4771 Decision Mathematics 1
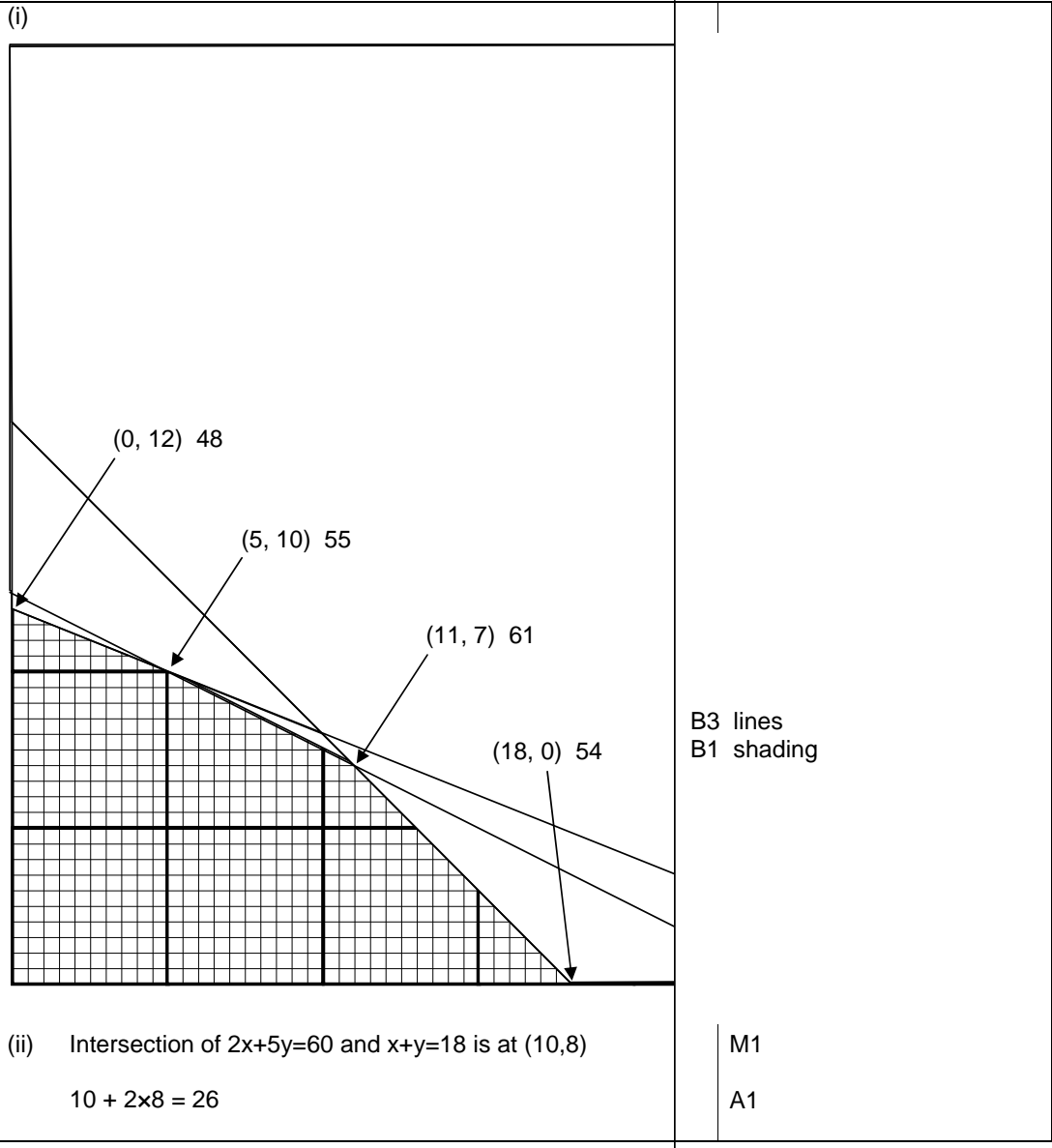
Question 1

(i) 1 and 6, 2 and 5, 3 and 4	B1
(ii)	M1 10 to 14 edges A4 (−1 each edge error)
(iii)	B1 identification B1 sketch

Question 2.

|	

(i)   A's c takes 2, leaving 3.
       You have to take 1.
       A's c takes one and you lose.
	M1
	A1
	A1

(ii) A's c takes 3 leaving 3. Then as above.	M1 A1
(iii) A's c takes 3 leaving 4. You can then take 1, leading to a win.	M1 A1 A1

Question 3.

(i)

(0, 12) 48

(5, 10) 55

(11, 7) 61

(18, 0) 54

B3 lines
B1 shading

(ii)   Intersection of 2x+5y=60 and x+y=18 is at (10,8)   M1

         10 + 2×8 = 26   A1

Question 4.

(i)	e.g. 0–4 exit 5–9 other vertex							B1 B1	
(ii)	e.g. 1	A	ExA					M1	process with exits
	2	A	B	A	B	A	B	ExB	A1
	3	A	ExA						
	4	A	B	A	B	A	ExA		
	5	A	B	ExB					
	6	A	B	A	B	A	B	ExB	
	7	A	B	A	B	ExB			
	8	A	ExA						
	9	A	B	ExB					
	10	A	ExA						
	0.5, 0.5, 1.9	(Theoretical answers: 2/3, 1/3, 2)						B1	probabilities
		(Gambler's ruin)						M1	duration
								A1	
(iii)	e.g. 0–2 exit 3–5 next vertex in cycle							M1	ignore
	6–8 other vertex 9–ignore and re-draw							DM1	conditionality
								A1	equal prob
								A1	efficient
(iv)	e.g. 1	A	B	A	B	A	ExA		M1
	2	A	C	A	ExA				A2
	3	A	ExA						
	4	A	B	C	B	C	ExC		
	5	A	ExA						
	6	A	C	A	B	ExB			
	7	A	ExA						
	8	A	B	C	ExC				
	9	A	ExA						
	10	A	ExA						
	0.7, 0.1, 0.2	(Theoretical probs are 0.5, 0.25, 0.25)						M1	
		(Markov chain)						A1	

Question 5.

(i)   e.g.
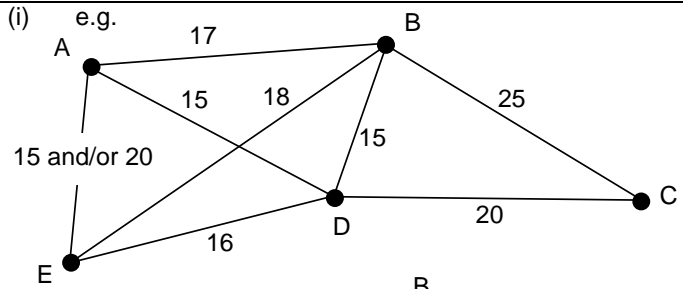
M1	
A1	connectivity
A1	lengths

(ii)
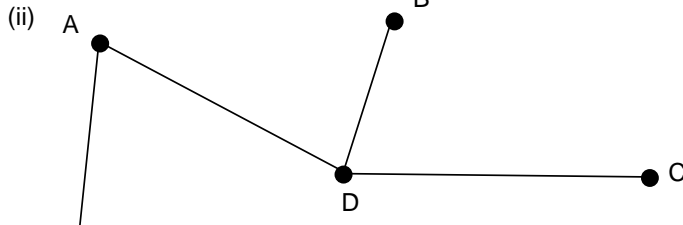
Order: AE; AD; DB; DC or
        AD; AE; DB; DC or
        AD; DB; AE; DC   Length: 65 km

M1	connected tree
A2	(−1 each error)
A1 B1	

OR
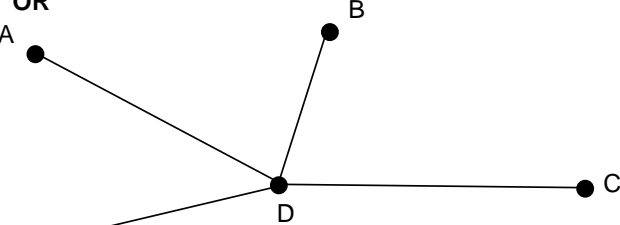
Order: AD; DB; DE; DC   Length: 66 km

(iii)
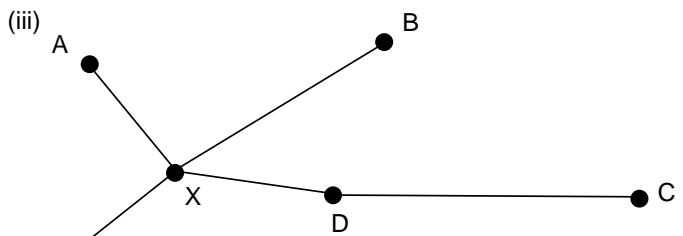
Length: 53 km
Advice: Close BC, AE and BD

M1	connected tree
A2	(−1 each error)
B1	
B3	

(iv)   facility (e.g. anglers)
        distances (e.g. B to C)

B1

Question 6.

(i)&(ii)

D 60	

60 200

0 0 A 100 | 100 100 B 60 | 160 160 E 40 | 200 200 F 2 | 220 220

C 150   G 30   H 10

160 190   230 230
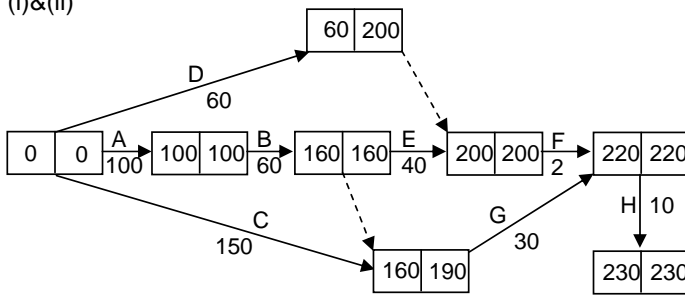
time – 230 minutes
critical – A; B; E; F; H

M1   sca (activity on arc)
A1   single start & end
A1   dummy
A1   rest

M1   forward pass
A1
M1   backward pass
A1

B1
B1   cao

(iii)   e.g.

H
G
F
E
D
C
B
A
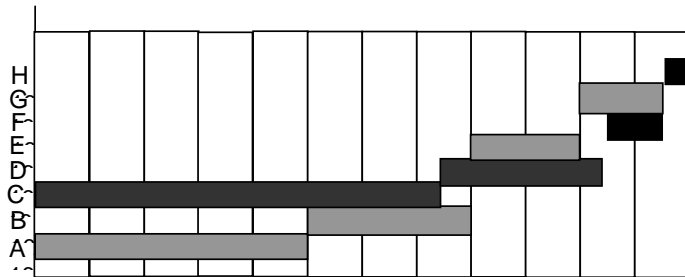
Least time = 240 mins

Minimum project completion times assumes no resource constraints.

M1   cascade
A2

B1   Joan/Keith

B1

B1