OCR
RECOGNISING ACHIEVEMENT

Friday 22 June 2012 – Afternoon

A2 GCE MATHEMATICS (MEI)

4772 Decision Mathematics 2

QUESTION PAPER

Candidates answer on the Printed Answer Book.

OCR supplied materials:
- Printed Answer Book 4772
- MEI Examination Formulae and Tables (MF2)

Other materials required:
- Scientific or graphical calculator

Duration: 1 hour 30 minutes

INSTRUCTIONS TO CANDIDATES

These instructions are the same on the Printed Answer Book and the Question Paper.

- The Question Paper will be found in the centre of the Printed Answer Book.
- Write your name, centre number and candidate number in the spaces provided on the Printed Answer Book. Please write clearly and in capital letters.
- **Write your answer to each question in the space provided in the Printed Answer Book**. Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Answer **all** the questions.
- Do **not** write in the bar codes.
- You are permitted to use a graphical calculator in this paper.
- Final answers should be given to a degree of accuracy appropriate to the context.

INFORMATION FOR CANDIDATES

This information is the same on the Printed Answer Book and the Question Paper.

- The number of marks is given in brackets **[ ]** at the end of each question or part question on the Question Paper.
- You are advised that an answer may receive **no marks** unless you show sufficient detail of the working to indicate that a correct method is being used.
- The total number of marks for this paper is **72**.
- The Printed Answer Book consists of **12** pages. The Question Paper consists of **8** pages. Any blank pages are indicated.

INSTRUCTIONS TO EXAMS OFFICER/INVIGILATOR

- Do not send this Question Paper for marking; it should be retained in the centre or recycled. Please contact OCR Copyright should you wish to re-use this document.

1 **(a)** When marking coursework, a teacher has to complete a form which includes the following:

In your opinion is this the original work of the pupil? (tick as appropriate)	
I have no reason to believe that it is not	☐
I cannot confirm that it is	☐

(i) The teacher suspects that a pupil has copied work from the internet. For each box, state whether the teacher should tick the box or not. **[2]**

(ii) The teacher has no suspicions about the work of another pupil, and has no information about how the work was produced. Which boxes should she tick? **[2]**

(iii) Explain why the teacher must always tick at least one box. **[2]**

(b) Angus, the ski instructor, says that the class will have to have lunch in Italy tomorrow if it is foggy or if the top ski lift is not working. On the next morning Chloe, one of Angus's students, says that it is not foggy, so they can have lunch in Switzerland.

Produce a line of a truth table which shows that Chloe's deduction is incorrect. You may produce a complete truth table if you wish, but you must indicate a row which shows that Chloe's deduction is incorrect. **[6]**

(c) You are given that the following two statements are true.

$$(X \vee \sim Y) \Rightarrow Z$$
$$\sim Z$$

Use Boolean algebra to show that Y is true. **[4]**

2 Adrian is considering selling his house and renting a flat.

Adrian still owes £150 000 on his house. He has a mortgage for this, for which he has to pay £4800 annual interest. If he sells he will pay off the £150 000 and invest the remainder of the proceeds at an interest rate of 2.5% per annum. He will use the interest to help to pay his rent.

His estate agent estimates that there is a 30% chance that the house will sell for £225 000, a 50% chance that it will sell for £250 000, and a 20% chance that it will sell for £275 000.

A flat will cost him £7500 per annum to rent.

(i) Draw a decision tree to help Adrian to decide whether to keep his house, or to sell it and rent a flat. Compare the EMVs of Adrian's annual outgoings, and ignore the costs of selling. **[6]**

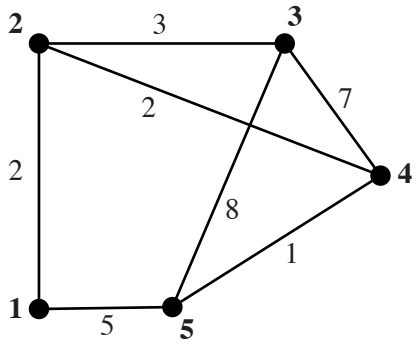
(ii) Would the analysis point to a different course of action if Adrian were to use a square root utility function, instead of EMVs? **[3]**

Adrian's circumstances change so that he has to decide now whether to sell or not in one year's time. Economic conditions might then be less favourable for the housing market, the same, or more favourable, these occurring with probabilities 0.3, 0.3 and 0.4 respectively. The possible selling prices and their probabilities are shown in the table.

Economic conditions and probabilities		Selling prices (£) and probabilities					
less favourable	0.3	200 000	0.2	225 000	0.3	250 000	0.5
unchanged	0.3	225 000	0.3	250 000	0.5	275 000	0.2
more favourable	0.4	250 000	0.3	300 000	0.5	350 000	0.2

(iii) Draw a decision tree to help Adrian to decide what to do. Compare the EMVs of Adrian's annual outgoings. Assume that he will still owe £150 000 in one year's time, and that the cost of renting and interest rates do not change. **[7]**

3 The weights on the network represent distances.



(i) The answer book shows the initial tables and the results of iterations 1, 2, 3 and 5 when Floyd's algorithm is applied to the network.

(*A*) Complete the two tables for iteration 4. **[6]**

(*B*) Use the final route table to give the shortest route from vertex **3** to vertex **5**. **[1]**

(*C*) Use the final distance table to produce a complete network with weights representing the shortest distances between vertices. **[2]**

(ii) Using the complete network of shortest distances, find a lower bound for the solution to the Travelling Salesperson Problem by deleting vertex **5** and its arcs, and by finding the length of a minimum connector for the remainder. (You may find the minimum connector by inspection.) **[3]**

(iii) Use the nearest neighbour algorithm, starting at vertex **1**, to produce a Hamilton cycle in the complete network. Give the length of your cycle. **[3]**

(iv) Interpret your Hamilton cycle in part **(iii)** in terms of the original network. **[2]**

(v) Give a walk of minimum length which traverses every arc on the original network at least once, and which returns to the start. Give the length of your walk. **[3]**

4 A publisher is considering producing three books over the next week: a mathematics book, a novel and a biography. The mathematics book will sell at £10 and costs £4 to produce. The novel will sell at £5 and costs £2 to produce. The biography will sell at £12 and costs £5 to produce. The publisher wants to maximise profit, and is confident that all books will be sold.

There are constraints on production. Each copy of the mathematics book needs 2 minutes of printing time, 1 minute of packing time, and 300 cm^3 of temporary storage space.

Each copy of the novel needs 1.5 minutes of printing time, 0.5 minutes of packing time, and 200 cm^3 of temporary storage space.

Each copy of the biography needs 2.5 minutes of printing time, 1.5 minutes of packing time, and 400 cm^3 of temporary storage space.

There are 10 000 minutes of printing time available on several printing presses, 7500 minutes of packing time, and 2 m^3 of temporary storage space.

(i) Explain how the following initial feasible tableau models this problem. **[5]**

P	x	y	z	$s1$	$s2$	$s3$	RHS
1	−6	−3	−7	0	0	0	0
0	2	1.5	2.5	1	0	0	10 000
0	1	0.5	1.5	0	1	0	7500
0	300	200	400	0	0	1	2 000 000

(ii) Use the simplex algorithm to solve your LP, and interpret your solution. **[8]**

(iii) The optimal solution involves producing just one of the three books. By how much would the price of each of the other books have to be increased to make them worth producing? **[2]**

There is a marketing requirement to provide at least 1000 copies of the novel.

(iv) Show how to incorporate this constraint into the initial tableau ready for an application of the two-stage simplex method.

Briefly describe how to use the modified tableau to solve the problem. You are NOT required to perform the iterations. **[5]**

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RECOGNISING ACHIEVEMENT

Friday 22 June 2012 – Afternoon

A2 GCE MATHEMATICS (MEI)

4772 Decision Mathematics 2

PRINTED ANSWER BOOK

Candidates answer on this Printed Answer Book.

OCR supplied materials:
- Question Paper 4772 (inserted)
- MEI Examination Formulae and Tables (MF2)

Other materials required:
- Scientific or graphical calculator

Duration: 1 hour 30 minutes

Candidate forename		Candidate surname	

Centre number						Candidate number				

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1(a)(i)	
1(a)(ii)	
1(a)(iii)	
1 (b)	

1 (c)	

2 (i)	
2 (ii)	

2 (iii)	

3

	1	2	3	4	5
1	∞	2	∞	∞	5
2	2	∞	3	2	∞
3	∞	3	∞	7	8
4	∞	2	7	∞	1
5	5	∞	8	1	∞

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

	1	2	3	4	5
1	∞	2	∞	∞	5
2	2	4	3	2	7
3	∞	3	∞	7	8
4	∞	2	7	∞	1
5	5	7	8	1	10

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

	1	2	3	4	5
1	4	2	5	4	5
2	2	4	3	2	7
3	5	3	6	5	8
4	4	2	5	4	1
5	5	7	8	1	10

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

	1	2	3	4	5
1	4	2	5	4	5
2	2	4	3	2	7
3	5	3	6	5	8
4	4	2	5	4	1
5	5	7	8	1	10

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

3 (i) (*A*)

	1	2	3	4	5
1					
2					
3					
4					
5					

	1	2	3	4	5
1					
2					
3					
4					
5					

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

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

3 (i) (*B*)

3 (i) (C)	
3 (ii)	

3 (iii)	
3 (iv)	
3 (v)	

PLEASE DO NOT WRITE IN THIS SPACE

4 (i)

4 (ii)

4 (iii)

4 (iv)

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OCR
RECOGNISING ACHIEVEMENT

GCE

Mathematics (MEI)

Advanced GCE

Unit **4772:** Decision Mathematics 2

Mark Scheme for June 2012

OCR (Oxford Cambridge and RSA) is a leading UK awarding body, providing a wide range of qualifications to meet the needs of candidates of all ages and abilities. OCR qualifications include AS/A Levels, Diplomas, GCSEs, OCR Nationals, Functional Skills, Key Skills, Entry Level qualifications, NVQs and vocational qualifications in areas such as IT, business, languages, teaching/training, administration and secretarial skills.

It is also responsible for developing new specifications to meet national requirements and the needs of students and teachers. OCR is a not-for-profit organisation; any surplus made is invested back into the establishment to help towards the development of qualifications and support, which keep pace with the changing needs of today's society.

This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

OCR will not enter into any discussion or correspondence in connection with this mark scheme.

Any enquiries about publications should be addressed to:

OCR Publications
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NOTTINGHAM
NG15 0DL

Telephone: 0870 770 6622
Facsimile: 01223 552610
E-mail: publications@ocr.org.uk

Annotations

Annotation in scoris	Meaning
✓and ✗	
BOD	Benefit of doubt
FT	Follow through
ISW	Ignore subsequent working
M0, M1	Method mark awarded 0, 1
A0, A1	Accuracy mark awarded 0, 1
B0, B1	Independent mark awarded 0, 1
SC	Special case
^	Omission sign
MR	Misread
Highlighting	

Other abbreviations in mark scheme	Meaning
E1	Mark for explaining
U1	Mark for correct units
G1	Mark for a correct feature on a graph
M1 dep*	Method mark dependent on a previous mark, indicated by *
cao	Correct answer only
oe	Or equivalent
rot	Rounded or truncated
soi	Seen or implied
www	Without wrong working

Subject-specific Marking Instructions

a. Annotations should be used whenever appropriate during your marking.

The A, M and B annotations must be used on your standardisation scripts for responses that are not awarded either 0 or full marks. It is vital that you annotate standardisation scripts fully to show how the marks have been awarded.

For subsequent marking you must make it clear how you have arrived at the mark you have awarded.

b. An element of professional judgement is required in the marking of any written paper. Remember that the mark scheme is designed to assist in marking incorrect solutions. Correct *solutions* leading to correct answers are awarded full marks but work must not be judged on the answer alone, and answers that are given in the question, especially, must be validly obtained; key steps in the working must always be looked at and anything unfamiliar must be investigated thoroughly.

Correct but unfamiliar or unexpected methods are often signalled by a correct result following an *apparently* incorrect method. Such work must be carefully assessed. When a candidate adopts a method which does not correspond to the mark scheme, award marks according to the spirit of the basic scheme; if you are in any doubt whatsoever (especially if several marks or candidates are involved) you should contact your Team Leader.

c. The following types of marks are available.

M
A suitable method has been selected and *applied* in a manner which shows that the method is essentially understood. Method marks are not usually lost for numerical errors, algebraic slips or errors in units. However, it is not usually sufficient for a candidate just to indicate an intention of using some method or just to quote a formula; the formula or idea must be applied to the specific problem in hand, eg by substituting the relevant quantities into the formula. In some cases the nature of the errors allowed for the award of an M mark may be specified.

A
Accuracy mark, awarded for a correct answer or intermediate step correctly obtained. Accuracy marks cannot be given unless the associated Method mark is earned (or implied). Therefore M0 A1 cannot ever be awarded.

B
Mark for a correct result or statement independent of Method marks.

E
A given result is to be established or a result has to be explained. This usually requires more working or explanation than the establishment of an unknown result.

Unless otherwise indicated, marks once gained cannot subsequently be lost, eg wrong working following a correct form of answer is ignored. Sometimes this is reinforced in the mark scheme by the abbreviation isw. However, this would not apply to a case where a candidate passes through the correct answer as part of a wrong argument.

d. When a part of a question has two or more 'method' steps, the M marks are in principle independent unless the scheme specifically says otherwise; and similarly where there are several B marks allocated. (The notation 'dep *' is used to indicate that a particular mark is dependent on an earlier, asterisked, mark in the scheme.) Of course, in practice it may happen that when a candidate has once gone wrong in a part of a question, the work from there on is worthless so that no more marks can sensibly be given. On the other hand, when two or more steps are successfully run together by the candidate, the earlier marks are implied and full credit must be given.

e. The abbreviation ft implies that the A or B mark indicated is allowed for work correctly following on from previously incorrect results. Otherwise, A and B marks are given for correct work only – differences in notation are of course permitted. A (accuracy) marks are not given for answers obtained from incorrect working. When A or B marks are awarded for work at an intermediate stage of a solution, there may be various alternatives that are equally acceptable. In such cases, exactly what is acceptable will be detailed in the mark scheme rationale. If this is not the case please consult your Team Leader.

Sometimes the answer to one part of a question is used in a later part of the same question. In this case, A marks will often be 'follow through'. In such cases you must ensure that you refer back to the answer of the previous part question even if this is not shown within the image zone. You may find it easier to mark follow through questions candidate-by-candidate rather than question-by-question.

f. Wrong or missing units in an answer should not lead to the loss of a mark unless the scheme specifically indicates otherwise. Candidates are expected to give numerical answers to an appropriate degree of accuracy, with 3 significant figures often being the norm. Small variations in the degree of accuracy to which an answer is given (eg 2 or 4 significant figures where 3 is expected) should not normally be penalised, while answers which are grossly over- or under-specified should normally result in the loss of a mark. The situation regarding any particular cases where the accuracy of the answer may be a marking issue should be detailed in the mark scheme rationale. If in doubt, contact your Team Leader.

g. Rules for replaced work

If a candidate attempts a question more than once, and indicates which attempt he/she wishes to be marked, then examiners should do as the candidate requests.

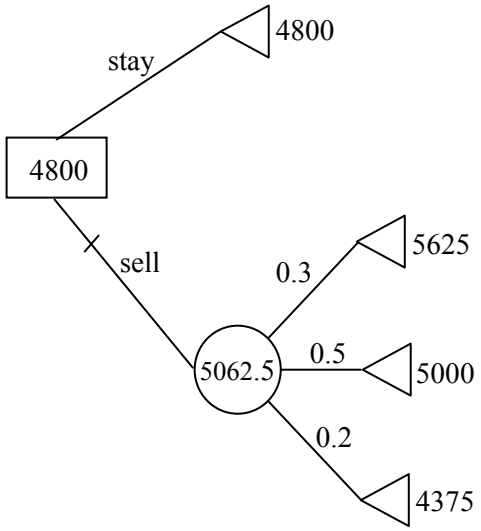
If there are two or more attempts at a question which have not been crossed out, examiners should mark what appears to be the last (complete) attempt and ignore the others.

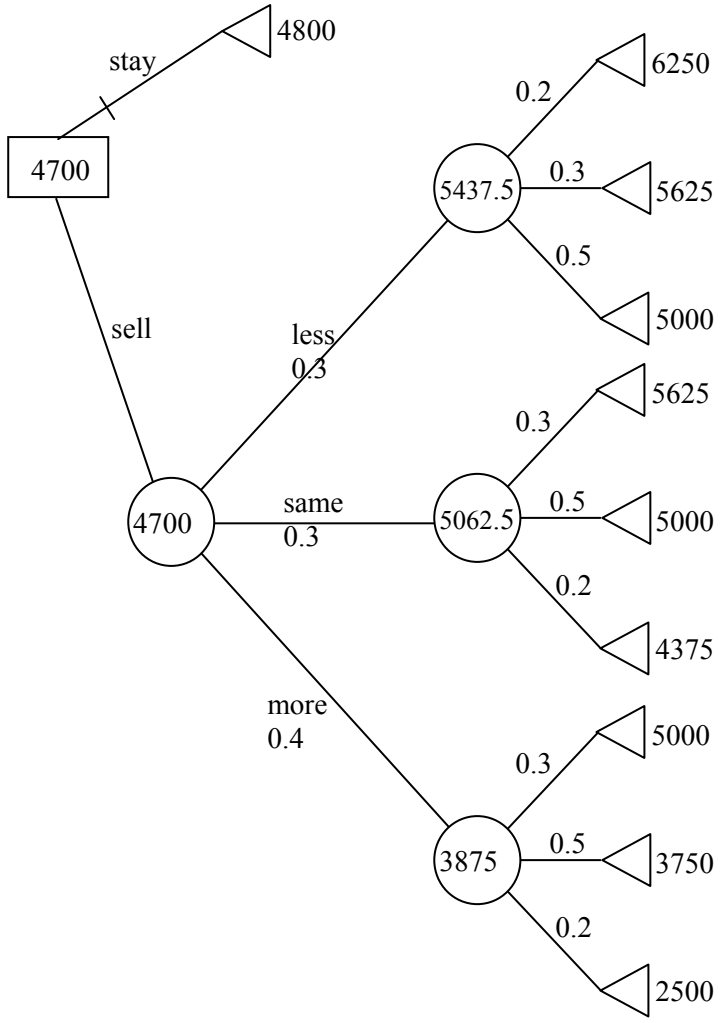
NB Follow these maths-specific instructions rather than those in the assessor handbook.

h. For a *genuine* misreading (of numbers or symbols) which is such that the object and the difficulty of the question remain unaltered, mark according to the scheme but following through from the candidate's data. A penalty is then applied; 1 mark is generally appropriate, though this may differ for some units. This is achieved by withholding one A mark in the question.

Note that a miscopy of the candidate's own working is not a misread but an accuracy error.

Question			Answer	Marks	Guidance	
1	(a)	(i)	She should not tick the first box. She should tick the second box.	B1 B1 **[2]**		
1	(a)	(ii)	She should tick both boxes.	B1B1 **[2]**		
1	(a)	(iii)	eg To tick neither box would be contradictory, confirming that it is original, but having reason to believe that it is not.	M1 A1 **[2]**	looking at "neither" case, or equivalent.	
1	(b)		eg I – lunch in Italy F – foggy T – top lift not working $((F \vee T) \Rightarrow I) \Leftrightarrow (\sim F \Rightarrow \sim I)$ (ignore $\sim F \Rightarrow I$ if included) 0 1 1 1 1 0 10 0 01	M1 A1 A1 A1 A1 A1 **[6]**	identification of propositions Angus's statement Chloe's statement equivalence 0/1s for Angus and Chloe 0 for equivalence	SC B1 for examining not foggy and lift not working
1	(c)		$(X \vee \sim Y) \Rightarrow Z$ $\sim Z \Rightarrow \sim(X \vee \sim Y)$ contrapositive $\sim Z \Rightarrow \sim X \wedge Y$ De Morgan $\sim Z$ given $\sim X \wedge Y$ Y	 M1A1 B1 B1 **[4]**	 deducing Y from $\sim X \wedge Y$	

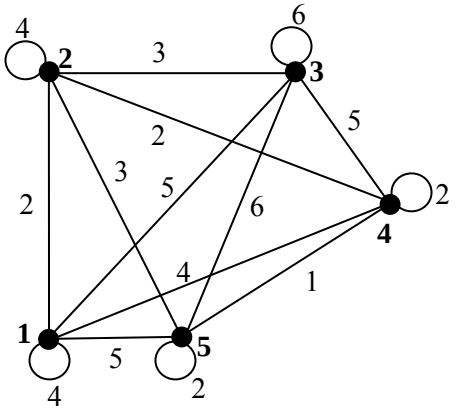
Question			Answer	Marks	Guidance	
2	(i)			B1 M1 A1 M1 A1 B1 **[6]**	decision node chance node 3-split rent costs (a correct value) –1 each error decision	
2	(ii)		$0.3\times\sqrt{5625}+0.5\times\sqrt{5000}+0.2\times\sqrt{4375}=71.08$ $\sqrt{4800}=69.28$, so no change	M1A1 A1 **[3]**		

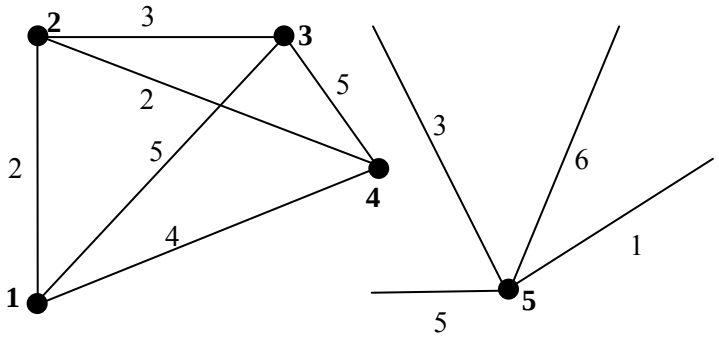
Question	Answer	Marks	Guidance	
(iii)		M1 A1 M1 A1 M1 A1 B1 **[7]**	new chance node 3-split "less" (a correct value) "more" (a correct value) 4700	 (follow through)

Question			Answer	Marks	Guidance	
3	(i)	(a)		M1 A2 M1 A2 **[6]**	(–1 each error) (–1 each error)	

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

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

3	(i)	(b)	$3 \rightarrow 2 \rightarrow 4 \rightarrow 5$		B1 **[1]**							
3	(i)	(c)			M1 A1 **[2]**	complete						

Question			Answer	Marks	Guidance	
3	(ii)		 Lower bound = (2 + 2 + 3) + (1 + 3) = 11	M1 A1 A1 **[3]**	delete vertex **5** plus arcs (2 + 2 + 3) 1 + 3	
3	(iii)		**1** → **2** → **4** → **5** → **3** → **1** of total length 16	M1A1B1 **[3]**	M1 for **1** → **2** → **4** → **5**	
3	(iv)		**1** → **2** → **4** → **5** → (**4** → **2**) → **3** → (**2**) → **1**	M1A1 **[2]**	SC 1 id seen elsewhere	
3	(v)		eg **1** → **2** → **3** → **2** → **4** → **3** → **5** → **4** → **5** → **1** Length = 32	M1A1 B1 **[3]**	2→3 or 5→4 repeated for M1	
4	(i)		Let x be the number of maths books produced … Line 1 ⇔ max $6x + 3y + 7z$ (10 − 4 = 6 etc.) Line 2 ⇔ $2x + 1.5y + 2.5z \leq 10000$ (printing time) Line 3 ⇔ $x + 0.5y + 1.5z \leq 7500$ (packing time) Line 4 ⇔ $300x + 200y + 400z \leq 2000000$ (storage space)	B1 B1 B1 B1 B1 **[5]**	variable defs.“number of” objective constraints	

Question			Answer	Marks	Guidance	
4	(ii)					

P	*x*	*y*	*z*	s1	s2	s3	RHS
1	–6	–3	–7	0	0	0	0
0	2	1.5	2.5	1	0	0	10000
0	1	0.5	1.5	0	1	0	7500
0	300	200	400	0	0	1	2000000
1	–0.4	1.2	0	2.8	0	0	28000
0	0.8	0.6	1	0.4	0	0	4000
0	–0.2	–0.4	0	–0.6	1	0	1500
0	–20	–40	0	–160	0	1	400000
1	0	1.5	0.5	3	0	0	30000
0	1	0.75	1.25	0.5	0	0	5000
0	0	–0.25	0.25	–0.5	1	0	2500
0	0	–25	25	–150	0	1	500000

Marks	Guidance
B1	pivot (pivot on *x* OK)
M1	a correct row or column
A1	
B1	pivot
M1	a correct row or column
A1	

Produce 5000 maths books – B1
at a profit of £30000. B1
(2500 packing minutes spare and 0.5 m^3 storage space spare.)

[8]

4	(iii)		£1.50 and 50p respectively.	B1B1 **[2]**	

Question			Answer	Marks	Guidance	
4	(iv)					

Q	*P*	*x*	*y*	*z*	s1	s2	s3	s4	a	RHS
1	0	0	1	0	0	0	0	–1	0	1000
0	1	–6	–3	–7	0	0	0	0	0	0
0	0	2	1.5	2.5	1	0	0	0	0	10000
0	0	1	0.5	1.5	0	1	0	0	0	7500
0	0	300	200	400	0	0	1	0	0	2000000
0	0	0	1	0	0	0	0	–1	1	1000

Answer	Marks	Guidance
	B1	new objective
	B1	surplus + artificial
	B1	new constraint
Minimise Q until 0 (if feasible).	B1	
Then drop Q and a and proceed to optimum.	B1	
	[5]	

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4772 Decision Mathematics 2

General Comments

Many candidates for this paper were able mathematicians. Their performances were good.

Nevertheless, there was much challenge in the paper, particularly in question 1.

Comments on Individual Questions

1) (a) Candidates did well with parts (i) and (ii), but part (iii) proved very difficult. Parts (i) and (ii) were concerned with what a teacher must do in two different circumstances. Part (iii) asked the candidates to explain/prove why at least one box must be ticked under **all** circumstances. Most candidates started their answers along the lines "If the teacher ...", and were therefore immediately sunk. Looking at specific circumstances did not gain marks. Candidates needed to show that the negations of the statements were contradictory. It needed an argument focusing on the statements, and not on externalities.

(b) Many candidates failed to define their propositions. Many failed to translate Angus's statement and Chloe's statement into compound propositions. Many that did so failed to test the equivalence of the two statements, or more specifically to compare truth values when it was not foggy, when the top lift was not working, and when lunch was taken in Italy.

(c) The key to this question was to write down the contrapositive of the given implication. There were several well-argued answers which did not explicitly use Boolean algebra. These could only earn partial credit. Truth table solutions earned no credit here.

2) This question was answered very well. The computations of the paybacks in parts (i) and (iii) caused difficulties – unsurprisingly given the inherent complexities. Pleasingly, the majority of candidates handled part (ii) well. The point here is that the square roots of the paybacks need to be taken, and not the square roots of probabilistically weighted means of those paybacks. This was very well understood.

3) Question 3 had many and varied points. It covered a lot of ground without raising any significant difficulties for the candidates.

4) Candidates were generally very happy with parts (ii) and (iv). Quite a few knew the post-optimal analysis in part (ii), which was pleasing.
In part (i)there were many candidates who busied themselves with explaining the mechanics of surplus variables et al, rather than with the modelling that was asked for in the question. Far too many candidates, if they remembered to define their variables, neglected that essential phrase "the **number** of ...".

GCE Mathematics (MEI)

			Max Mark	90% cp	a	b	c	d	e	u
4753/01	(C3) MEI Methods for Advanced Mathematics with Coursework: Written Paper	Raw	72	66	60	53	47	41	34	0
4753/02	(C3) MEI Methods for Advanced Mathematics with Coursework: Coursework	Raw	18	16	15	13	11	9	8	0
4753/82	(C3) MEI Methods for Advanced Mathematics with Coursework: Carried Forward Coursework Mark	Raw	18	16	15	13	11	9	8	0
4753	(C3) MEI Methods for Advanced Mathematics with Coursework	UMS	100	90	80	70	60	50	40	0
4754/01	(C4) MEI Applications of Advanced Mathematics	Raw	90	73	65	57	50	43	36	0
		UMS	100	90	80	70	60	50	40	0
4756/01	(FP2) MEI Further Methods for Advanced Mathematics	Raw	72	66	61	53	46	39	32	0
		UMS	100	90	80	70	60	50	40	0
4757/01	(FP3) MEI Further Applications of Advanced Mathematics	Raw	72	61	54	47	40	34	28	0
		UMS	100	90	80	70	60	50	40	0

4758/01	(DE) MEI Differential Equations with Coursework: Written Paper	Raw	72	68	63	57	51	45	39	0
4758/02	(DE) MEI Differential Equations with Coursework: Coursework	Raw	18	16	15	13	11	9	8	0
4758/82	(DE) MEI Differential Equations with Coursework: Carried Forward Coursework Mark	Raw	18	16	15	13	11	9	8	0
4758	(DE) MEI Differential Equations with Coursework	UMS	100	90	80	70	60	50	40	0
4762/01	(M2) MEI Mechanics 2	Raw	72	65	58	51	44	38	32	0
		UMS	100	90	80	70	60	50	40	0
4763/01	(M3) MEI Mechanics 3	Raw	72	67	63	56	50	44	38	0
		UMS	100	90	80	70	60	50	40	0
4764/01	(M4) MEI Mechanics 4	Raw	72	63	56	49	42	35	29	0
		UMS	100	90	80	70	60	50	40	0
4767/01	(S2) MEI Statistics 2	Raw	72	66	61	55	49	43	38	0
		UMS	100	90	80	70	60	50	40	0
4768/01	(S3) MEI Statistics 3	Raw	72	65	58	51	44	38	32	0
		UMS	100	90	80	70	60	50	40	0
4769/01	(S4) MEI Statistics 4	Raw	72	63	56	49	42	35	28	0
		UMS	100	90	80	70	60	50	40	0
4772/01	(D2) MEI Decision Mathematics 2	Raw	72	62	56	50	44	39	34	0
		UMS	100	90	80	70	60	50	40	0
4773/01	(DC) MEI Decision Mathematics Computation	Raw	72	52	46	40	34	29	24	0
		UMS	100	90	80	70	60	50	40	0
4777/01	(NC) MEI Numerical Computation	Raw	72	63	55	47	39	32	25	0
		UMS	100	90	80	70	60	50	40	0