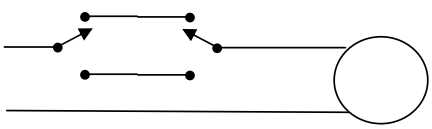
4772 Decision Mathematics 2

1.

(a)(i) "not fail" → "succeed" B1
"disagree less" → "agree more" B1

(ii) e.g. "I don't entirely agree with you". M1 same meaning
A1 simpler

(b) e.g.



M1 2 switches + light in a circuit
A4 one for each correct setting

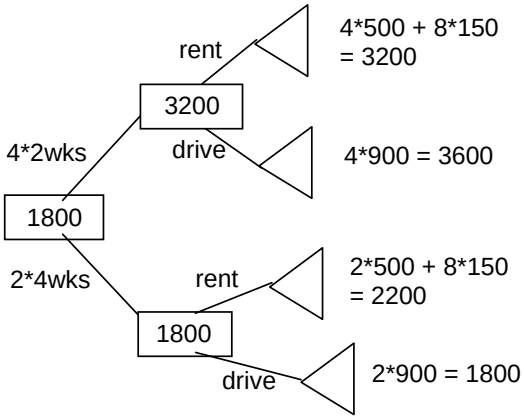
(c)

((a	∧	b)	∨	(~a	∧	~b))	⇔	((~a	∨	b)	∧	(a	∨	~b))
1	1	1	**1**	0	0	0	**1**	0	1	1	**1**	1	1	0
1	0	0	**0**	0	0	1	**1**	0	0	0	**0**	1	1	1
0	0	1	**0**	1	0	0	**1**	1	1	1	**0**	0	0	0
0	0	0	**1**	1	1	1	**1**	1	1	0	**1**	0	1	1

M1 4 lines
A1 a's and b's
A1 negations
A1 level 1 and's
A1 level 1 or's
A1 level 2
A1 result

2.

(i) e.g. (Decisions could be in other order.)



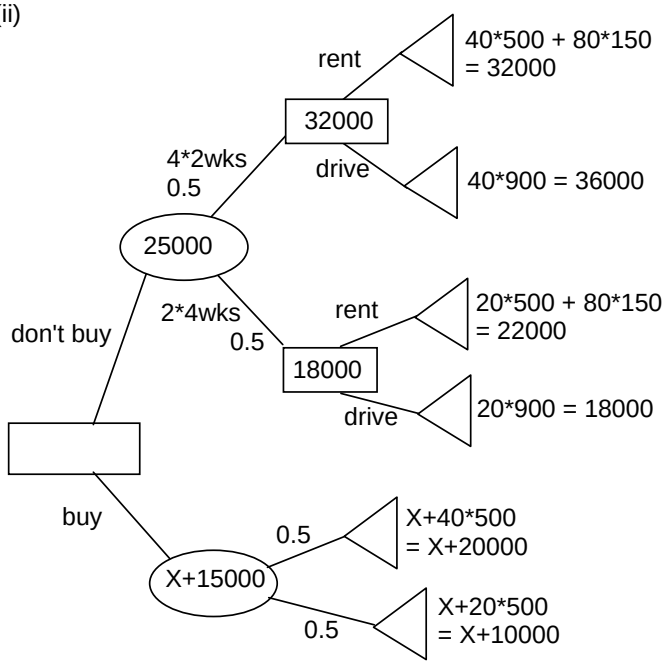
Drive down for 2 lots of 4 weeks

M1 4*2/2*4
M1 rent/drive
A1

M1 costs
A1

B1 advice

(ii)



Jane could save money if she spent less than £10000 on a car

B1 buy/don't buy

M1 don't buy analysis
A1 costings

M1 chance node
A1 buy analysis

M1 buy costings
A1

B1

B1

(iii) EMV – expected monetary value – probabilistically weighted cash values
Utility measure is an alternative.

B1

3.

(a) (i)

	1	2	3	4
1	∞	14	11	24
2	14	∞	15	∞
3	11	15	∞	12
4	24	∞	12	∞

	1	2	3	4
1	1	2	3	4
2	1	2	3	4
3	1	2	3	4
4	1	2	3	4

M1 sca Floyd
A1 distance
A1 route

	1	2	3	4
1	∞	14	11	24
2	14	28	15	38
3	11	15	22	12
4	24	38	12	48

	1	2	3	4
1	1	2	3	4
2	1	1	3	1
3	1	2	1	4
4	1	1	3	1

A1

	1	2	3	4
1	28	14	11	24
2	14	28	15	38
3	11	15	22	12
4	24	38	12	48

	1	2	3	4
1	2	2	3	4
2	1	1	3	1
3	1	2	1	4
4	1	1	3	1

A1

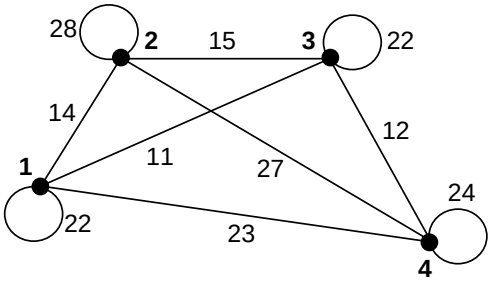
	1	2	3	4
1	22	14	11	23
2	14	28	15	27
3	11	15	22	12
4	23	27	12	24

	1	2	3	4
1	3	2	3	3
2	1	1	3	3
3	1	2	1	4
4	3	3	3	3

A1

	1	2	3	4
1	22	14	11	23
2	14	28	15	27
3	11	15	22	12
4	23	27	12	24

	1	2	3	4
1	3	2	3	3
2	1	1	3	3
3	1	2	1	4
4	3	3	3	3



B1 loops
B1 rest

(ii) **1 3 4 2 1**
64
⇒ **1 3 4 3 2 1**

M1 A1
B1
B1

(iii) 27 + 11 + 14 = 52 TSP solution has length between 52 and 64	M1 A1 M1 A1
(b) e.g. **1 3 1 2 3 4 1** length = 87 One repeated arc → Eulerian	M1 A1 A1 B1

4.

(i) Let a be the number of tonnes of A produced … M1 A1

Max a+b+c B1
st 3a+2b+5c<60 B1
5a+6b+2c<50 B1

(ii) e.g.

P	a	b	c	s_1	s_2	RHS
1	–1	–1	–1	0	0	0
0	3	2	5	1	0	60
0	5	6	2	0	1	50
1	–0.4	–0.6	0	0.2	0	12
0	0.6	0.4	1	0.2	0	12
0	3.8	5.2	0	–0.4	1	26
1	>0	0	0	>0	>0	15
0		0	1			10
0	19/26	1	0	–2/26	5/26	5

M1 initial tableau
A1

M1 pivot
A1

M1
A1

Make 5 tonnes of B and 10 tonnes of C B1 interpretation

(iii) & (iv) e.g.

A	P	a	b	c	s_1	s_2	s_3	art	RHS
1	0	1	0	0	0	0	–1	0	8
0	1	–1	–1	–1	0	0	0	0	0
0	0	3	2	5	1	0	0	0	60
0	0	5	6	2	0	1	0	0	50
0	0	1	0	0	0	0	–1	1	8
1	0	0	0	0	0	0	0	–1	0
0	1	0	–1	–1	0	0	–1	1	8
0	0	0	2	5	1	0	3	–3	36
0	0	0	6	2	0	1	5	–5	10
0	0	1	0	0	0	0	–1	1	8
	1	0	2	0	0	0.5	1.5		13
	0	0	–13	0	1	–2.5	–4.5		11
	0	0	3	1	0	0.5	2.5		5
	0	1	0	0	0	0	–1		8

B1 new constraint

M1 surplus +
A1 artificial

B1 new objective

M1
A1

B1

Make 8 tonnes of A and 5 tonnes of C B1 interpretation