 50 <u>40 45</u> 35 30 25 20 90 55 50 45 40 35 30 <u>20 25</u></p> <p>90 55 50 45 40 35 30 25 20 90 55 50 45 40 35 30 25 20</p>	<p>M1</p> <p>A1 (1st pass)</p> <p>A1 (2nd pass)</p> <p>A1 (3rd pass)</p> <p>A1 E50</p> <p>(5)</p>
(b)	<p>$\frac{475}{120} \approx 3.96$ so lower bound is 4 tapes</p>	<p>M1 A1 (2)</p>
(c)	<p>Tape 1 : 90 + 30 (full) Tape 3 : 45 + 40 + 35 (full) Tape 5 : 20</p> <p>Tape 2 : 55 + 50 Tape 4 : 35 + 30 + 25 + 20</p>	<p>M1</p> <p>A1</p> <p>A1 (3)</p>
(d)	<p>e.g. Tape 1 : 90 + 30 (full)</p> <p>Tape 2 : 55 + 35 + 30 (full)</p> <p>Tape 3 : 45 + 40 + 35 (full)</p> <p>Tape 4 : 50 + 25 + 20 + 20</p>	<p>M1</p> <p>A1</p> <p>(2)</p>
<p>12</p>		

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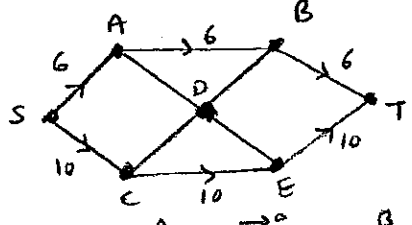
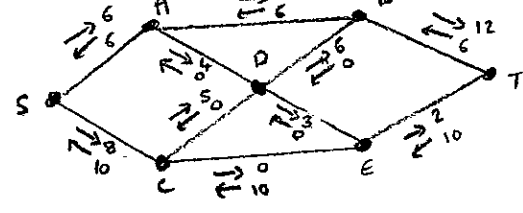
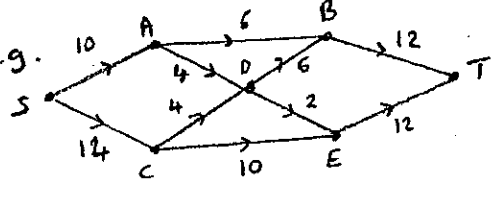
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Advanced Supplementary/Advanced Level

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6) (a)	<p>Finds a cut less than 30 e.g. AB, AD, CD, CE - 25 or AB, BD, ET - 24 or a consideration of flow input / flow output through e.g. A and C</p>	<p>M1 A1 A1 (3)</p>
(b)	<p>(i) SABT - 6 (ii) SCET - 10</p>	<p>B1 B1 (2)</p>
(c)		<p>B1 (1)</p>
(d)	 <p>e.g. SA DBT - 4 SC DBT - 2 SC DET - 2, ∴ max flow 24</p>	<p>M1 A1 M1 A1 A1 B1 (6)</p>
(e)		<p>M1 A1 (2)</p>
(f)	<p>Refers to max flow - min cut theorem and the cut through AB, BD, ET of value 24</p>	<p>M1 A1 (2)</p> <p style="text-align: right;">16</p>

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7 (a)(i)	Slack variables, used to enable us to write inequalities as equalities all ≥ 0	M1 A1																																																																																																																								
(ii)	$P - 3x - 6y - 4z = 0$	B1 (3)																																																																																																																								
(b)	<table border="1"> <thead> <tr> <th>b.v.</th> <th>x</th> <th>y</th> <th>z</th> <th>r</th> <th>s</th> <th>t</th> <th>value</th> </tr> </thead> <tbody> <tr> <td>r</td> <td>1</td> <td>0</td> <td>1</td> <td>1</td> <td>0</td> <td>0</td> <td>4</td> </tr> <tr> <td>s</td> <td>1</td> <td>4</td> <td>2</td> <td>0</td> <td>1</td> <td>0</td> <td>6</td> </tr> <tr> <td>t</td> <td>1</td> <td>1</td> <td>2</td> <td>0</td> <td>0</td> <td>1</td> <td>12</td> </tr> <tr> <td>P</td> <td>-3</td> <td>-6</td> <td>-4</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> </tr> </tbody> </table> <p style="text-align: right;">$R_2 \div 4$</p> <table border="1"> <thead> <tr> <th>b.v.</th> <th>x</th> <th>y</th> <th>z</th> <th>r</th> <th>s</th> <th>t</th> <th>value</th> </tr> </thead> <tbody> <tr> <td>r</td> <td>1</td> <td>0</td> <td>1</td> <td>1</td> <td>0</td> <td>0</td> <td>4</td> </tr> <tr> <td>y</td> <td>$\frac{1}{4}$</td> <td>1</td> <td>$\frac{1}{2}$</td> <td>0</td> <td>$\frac{1}{4}$</td> <td>0</td> <td>$\frac{1}{2}$</td> </tr> <tr> <td>t</td> <td>$\frac{3}{4}$</td> <td>0</td> <td>$\frac{1}{2}$</td> <td>0</td> <td>$-\frac{1}{4}$</td> <td>1</td> <td>$10\frac{1}{2}$</td> </tr> <tr> <td>P</td> <td>$-1\frac{1}{2}$</td> <td>0</td> <td>-1</td> <td>0</td> <td>$1\frac{1}{2}$</td> <td>0</td> <td>9</td> </tr> </tbody> </table> <p style="text-align: right;">$R_3 - R_2$ $R_4 + 6R_2$</p> <table border="1"> <thead> <tr> <th>b.v.</th> <th>x</th> <th>y</th> <th>z</th> <th>r</th> <th>s</th> <th>t</th> <th>value</th> </tr> </thead> <tbody> <tr> <td>x</td> <td>1</td> <td>0</td> <td>1</td> <td>1</td> <td>0</td> <td>0</td> <td>4</td> </tr> <tr> <td>y</td> <td>0</td> <td>1</td> <td>$\frac{1}{4}$</td> <td>$-\frac{1}{4}$</td> <td>$\frac{1}{4}$</td> <td>0</td> <td>$\frac{1}{2}$</td> </tr> <tr> <td>t</td> <td>0</td> <td>0</td> <td>$\frac{3}{4}$</td> <td>$-\frac{3}{4}$</td> <td>$-\frac{1}{4}$</td> <td>1</td> <td>$7\frac{1}{2}$</td> </tr> <tr> <td>P</td> <td>0</td> <td>0</td> <td>$\frac{1}{2}$</td> <td>$1\frac{1}{2}$</td> <td>$1\frac{1}{2}$</td> <td>0</td> <td>15</td> </tr> </tbody> </table> <p style="text-align: right;">$R_2 - \frac{1}{4}R_1$ $R_3 - \frac{3}{4}R_1$ $R_4 + \frac{1}{2}R_1$</p>	b.v.	x	y	z	r	s	t	value	r	1	0	1	1	0	0	4	s	1	4	2	0	1	0	6	t	1	1	2	0	0	1	12	P	-3	-6	-4	0	0	0	0	b.v.	x	y	z	r	s	t	value	r	1	0	1	1	0	0	4	y	$\frac{1}{4}$	1	$\frac{1}{2}$	0	$\frac{1}{4}$	0	$\frac{1}{2}$	t	$\frac{3}{4}$	0	$\frac{1}{2}$	0	$-\frac{1}{4}$	1	$10\frac{1}{2}$	P	$-1\frac{1}{2}$	0	-1	0	$1\frac{1}{2}$	0	9	b.v.	x	y	z	r	s	t	value	x	1	0	1	1	0	0	4	y	0	1	$\frac{1}{4}$	$-\frac{1}{4}$	$\frac{1}{4}$	0	$\frac{1}{2}$	t	0	0	$\frac{3}{4}$	$-\frac{3}{4}$	$-\frac{1}{4}$	1	$7\frac{1}{2}$	P	0	0	$\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	0	15	<p>M1</p> <p>M1</p> <p>A1 (R2)</p> <p>M1</p> <p>A1</p> <p>A1</p> <p>A1</p> <p>A1 (pivot)</p> <p>M1</p> <p>A1</p> <p>A1</p> <p>A1</p> <p>(10)</p>
b.v.	x	y	z	r	s	t	value																																																																																																																			
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(c)	<p>Maximum profit is £15</p> <p>when $x = 4$ kg, $y = \frac{1}{2}$ kg, $z = 0$ kg</p> <p>The first and second constraints have no slack</p> <p>There is a slack of $(7\frac{1}{2})$ in the third constraint</p>	<p>M1 A1 ✓</p> <p>A1 ✓</p> <p>B1 ✓</p> <p>(4)</p>																																																																																																																								

Question 2 Prim's Algorithm (a) only

Part (a) is worth 4 marks. If they use Prim they will get 2 marks maximum Put S.C in the margin.

M1 - Their first 4 are correct
- tree growing in a connected manner

A1 - CAO

E.g. for m marks

starts at A AG, GC, GF, FD for m1

starts at B BC, CG, GF, FD for m1

starts at C CG, GF, FD, DE for m1

starts at D DF, FG, GC, DE for m1

starts at E ED, DF, FG, GC for m1

starts at F FD, FG, GC, DE for m1

starts at G GC, GF, FD, DE for m1

SG James

Q 5a Ascending

MARK AS MISREAD - unless they reverse in (a)

Left to Right

- 90 50 55 40 20 35 30 25 45
- 50 90 55 40 20 35 30 25 45
- 50 55 90 40 20 35 30 25 45
- 50 55 40 90 20 35 30 25 45
- 50 55 40 20 90 35 30 25 45
- 50 55 40 20 35 90 30 25 45
- 50 55 40 20 35 30 90 25 45
- 50 55 40 20 35 30 25 90 45
- 50 55 40 20 35 30 25 90 45
- 50 40 55 20 35 30 25 45 90 (MIA)
- 50 40 20 55 35 30 25 45 90
- 50 40 20 35 55 30 25 45 90
- 50 40 20 35 30 55 25 45 90
- 50 40 20 35 30 25 55 45 90
- 50 40 20 35 30 25 45 55 90 (AIN)
- 40 50 20 35 30 25 45 55 90
- 40 20 50 35 30 25 45 55 90
- 40 20 35 50 30 25 45 55 90
- 40 20 35 30 50 25 45 55 90
- 40 20 35 30 25 50 45 55 90
- 40 20 35 30 25 45 50 55 90 (AIN)
- 20 40 35 30 25 45 50 55 90
- 20 35 40 30 25 45 50 55 90
- 20 35 30 40 25 45 50 55 90
- 20 35 30 25 40 45 50 55 90
- 20 30 35 25 40 45 50 55 90
- 20 30 25 35 40 45 50 55 90
- 20 25 30 35 40 45 50 55 90 (Alco)

Stop.

Now subject (a) 2A's

Right to Left

- 90 50 55 40 20 35 30 25 45
- 90 50 55 40 20 35 25 30 45
- 90 50 55 40 20 25 35 30 45
- 90 50 55 20 40 25 35 30 45
- 90 50 55 20 40 25 35 30 45
- 90 50 20 55 40 25 35 30 45
- 90 20 50 55 40 25 35 30 45
- (MIA) 20 90 50 55 40 25 35 30 45
- 20 90 50 55 40 25 30 35 45
- 20 90 50 55 25 40 30 35 45
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- 20 90 25 50 55 40 30 35 45
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- 20 25 30 35 40 90 50 45 55
- 20 25 30 35 40 90 45 50 55
- 20 25 30 35 40 45 90 50 55
- 20 25 30 35 40 45 50 90 55
- (Alco) 20 25 30 35 40 45 50 55 90

Stop

Now subject (a) 2A's