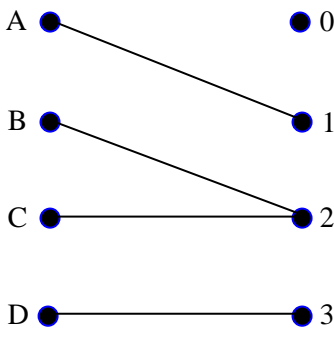


4771 Decision Mathematics 1

1.

<p>(i)</p> 	<p>M1 bipartite A1 one arc from each letter A1 David A1 rest</p>
<p>(ii) Can't both have someone shaking hands with everyone and someone not shaking hands at all.</p>	<p>B1 $0 \Rightarrow \sim 3$ B1 $3 \Rightarrow \sim 0$</p>
<p>(iii) n arcs leaving By (ii) only $n-1$ destinations</p>	<p>B1 B1</p>

2.

<p>(i)</p> <table border="1" data-bbox="255 1198 829 1400"> <thead> <tr> <th>n</th> <th>i</th> <th>j</th> <th>k</th> </tr> </thead> <tbody> <tr> <td>5</td> <td>1</td> <td>3</td> <td>3</td> </tr> <tr> <td></td> <td>2</td> <td>2</td> <td>8</td> </tr> <tr> <td></td> <td>3</td> <td>1</td> <td>13</td> </tr> <tr> <td></td> <td>4</td> <td>0</td> <td>16</td> </tr> </tbody> </table> <p>$k = 16$</p>	n	i	j	k	5	1	3	3		2	2	8		3	1	13		4	0	16	<p>B1 B1 B1 B1 B1</p>
n	i	j	k																		
5	1	3	3																		
	2	2	8																		
	3	1	13																		
	4	0	16																		
<p>(ii) $f(5) = 125/6 - 35/6 + 1 = 90/6 + 1 = 16$ (Need to see 125 or 20.8$\dot{3}$ for A1)</p>	<p>M1 substituting A1</p>																				
<p>(iii) cubic complexity</p>	<p>B1</p>																				

3.

(i)

The diagram shows a network with nodes: start, A, B, C, D, E, F, G, and end. Each node has a box containing numerical values. Edges are labeled with weights. A path is highlighted from start to end.

Node boxes (top row to bottom row):

- start:

1	0
- A:

2	2
2	
- B:

5	8
10	8
- C:

3	4
4	
- D:

12	
- E:

4	5
5	
- F:

6	9
10	9
- G:

7	10
10	
- end:

8	11
12	11

Edges and weights:

- start to A: 2
- start to B: 10
- start to C: 4
- A to D: 10
- A to E: 3
- B to E: 3
- B to F: 1
- C to F: 6
- C to G: 6
- D to end: 12 (sweet £2)
- E to end: 7
- F to end: 2
- G to end: 7

Cheapest: £11
 [start (£2 starter)] → A (£3 main) → E (£3 main) → B (£1 main) → F (£2 sweet) → [end]

(ii) repeated mains !
 directed network

M1	Dijkstra
A1	order
A1	labels
A1	working values
B1	£11
B1	route
B1	
B1	

4.

<p>(i) e.g. 00-47→90 48-79→80 80-95→40 96, 97, 98, 99 ignore</p> <p>(ii) smaller proportion rejected</p> <p>(iii) e.g. 90, 90, 90, 80 350</p> <p>(iv) e.g. 90, 80, 90, 80 340 80, 90, 80, 80 330 90, 40, 80, 90 300 40, 90, 90, 90 310 90, 90, 90, 90 360 80, 80, 40, 90 290 80, 80, 80, 90 330 90, 80, 90, 90 350 90, 40, 40, 80 250</p> <p>prob (load>325) = 0.6</p> <p>(v) e.g. family groups</p>	<p>M1 some rejected A3 correct proportions (-1 each error) A1 efficient</p> <p>B1</p> <p>M1 A1 A1√</p> <p>M1 A3 (-1 each error)√</p> <p>M1 A1</p> <p>B1</p>
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5.

<p>(i)&(ii) e.g.</p> <p>time – 60 minutes critical – A; C; E; F; G; H</p> <p>(iii) A and B at £300</p> <p>A; C; G; H B; E; F</p>	<p>M1 sca (activity on arc) A1 single start & end A1 dummy A1 rest</p> <p>M1 forward pass A1 M1 backward pass A1</p> <p>B1 √ B1 cao</p> <p>B1 2 out of A, B, E B1 A B1 B B1 300 from A and B B1 B1</p>
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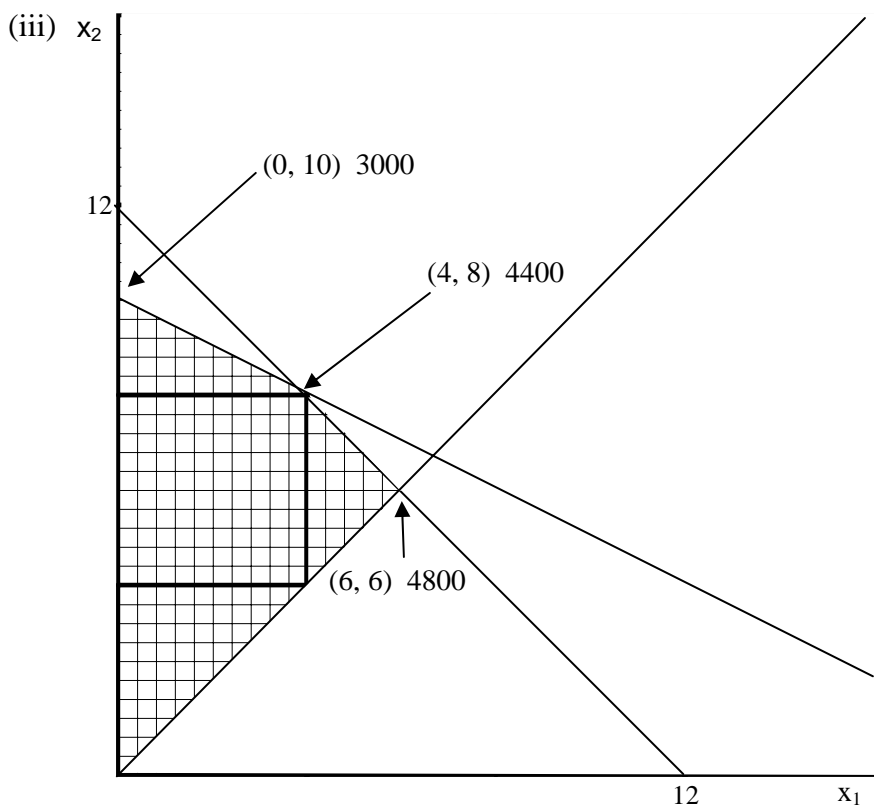
6.

- (i) x_i represents the number of tonnes produced in month i
 $x_2 \leq x_3$
 $x_1 + x_2 \leq 12$

M1 quantities
 A1 tonnes
 B1
 B1

- (ii) Substitute $x_3 = 20 - x_1 - x_2$
 $x_2 \leq x_3 \rightarrow x_1 + 2x_2 \leq 20$
 Min $2000x_1 + 2200x_2 + 2500x_3 \rightarrow$ Max $500x_1 + 300x_2$

M1
 A1
 A1



M1 sca
 A3 lines
 A1 shading

 M1 >1 evaluated
 point or profit
 line
 A1 (6, 6) or 4800

Production plan: 6 tonnes in month 1
 6 tonnes in month 2
 8 tonnes in month 3

 Cost = £45200

M1 ✓ all 3

 A1 cao