Mark Scheme 4772
June 2005

Instructions to markers

M marks are for method and are dependent on correct numerical substitution/correct application. Method marks can only be awarded if the method used would have led to the correct answer had not an arithmetic error occurred.
M marks may be awarded following evidence of an **sca** (substantially correct attempt).

M marks can be implied by correct answers.

A marks are for accuracy, and are dependent upon the immediately preceding **M** mark. They cannot be awarded unless the **M** mark is awarded.

B marks are for specific results or statements, and are independent of method.

√ marks are for follow-through. This applies to **A** marks for answers which follow correctly from a previous incorrect result. Whilst mark schemes will occasionally emphasise a follow-through requirement, the default will be to apply follow-through whenever possible. The exception to this are **A** marks which are labelled **cao** (correct answer only).

MR Where a candidate misreads all or part of a question, and where the integrity/difficulty of the question is not affected, a penalty (of –1, –2 or –3) can be applied (according to the extent of the work affected), and the question marked as read.
Note that it is **not** a misread if a candidate makes an error in copying his own work.

SC special case

1.

(a)

(i) If sidelights and headlights are on, and if the foglights are switched on.

B1
B1

(ii) $\sim(\sim s \vee \sim h) \wedge f$

M1 A1

(iii)

(s	$\wedge$	h)	$\wedge$	f	$\Leftrightarrow$	~	(~	s	$\vee$	~	h)	$\wedge$	f
0	0	0	0	0	1	0	1	0	1	1	0	0	0
0	0	0	0	1	1	0	1	0	1	1	0	0	1
0	0	1	0	0	1	0	1	0	1	0	1	0	0
0	0	1	0	1	1	0	1	0	1	0	1	0	1
1	0	0	0	0	1	0	0	1	1	1	0	0	0
1	0	0	0	1	1	0	0	1	1	1	0	0	1

M1 8 rows
A1 $s \wedge h \wedge f$
A1 $\sim(\sim s \vee \sim h) \wedge f$

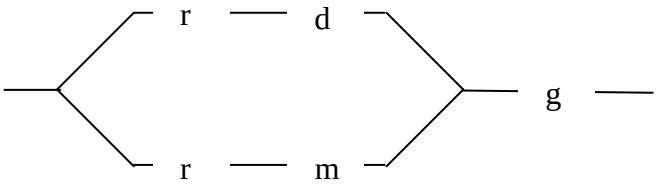
Accept t/table showing $s \wedge h = \sim(\sim s \vee \sim h)$

alternativ

B1 comment re $\wedge f$
M1 4 lines
A1

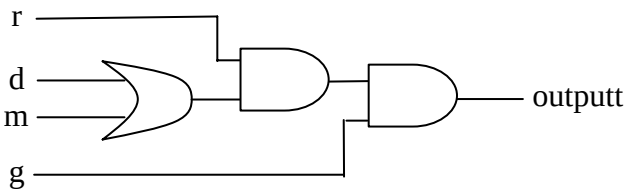
(b)

(i)



M1
A1

(ii)



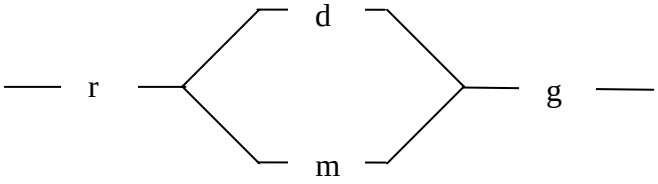
M1
A1 "or"
A1 first "and"
A1 second "and"

(iii) $r \wedge (d \vee m) \wedge g = (r \wedge (d \vee m)) \wedge g$ by associativity

$= ((r \wedge d) \vee (r \wedge m)) \wedge g$ by distributivity

M1 distributive law
A1 handling brackets
(law names not needed)

(iv)

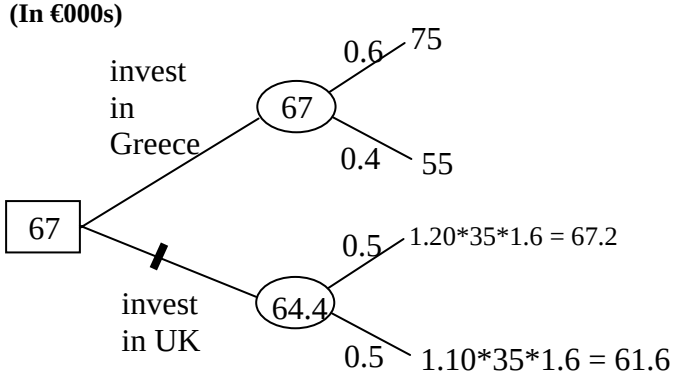


B1

2.

(i)

(In €000s)

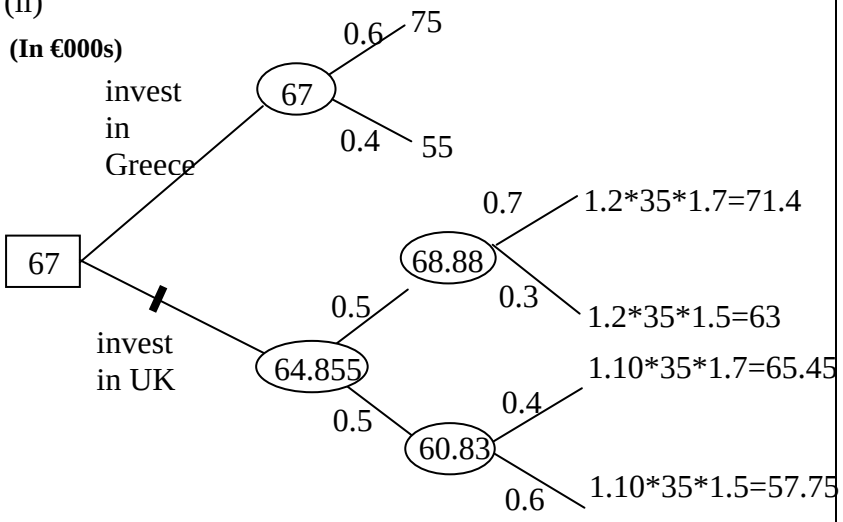


M1
A1 chance nodes
A1 choice node

B1√ invest in Greece

(ii)

(In €000s)

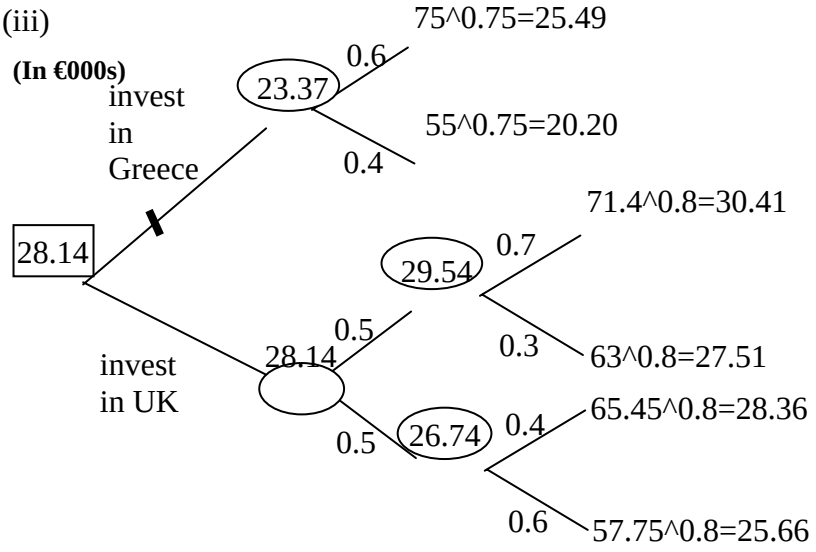


M1 new chance nodes
A1 64.855 or .86 or .85

B1 invest in Greece

(iii)

(In €000s)



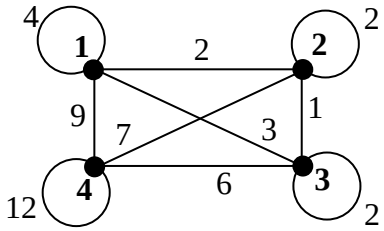
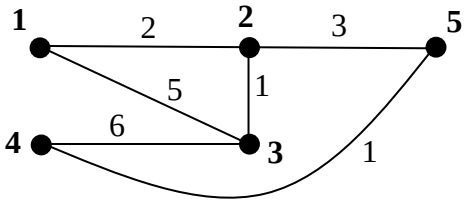
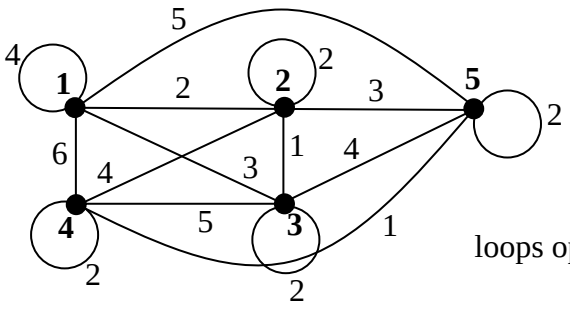
M1 utilities
A1 23.37 and 28.14

B1 invest in UK

2 (cont)

(iv) Require $\frac{1.2+1.1}{2}\times 35\times x = 67$, giving x = 1.665	M1 A1 cao
(v) Require $\frac{(1.2\times 35\times y)^{0.8}+(1.1\times 35\times y)^{0.8}}{2} = 23.37$. Trying y = 1.277: $(1.2\times 35\times 1.277)^{0.8} = 24.185$ $(1.1\times 35\times 1.277)^{0.8} = 22.559$ (24.185+22.559)/2 = 23.37	M1 cash M1 house A1 one bracket evaluated correctly A1

3.

(i)  loops optional	M1 A1
(ii) First vertex en route is 3. First vertex en route from 3 to 1 is 2. First vertex en route from 2 to 1 is 1.	M1 A1
(iii)  	B1
 loops optional	M1 A1

(iv)

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

	1	**2**	**3**	**4**	**5**
1	2	2	2	2	2
2	1	3	3	5	5
3	2	2	2	2	2
4	5	5	5	5	5
5	2	2	2	4	4

B1 distance matrix

M1 route matrix
A1 cao

(v) 1 2 3 5 4 1
14
1 2 3 2 5 4 5 2 1

M1
A1
A1

(vi)

1 2 4 3

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

Lower bound is 5 + 2 + 3 = 10

M1 Prim on matrix
A1

B1 B1

(vii) e.g.
1 2 5 4 3 2 3 1
19

M1 A1 cao
B1

4.

(i) The objective is nonlinear. — B1

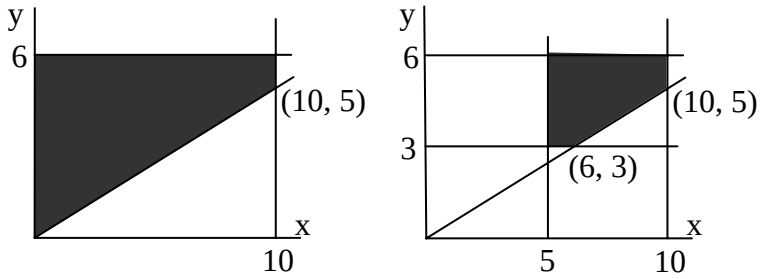
(ii)

P	x	y	S1	S2	S3	RHS
1	−1	1	0	0	0	0
0	1	0	1	0	0	10
0	0	1	0	1	0	6
0	1	−2	0	0	1	0
1	0	−1	0	0	1	0
0	0	2	1	0	−1	10
0	0	1	0	1	0	6
0	1	−2	0	0	1	0
1	0	0	1/2	0	1/2	5
0	0	1	1/2	0	−1/2	5

M1 tableau
A1
M1 pivot choice
A1 pivot
M1 pivot choice
A1 pivot

10 ml of oil and 5 ml of vinegar — B1

(iii)



B1 $x \leq 10$ and $y \leq 6$
B1 $5 \leq x$ and $3 \leq y$
B1 proportion line
B1 region 1
B1 region 2

(iv) Omitted constraints non-active — B1
(0, 0) not in feasible region. — B1

(v)

C	P	x	y	s1	s2	s3	s4	s5	a1	a2	RHS
1	0	1	1	0	–1	0	–1	0	0	0	8
0	1	1	–1	0	0	0	0	0	0	0	0
0	0	1	0	1	0	0	0	0	0	0	10
0	0	1	0	0	–1	0	0	0	1	0	5
0	0	0	1	0	0	1	0	0	0	0	6
0	0	0	1	0	0	0	–1	0	0	1	3
0	0	1	–2	0	0	0	0	1	0	0	0

B1 > constraints
B1 artificial columns
B1 new objective

Minimise C, hopefully to zero. — B1
Thereafter delete C row and a1/a2 columns, and proceed as usual. — B1