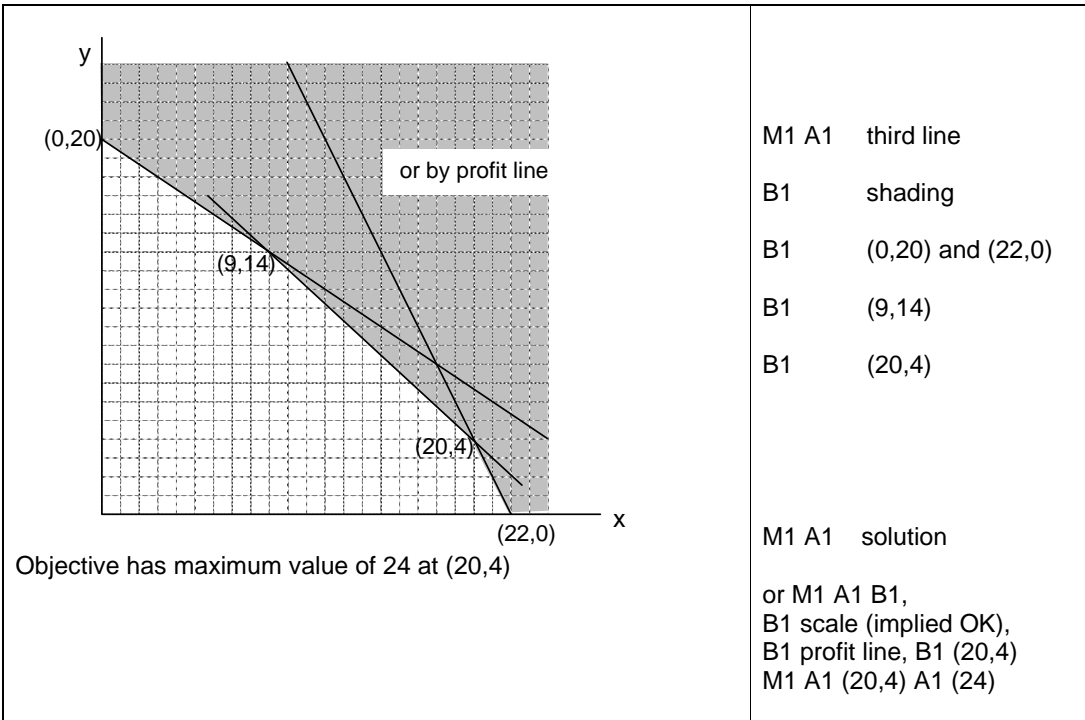


4771 Decision Mathematics 1

Solutions

1.



2.

(i)		X	Y	M1
	5, 14, 153, 6, 24, 2, 14, 15	5, 14, 153	5, 2	
	5, 14, 6, 24, 14, 15	5, 14, 24	5	
	14, 6, 14, 15,	14, 15	14, 6	
	14, 14			
	Answer = 14			A1
	Comparisons = 30			A1
(ii)		X	Y	M1
	5, 14, 153, 6, 24, 2, 14	5, 14, 153	5, 2	
	5, 14, 6, 24, 14	5, 14, 24	5	
	14, 6, 14	14	14, 6	
	14			
	Answer = 14			A1
	Comparisons = 24			A1
(iii)	Median			B1
(iv)	Time taken approximately proportional to square of length of list (or twice length takes four times the time, or equivalent).			B1

3.

(i)	$T_1 \rightarrow T_2$	$T_1 \rightarrow T_3 \rightarrow T_2$	M1	
	$T_1 \rightarrow T_3$	$T_1 \rightarrow T_2 \rightarrow T_3$		A1
	$T_1 \rightarrow T_2 \rightarrow T_3 \rightarrow T_4$	$T_1 \rightarrow T_3 \rightarrow T_4$		
(ii)	$T_4 \rightarrow T_3 \rightarrow T_2 \rightarrow T_1$	$T_4 \rightarrow T_3 \rightarrow T_1$	M1	
	$T_4 \rightarrow T_3 \rightarrow T_1 \rightarrow T_2$	$T_4 \rightarrow T_3 \rightarrow T_2$		A1
	$T_4 \rightarrow T_3$			
(iii)	22		M1 allow for 23	
(iv)	11		A1	
			M1 halving (not 11.5)	
			A1	

4.

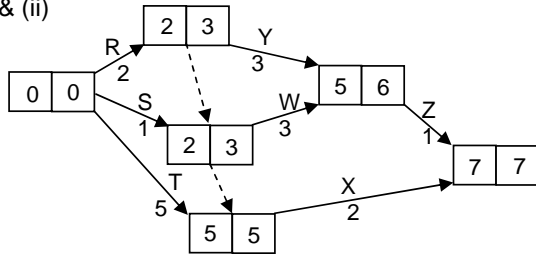
<p>(i) e.g. 00-09→1 10-39→2 40-79→3 80-89→4 90-99→5</p> <p>(ii) e.g. 00-15→1 16-47→2 48-55→3 56-79→4 80-87→5 88-95→6 96, 97, 98, 99 reject</p> <p>(iii) & (iv)</p> <table border="1"> <thead> <tr> <th>Sim. no.</th> <th colspan="10">Cars arriving after Joe – time interval number of passengers</th> <th>Time to 15 passengers (minutes)</th> </tr> </thead> <tbody> <tr><td>1</td><td>3</td><td>2</td><td>2</td><td>1</td><td>1</td><td>2</td><td>2</td><td>2</td><td>3</td><td>1</td><td>6</td></tr> <tr><td>2</td><td>3</td><td>1</td><td>2</td><td>2</td><td>1</td><td>4</td><td>1</td><td>2</td><td>5</td><td>1</td><td>6</td></tr> <tr><td>3</td><td>5</td><td>1</td><td>2</td><td>2</td><td>2</td><td>1</td><td>3</td><td>4</td><td>2</td><td>2</td><td>12</td></tr> <tr><td>4</td><td>4</td><td>6</td><td>3</td><td>2</td><td>4</td><td>1</td><td>1</td><td>2</td><td>2</td><td>3</td><td>4</td></tr> <tr><td>5</td><td>5</td><td>1</td><td>4</td><td>1</td><td>3</td><td>2</td><td>5</td><td>4</td><td>2</td><td>2</td><td>17</td></tr> <tr><td>6</td><td>4</td><td>4</td><td>4</td><td>2</td><td>5</td><td>3</td><td>1</td><td>4</td><td>1</td><td>4</td><td>8</td></tr> <tr><td>7</td><td>4</td><td>1</td><td>4</td><td>2</td><td>3</td><td>1</td><td>5</td><td>4</td><td>1</td><td>3</td><td>16</td></tr> <tr><td>8</td><td>2</td><td>2</td><td>2</td><td>2</td><td>2</td><td>4</td><td>3</td><td>5</td><td>1</td><td>2</td><td>6</td></tr> <tr><td>9</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>2</td><td>5</td></tr> <tr><td>10</td><td>2</td><td>4</td><td>3</td><td>2</td><td>2</td><td>6</td><td>2</td><td>5</td><td>2</td><td>1</td><td>5</td></tr> </tbody> </table> <p>(v) 0.8 more runs</p>	Sim. no.	Cars arriving after Joe – time interval number of passengers										Time to 15 passengers (minutes)	1	3	2	2	1	1	2	2	2	3	1	6	2	3	1	2	2	1	4	1	2	5	1	6	3	5	1	2	2	2	1	3	4	2	2	12	4	4	6	3	2	4	1	1	2	2	3	4	5	5	1	4	1	3	2	5	4	2	2	17	6	4	4	4	2	5	3	1	4	1	4	8	7	4	1	4	2	3	1	5	4	1	3	16	8	2	2	2	2	2	4	3	5	1	2	6	9	1	1	1	1	1	1	1	1	1	2	5	10	2	4	3	2	2	6	2	5	2	1	5	<p>M1 A1 proportions OK A1 efficient</p> <p>M1 some rejected A2 proportions OK (-1 each error) A1 efficient</p> <p>M1 A2 (-1 each error)</p> <p>M1 simulation A1 time intervals A1 passengers A1 time to wait</p> <p>B1 B1</p>
Sim. no.	Cars arriving after Joe – time interval number of passengers										Time to 15 passengers (minutes)																																																																																																																										
1	3	2	2	1	1	2	2	2	3	1	6																																																																																																																										
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8	2	2	2	2	2	4	3	5	1	2	6																																																																																																																										
9	1	1	1	1	1	1	1	1	1	2	5																																																																																																																										
10	2	4	3	2	2	6	2	5	2	1	5																																																																																																																										

5.

(a)(i) Activity D.
Depends on A and B in project 1, but on A, B and C in project 2.

(ii) Project 1: Duration is 5 for $x < 3$, thence $x + 2$.
Project 2: Duration is 5 for $x < 2$, thence $x + 3$

(b) (i) & (ii)



Project duration – 7
Critical activities – T, X

- M1
- A1
- A1

- B1 "5"
- B1 B1 beyond 5

- M1 activity-on-arc
- A1 single start and single end
- A2 precedences (-1 each error)

- M1 A1 forward pass
- M1 A1 backward pass

- B1
- B1

6.

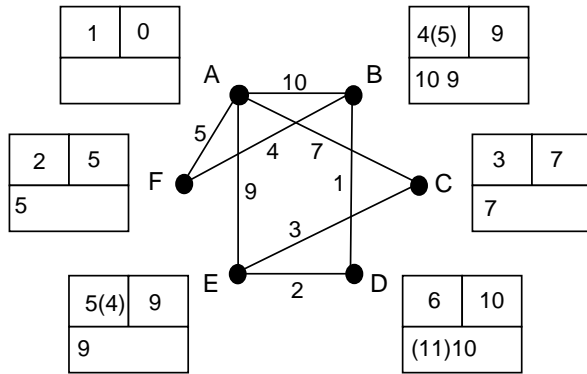
(i)

Order of inclusion	1	3	6	4	5	2
	A	B	C	D	E	F
A	-	10	7	-	9	5
B	10	-	-	1	-	4
C	7	-	-	-	3	-
D	-	1	-	-	2	-
E	9	-	3	2	-	-
F	5	4	-	-	-	-

Arcs: AF, FB, BD, DE, EC

Length: 15

(ii) & (iii)



Arcs: AF, FB, BD, AC, AE

Length: 26

(iv) Cubic

n applications of Dijkstra, which is quadratic

M1
A1 select
A1 delete
A1 order

B1

B1

B1 arcs
B1 lengths

M1 Dijkstra
A1 working values
A1 order of labelling
A1 labels

M1
A1

B1

B1