Mark Scheme 4772
June 2006

1.

(i)

~ (	~	T	⇒	~	S)	⇔	~	T	∧	S
0	1	0	1	1	0	1	1	0	0	0
1	1	0	0	0	1	1	1	0	1	1
0	0	1	1	1	0	1	0	1	0	0
0	0	1	1	0	1	1	0	1	0	1

M1 4 lines
A1 T and S
A1 ~T (twice) and ~S
A1 ⇒
A1 ∧
A1 ~on LHS
M1
A1 result

(ii)

A	⇒	B	⇔	~	A	∨	B
0	1	0	1	1	0	1	0
0	1	1	1	1	0	1	1
1	0	0	1	0	1	0	0
1	1	1	1	0	1	1	1

or a correct verbal argument

M1
A1

$$\sim(\sim T \Rightarrow \sim S) \Leftrightarrow \sim(T \vee \sim S) \Leftrightarrow \sim T \wedge S$$

M1 Boolean
A1 applying result
A1 correct negating

(iii) Joanna will not try and will succeed

B1 not try
B1 and
B1 succeed

2.

(i)

	1	2	3	4
1	∞	2	6	4
2	2	∞	3	1
3	6	3	∞	1
4	4	1	1	∞

	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	∞	2	6	4
2	2	4	3	1
3	6	3	12	1
4	4	1	1	8

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

A1

	1	2	3	4
1	4	2	5	3
2	2	4	3	1
3	5	3	6	1
4	3	1	1	2

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

A1

	1	2	3	4
1	4	2	5	3
2	2	4	3	1
3	5	3	6	1
4	3	1	1	2

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

A1 no change

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

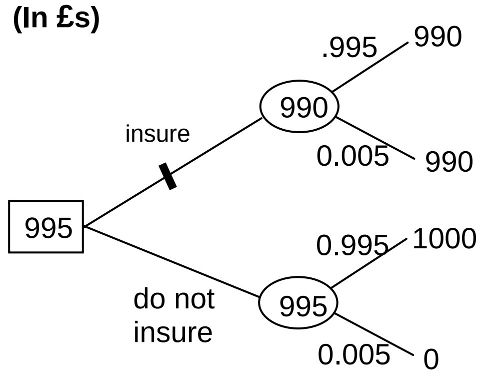
	1	2	3	4
1	2	2	(2)	2
2	1	4	4	4
3	4	4	4	4
4	2	2	3	2

A1 circled element
A1 rest

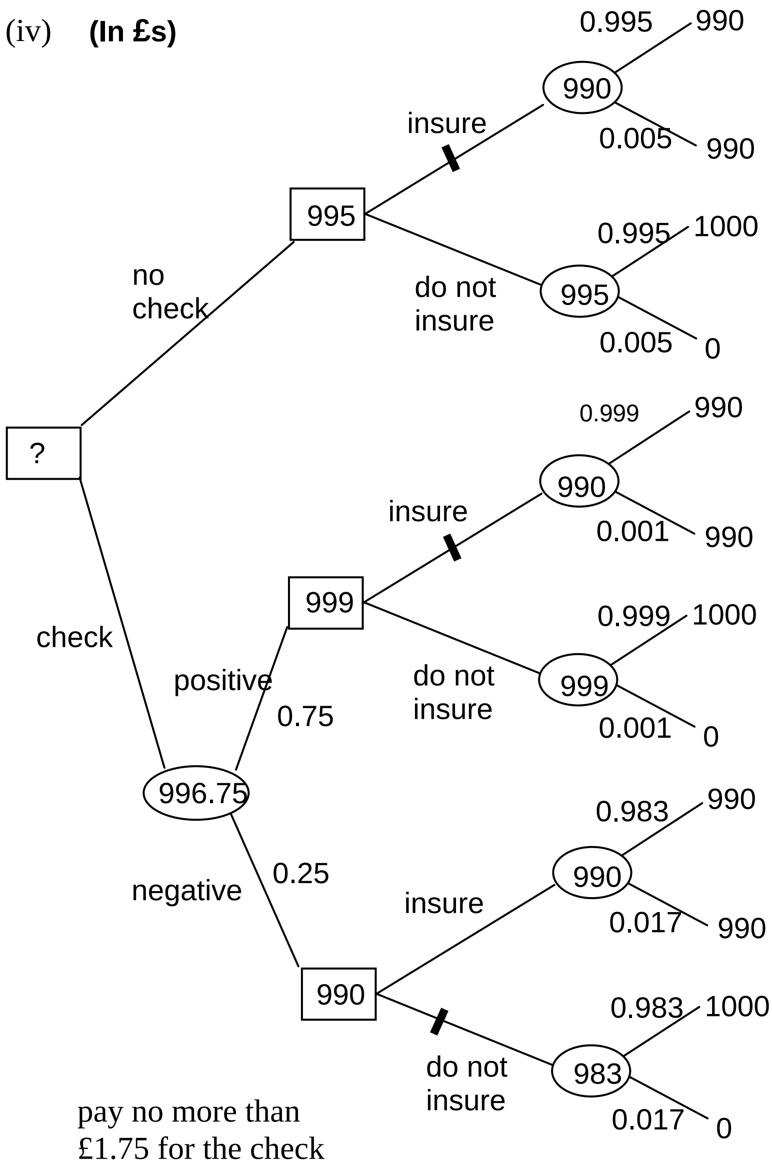
(ii) distance = 4 (row 1, col 3 of dist matrix) — M1 A1
route = 1, 2, 4, 3 (1 – r1c3 – r2c3 – r4c3 of route matrix) — M1 A1

(iii) **1**, **2**, **4**, **3**, **1** — B1
1, **2**, **4**, **3**, **4**, **2**, **1** — M1 A1
8 — B1

3.

<table>
<tr><td>(i) (In £s)

</td><td>M1 pay–offs
A1

M1 chance nodes
A1

M1 decision node
A1</td></tr>
<tr><td>(ii) Do not insure.
Pay no more than £5 for it.</td><td>B1
B1</td></tr>
<tr><td>(iii) Yes $\left(\left(\sqrt[3]{990}\times(0.995+0.005)\right) \text{ v } \left(0.995\times\sqrt[3]{1000}\right)\right)$
$\sqrt[3]{1000-x}=9.95$ giving x = £14.93</td><td>B1
M1 A1</td></tr>
<tr><td>(iv) (In £s)


pay no more than
£1.75 for the check</td><td>M1 check/no check
A1

M1 positive/negative
A1

M1 insure/not insure
A1

M1 go/no go
A1

B1</td></tr>
</table>

4. (i) a is the number of aardvarks, etc. — B1

First inequality models the furry material constraint — M1

Second inequality models the woolly material constraint — A1

Third inequality models the glass eyes constraint

That would model a "pairs of glass eyes" constraint. — B1

(ii) The problem is an IP, so the number of eyes used will be integer anyway. — B1

(iii) e.g.

P	a	b	c	s1	s2	s3	RHS
1	−3	–5	–2	0	0	0	0
0	0.5	1	1	1	0	0	11
0	2	1.5	1	0	1	0	24
0	2	2	2	0	0	1	30
1	–0.5	0	3	5	0	0	55
0	0.5	1	1	1	0	0	11
0	1.25	0	-0.5	–1.5	1	0	7.5
0	1	0	0	–2	0	1	8
1	0	0	2.8	4.4	0.4	0	58
0	0	1	1.2	1.6	–0.4	0	8
0	1	0	–0.4	–1.2	0.8	0	6
0	0	0	0.4	0.8	0.8	1	2

M1
A1

M1 pivot choice
A1 pivot

M1 pivot choice
A1 pivot

Make 6 aardvarks and 8 bears giving £58 profit. — B1 B1

2 eyes are left over. — B1

(iv)

P	a	b	c	s 1	s 2	s 3	su 4	a	RHS
1	−3	–5	– (2+M)	0	0	0	M	0	–2M
0	0.5	1	1	1	0	0	0	0	11
0	2	1.5	1	0	1	0	0	0	24
0	2	2	2	0	0	1	0	0	30
0	0	0	1	0	0	0	–1	1	2

B1 new constraint
M1 objective
A1

or

C	P	a	b	c	s 1	s 2	s 3	su 4	a	RHS
1	0	0	0	1	0	0	0	–1	0	2
0	1	−3	–5	–2	0	0	0	0	0	0
0	0	0.5	1	1	1	0	0	0	0	11
0	0	2	1.5	1	0	1	0	0	0	24
0	0	2	2	2	0	0	1	0	0	30
0	0	0	0	1	0	0	0	–1	1	2

(v) $8\times0.5 + 2\times1 + 5\times1 = 11$

$8\times2 + 2\times1.5 + 5\times1 = 24$ — B1

$8\times2 + 2\times2 + 5\times2 = 30$

$3\times8 + 5\times2 + 2\times5 = 44$ but $3\times6 + 5\times6 + 2\times2 = 52$ — B1

1 m^2 of woolly material and 2 eyes left. — B1