OCR

Tuesday 10 June 2014 – Morning

AS GCE MATHEMATICS (MEI)

4771/01 Decision Mathematics 1

QUESTION PAPER

Candidates answer on the Printed Answer Book.

OCR supplied materials:
- Printed Answer Book 4771/01
- 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 inside 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 scientific or 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.

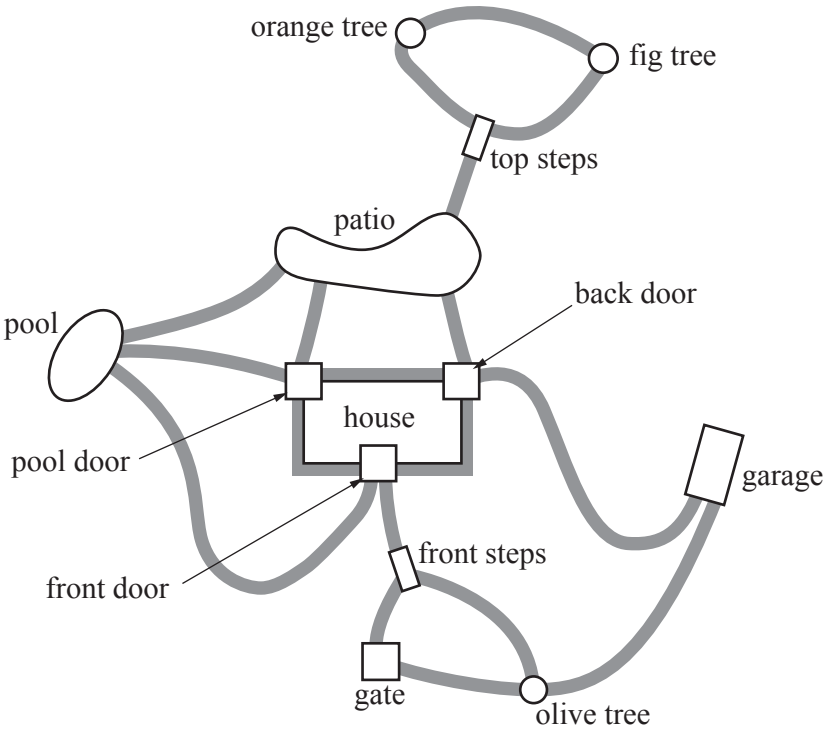
- The number of marks is given in brackets **[ ]** at the end of each question or part question on the Question Paper.
- You are advised that an answer may receive **no marks** unless you show sufficient detail of the working to indicate that a correct method is being used.
- The total number of marks 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.

Section A (24 marks)

1 The diagram shows the layout of a Mediterranean garden. Thick lines represent paths.



(i) Draw a graph to represent this information using the vertices listed below, and with arcs representing the 18 paths.

Vertices: patio (pa); pool (po); top steps (ts); orange tree (or); fig tree (fi); pool door (pd); back door (bd); front door (fd); front steps (fs); gate (gat); olive tree (ol); garage (gar). **[2]**

Joanna, the householder, wants to walk along all of the paths.

(ii) Explain why she cannot do this without repeating at least one path. **[1]**

(iii) Write down a route for Joanna to walk along all of the paths, repeating exactly one path. Write down the path which must be repeated. **[3]**

Joanna has a new path constructed which links the pool directly to the top steps.

(iv) Describe how this affects Joanna's walk, and where she can start and finish. (You are not required to give a new route.) **[2]**

2 Honor either has coffee or tea at breakfast. On one third of days she chooses coffee, otherwise she has tea. She can never remember what she had the day before.

(i) Construct a simulation rule, using one-digit random numbers, to model Honor's choices of breakfast drink. **[2]**

(ii) Using the one-digit random numbers in your answer book, simulate Honor's choice of breakfast drink for 10 days. **[1]**

Honor also has either coffee or tea at the end of her evening meal, but she does remember what she had for breakfast, and her choice depends on it. If she had coffee at breakfast then the probability of her having coffee again is 0.55. If she had tea for breakfast, then the probability of her having tea again is 0.15.

(iii) Construct a simulation rule, using two-digit random numbers, to model Honor's choice of evening drink given that she had coffee at breakfast.

Construct a simulation rule, using two-digit random numbers, to model Honor's choice of evening drink given that she had tea at breakfast. **[2]**

(iv) Using your breakfast simulation from part **(ii)**, and the two-digit random numbers in your answer book, simulate Honor's choice of evening drink for 10 days. **[2]**

(v) Use your results from parts **(ii)** and **(iv)** to estimate the proportion of Honor's drinks, breakfast and evening meal combined, which are coffee. **[1]**

Question 3 begins on page 4

3 Six remote villages are linked by a set of roads. Two villages are connected directly if there is a road between them which does not pass through another village. The table gives the lengths in miles of all direct connections.

	A	B	C	D	E	F
A		6	7	12		3
B	6		10		8	
C	7	10		2		
D	12		2		9	8
E		8		9		
F	3			8		

(i) Why might it be thought surprising that the direct distance between A and D is as long as 12 miles? Give a possible reason why the distance is longer than might have been expected. **[2]**

(ii) Use the tabular form of Prim's algorithm, starting at A, to find a minimum connector for these villages. Draw your connector and give its total length. **[6]**

Section B (48 marks)

4 The table lists tasks which are involved in adding a back door to a garage. The table also lists the duration and immediate predecessor(s) for each task. Each task is undertaken by one person.

Task		Duration (hours)	Immediate predecessor(s)
A	measure	0.5	–
B	manufacture frame and door	5	A
C	cut hole in wall	2	A
D	fit lintel and marble step	1.5	C
E	fit frame	1	B, C
F	fit door	1	E
G	repair plaster around door	1	E

(i) Draw an activity on arc network for these activities. **[5]**

(ii) Mark on your diagram the early time and the late time for each event. Give the minimum completion time and the critical activities. **[6]**

(iii) Produce a schedule to show how two people can complete the project in the minimum time. **[2]**

Soon after starting activity D, the marble step breaks. Getting a replacement step adds 4 hours to the duration of activity D.

(iv) How does this delay affect the minimum completion time, the critical activities and the minimum time needed for two people to complete the project? **[3]**

Question 5 begins on page 6

5 **(a)** The following instructions operate on positive integers greater than 4.

Step 10	Choose any positive integer greater than 4, and call it n.
Step 15	Write down n.
Step 20	If n is even then let $n = \frac{n}{2}$ and write down the result.
Step 30	If n is odd then let $n = 3n + 1$ and write down the result.
Step 40	Go to Step 20.

(i) Apply the instructions with 6 as the chosen integer, stopping when a sequence repeats itself. **[2]**

(ii) Apply the instructions with 256 as the chosen integer, stopping when a sequence repeats itself. **[2]**

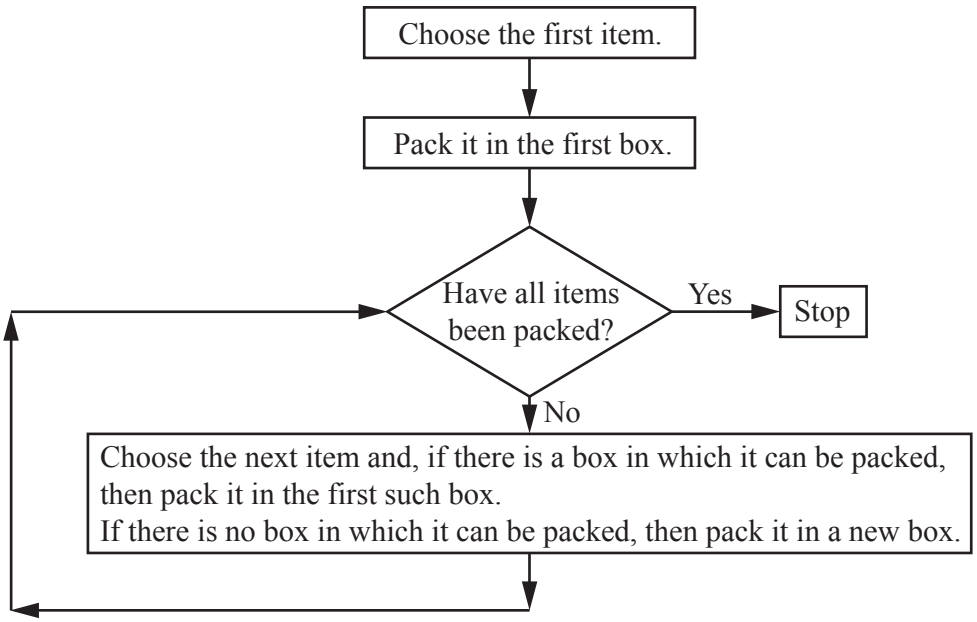
(iii) Add an instruction to stop the process when n becomes 1. **[1]**

(iv) It is not known if, when modified to stop cycling through 4, 2, 1, the instructions form an algorithm. What would need to be known for it to be an algorithm? **[1]**

(b) Six items with weights given in the table are to be packed into boxes each of which has a capacity of 10 kg.

Item	A	B	C	D	E	F
Weight (kg)	2	1	6	3	3	5

The first-fit algorithm is as follows.



(i) Use the first-fit algorithm to pack the items in the order given, and state how many boxes are needed. **[2]**

(ii) Place the items in increasing order of weight, and then apply the first-fit algorithm. **[2]**

(iii) Place the items in decreasing order of weight, and then apply the first-fit algorithm. **[2]**

An optimal solution is one which uses the least number of boxes.

(iv) Find a set of weights for which placing in decreasing order of weight, and then applying the first-fit algorithm, does not give an optimal solution. Show both the results of first-fit decreasing and an optimal solution. **[2]**

(v) First-fit decreasing has quadratic complexity. If it takes a person 30 seconds to apply first-fit decreasing to 6 items, about how long would it take that person to apply it to 60 items? **[2]**

Question 6 begins on page 8

6 Ian the chef is to make vegetable stew and vegetable soup for distribution to a small chain of vegetarian restaurants. The recipes for both of these require carrots, beans and tomatoes.

10 litres of stew requires 1.5 kg of carrots, 1 kg of beans and 1.5 kg of tomatoes.

10 litres of soup requires 1 kg of carrots, 0.75 kg of beans and 1.5 kg of tomatoes.

Ian has available 100 kg of carrots, 70 kg of beans and 110 kg of tomatoes.

(i) Identify appropriate variables and write down three inequalities corresponding to the availabilities of carrots, beans and tomatoes. **[5]**

(ii) Graph your inequalities and identify the region corresponding to feasible production plans. **[5]**

The profit on a litre of stew is £5, and the profit on a litre of soup is £4.

(iii) Find the most profitable production plan, showing your working. Give the maximum profit. **[3]**

Ian can buy in extra tomatoes at £2.50 per kg.

(iv) What extra quantity of tomatoes should Ian buy? How much extra profit would be generated by the extra expenditure? **[3]**

END OF QUESTION PAPER

OCR

Tuesday 10 June 2014 – Morning

AS GCE MATHEMATICS (MEI)

4771/01 Decision Mathematics 1

PRINTED ANSWER BOOK

Candidates answer on this Printed Answer Book.

OCR supplied materials:
- Question Paper 4771/01 (inserted)
- MEI Examination Formulae and Tables (MF2)

Other materials required:
- Scientific or graphical calculator

Duration: 1 hour 30 minutes

* 4 7 7 1 0 1 *

* 1 2 3 9 7 5 5 5 9 9 *

Candidate forename		Candidate surname	

Centre number						Candidate number				

INSTRUCTIONS TO CANDIDATES

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

- The Question Paper will be found inside 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 scientific or 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.

Section A (24 marks)

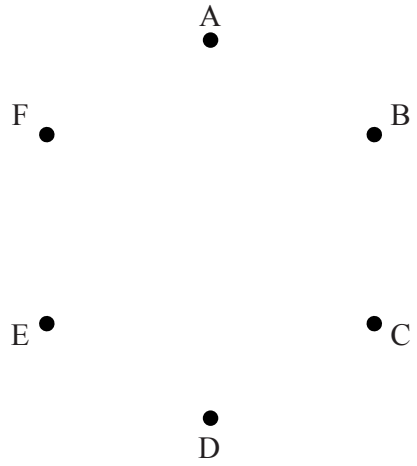
1 (i)	
1 (ii)	
1 (iii)	
1 (iv)	

2 (i)	
2 (ii)	**Random digits: 7 9 1 2 3 0 6 5 2 6 1 9 4 4 2**
2 (iii)	
2 (iv)	**Random numbers: 21 37 55 42 12 85 62 23 05 09 67 56 23 34 15**
2 (v)	

3 (i)

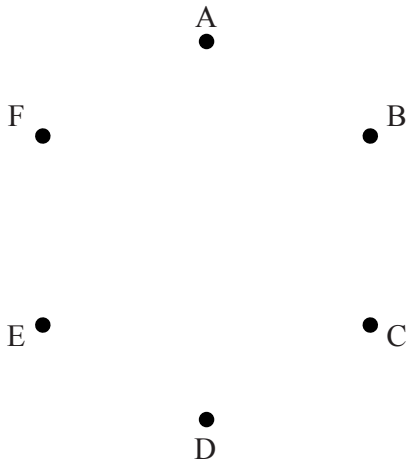
3 (ii) **A spare copy of this table and diagram can be found on page 5.**

	A	B	C	D	E	F
A		6	7	12		3
B	6		10		8	
C	7	10		2		
D	12		2		9	8
E		8		9		
F	3			8		



3 (ii) **Spare copy of table and diagram for question 3 (ii)**

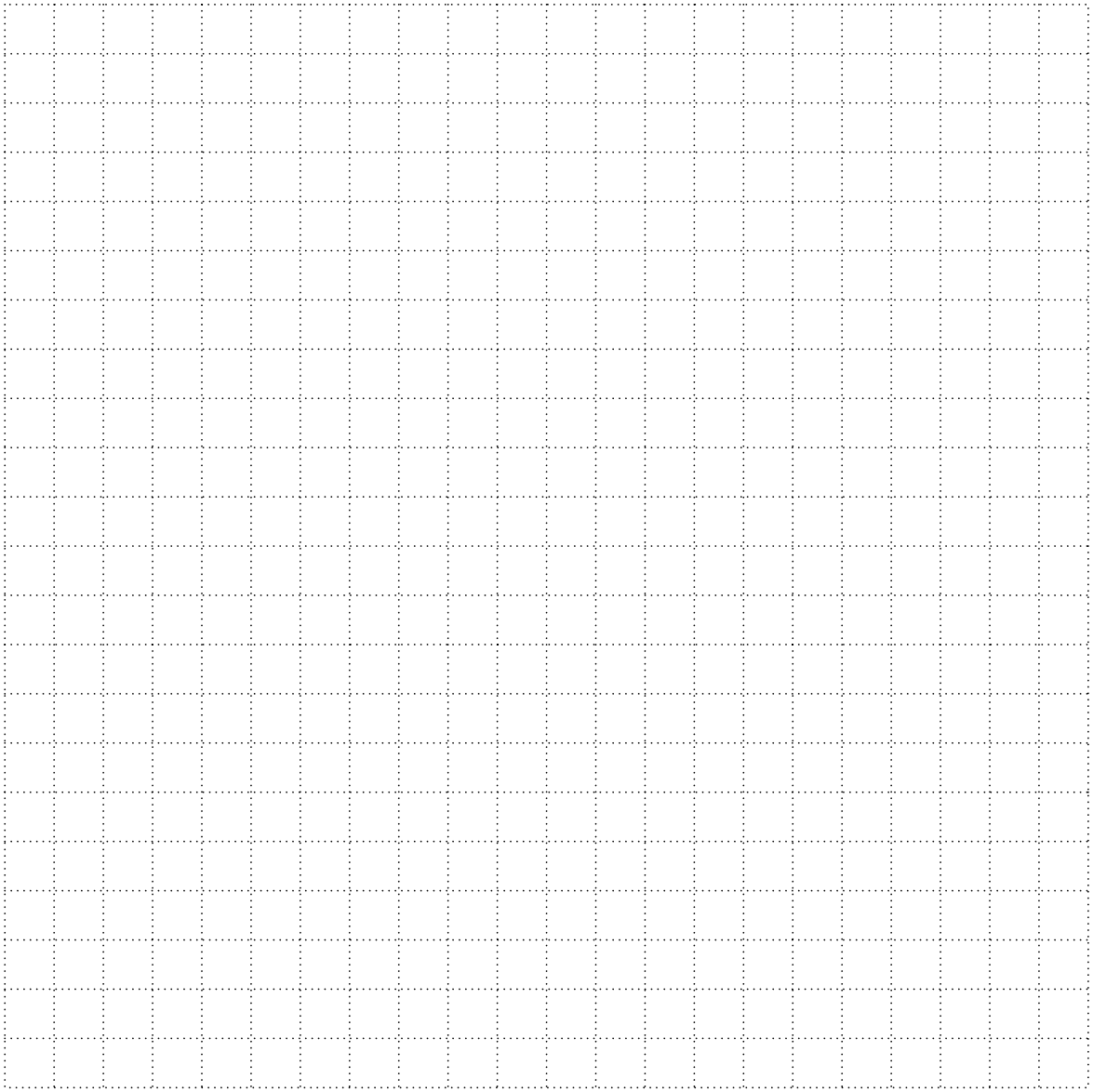
	A	B	C	D	E	F
A		6	7	12		3
B	6		10		8	
C	7	10		2		
D	12		2		9	8
E		8		9		
F	3			8		



Section B (48 marks)

4 (i) & (ii)	

4 (iii)



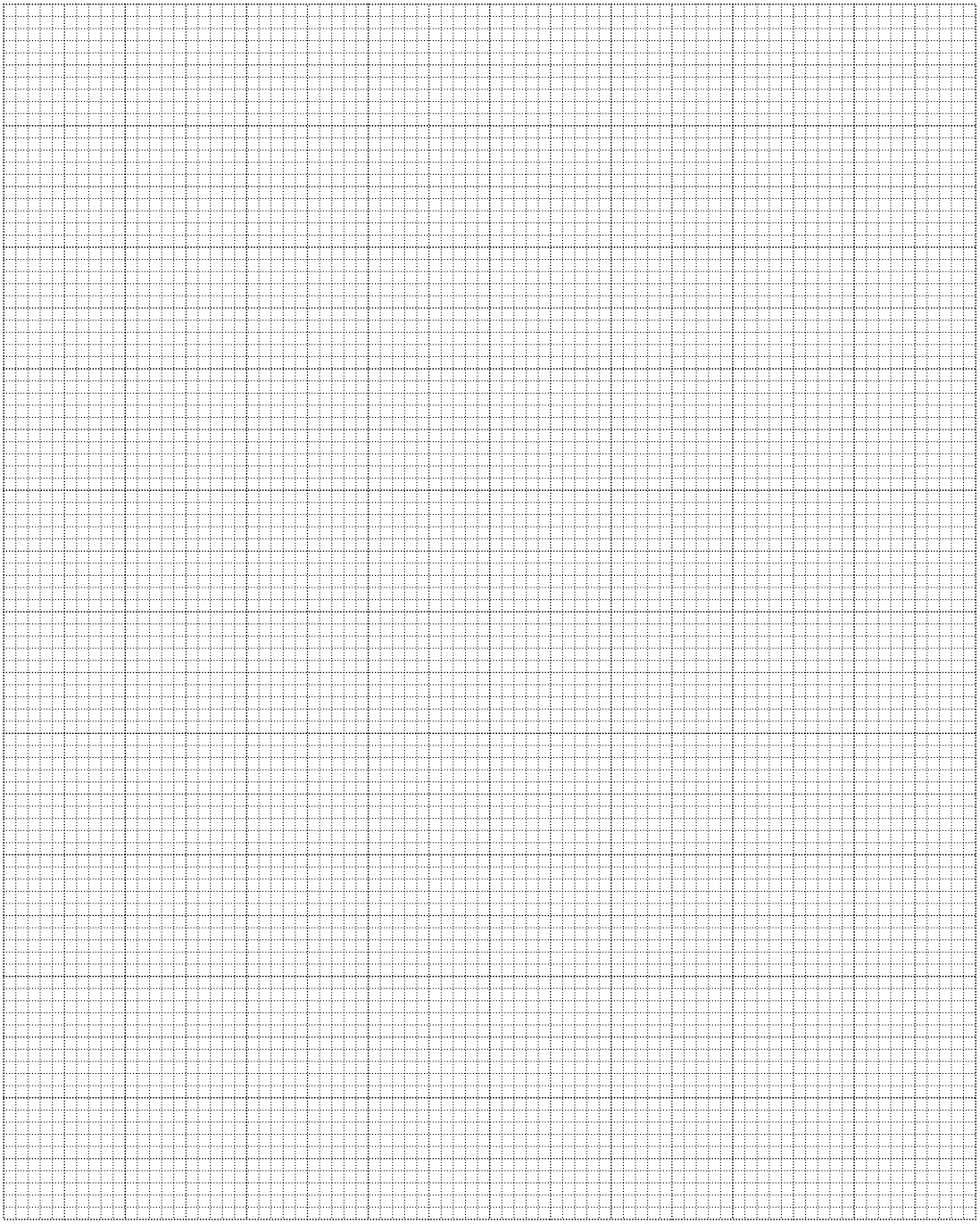
4 (iv)

5 (a) (i)	
5 (a) (ii)	
5 (a) (iii)	
5 (a) (iv)	
5 (b) (i)	
5 (b) (ii)	

5 (b) (iii)	
5 (b) (iv)	
5 (b) (v)	

6 (i)

6 (ii) **A spare copy of this graph paper is available on page 12.**



6 (iii)

6 (iv)

6 (ii) **Spare copy of graph paper for question 6 (ii)**

OCR
Oxford Cambridge and RSA

GCE

Mathematics (MEI)

Unit **4771**: Decision Mathematics 1

Advanced Subsidiary GCE

Mark Scheme for June 2014

1. Annotations and abbreviations

Annotation in scoris	Meaning
BP	Blank Page – this annotation **must** be used on all blank pages within an answer booklet (structured or unstructured) and on each page of an additional object where there is no candidate response.
✓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

2. Subject-specific Marking Instructions for GCE Mathematics (MEI) Decision strand

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 (e.g. 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

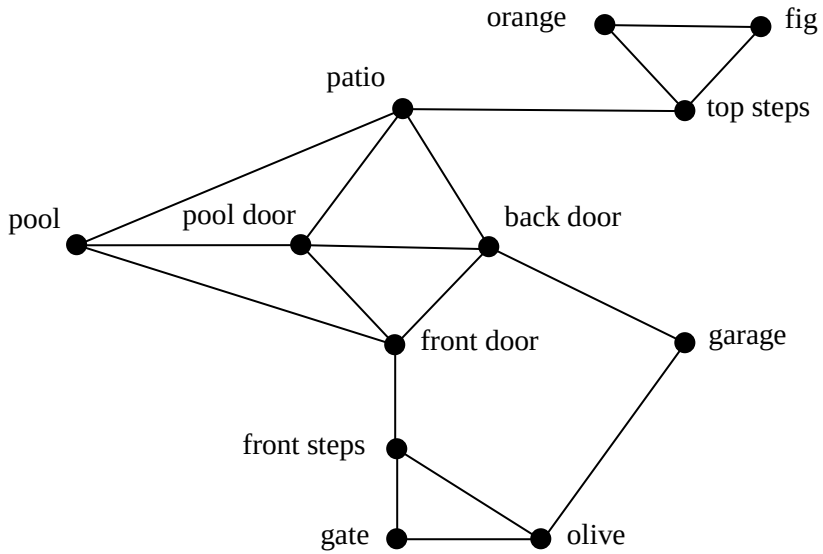
If a candidate attempts a question more than once, and indicates which attempt he/she wishes to be marked, then examiners should do as the candidate requests.

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.

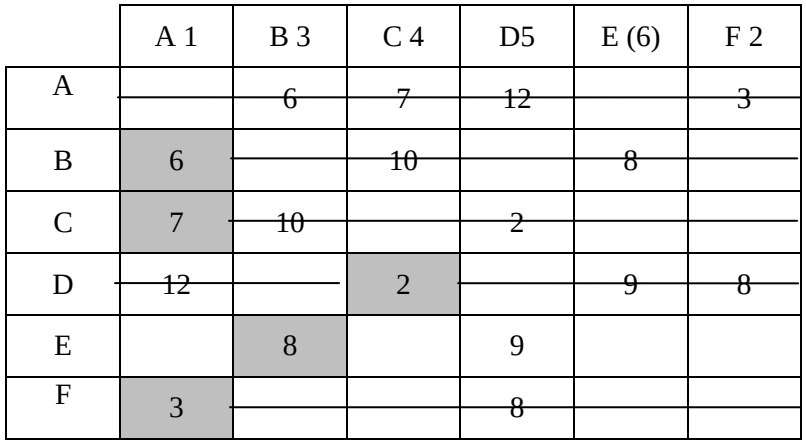
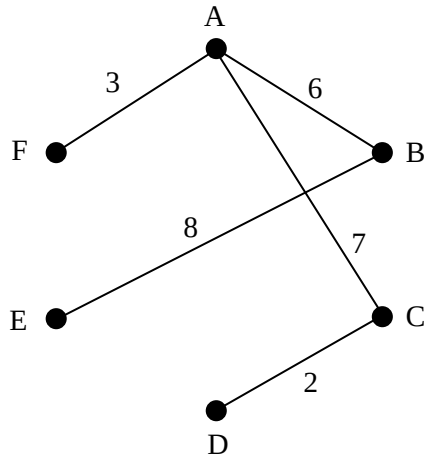
h For a *genuine* misreading (of numbers or symbols) which is such that the object and the difficulty of the question remain unaltered, mark according to the scheme but following through from the candidate's data. A penalty is then applied; 1 mark is generally appropriate, though this may differ for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

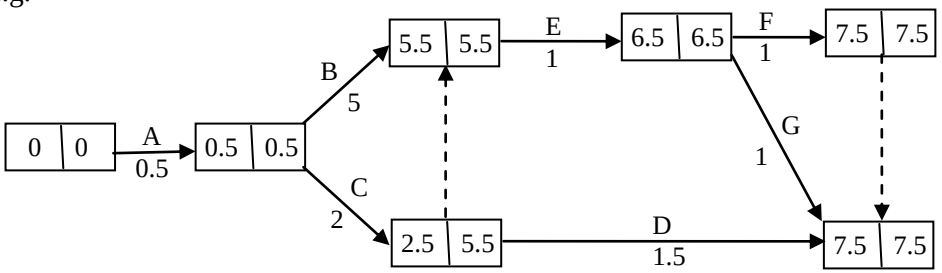
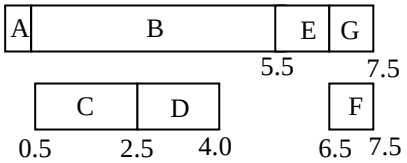
Note that a miscopy of the candidate's own working is not a misread but an accuracy error.

Question			Answer	Marks	Guidance
1	(i)			M1 A1 **[2]**	12 vertices connectivity (all 18 arcs and no extras)
1	(ii)		4 (or ">2" or "multiple" ... not "some") odd nodes ... top steps, pool, front steps, olive ... so neither Eulerian nor semi-Eulerian., but not just "not Eulerian". (This terminology not required.)	B1 **[1]**	
1	(iii)		start/end at pool/top steps, or vice versa e.g. po–pd-fd-po-pa-pd-bd-fd-fs-gat-ol-fs-ol-gar-bd-pa-ts-fi-or-ts (20 nodes, 19 arcs) path from front steps to the olive tree	M1 A1 B1 **[3]**	 must be stated

Question			Answer	Marks	Guidance
1	(iv)		Possible answer: No repetition of any arc needed Start/stop are front steps/olive	 M1 A1	
			Alternative answer: By repeating fs/ol or ol/fs ... can start and stop at same point, e.g. front door.	 (M1) (A1)	
				[2]	
2	(i)		e.g. 0,1,2 → coffee 3,4,5,6,7,8 → tea (9 → reject and redraw)	M1 A1 **[2]**	reject proportions + efficient, ie using 9 digits (so allow 00, 01, ..., 09)
2	(ii)		Ten simulated coffees or teas, corresponding to **their** rule and the given random digits. e.g. T C C T C T T C T C e.g. C T T T T C T T C T	B1 **[1]**	
2	(iii)		e.g. Coffee at breakfast 00-54 → coffee 55-99 → tea Tea at breakfast 00-14 → tea 15-99 → coffee	 B1 B1 **[2]**	 Breakfast drink must be specified. Breakfast drink must be specified.

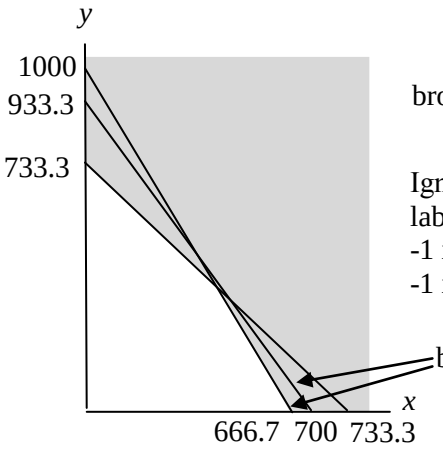
Question			Answer	Marks	Guidance
2	(iv)		Ten simulated coffees or teas, using answers to part (ii) to define which rule to use. e.g. C C T C C C C C T C e.g. C C T C C T C C C C e.g. C C C C T T C C C T	M1 A1 **[2]**	first 4, ref part (ii) ft errors in (ii)
2	(v)		Accumulating and computing the proportion. e.g. C - 65%	B1 **[1]**	ft

Question			Answer	Marks	Guidance
3	(i)		ACD is 7+ 2 = 9 (< 12) or AFD is 3+ 8 =11 (< 12) AD could by via some point of interest, or over difficult terrain, or ... The triangle inequality applies to triangles!	B1 B1 **[2]**	needs numerical justification
3	(ii)		 or transpose  26 (miles)	M1 M1 M1 A1 B1 B1 **[6]**	starting at and crossing row A (i.e. no selection in row) selecting FA and BA (or first two arcs following wrong start) numbering columns A, F and B (similarly) all correct (dependent on 3 Ms) (can cross all rows) cao (weights not needed) cao

Question			Answer	Marks	Guidance
4	(i) & (ii)		e.g.  minimum completion time = 7.5 hours critical activities – A, B, E, F, G (or ABEG + ABEF)	M1 A1 A1 A1 A1 M1 A1√ M1 A1√ B1 B1 **[11]**	Activity on arc Single start and end A, B, C, D (precedences) E (precedences) F and G (all correct) forward pass backward pass time (cao) critical activities (cao)
4	(iii)		e.g.  Needs to be clear what is done by whom. This doesn't necessarily require people being labelled ... but might.	B1 B1 **[2]**	not ft must be labelled or to scale (e.g. on the squares provided) Can be written out instead.
4	(iv)		8.0 hours or delay 0.5 hours A, C, D 8.5 hours or delay of 1 hour	B1 B1 B1 **[3]**	cao ISW if needed cao cao ISW if needed

Question			Answer	Marks	Guidance
5	(a)	(i)	$6 \rightarrow 3 \rightarrow 10 \rightarrow 5 \rightarrow 16 \rightarrow 8 \rightarrow 4 \rightarrow 2 \rightarrow 1 \rightarrow 4 \rightarrow 2 \rightarrow 1 \rightarrow$ ... (can stop at second "4")	M1 A1 **[2]**	$6 \rightarrow 3 \rightarrow 10$
5	(a)	(ii)	$256 \rightarrow 128 \rightarrow 64 \rightarrow 32 \rightarrow 16 \rightarrow 8 \rightarrow 4 \rightarrow 2 \rightarrow 1 \rightarrow 4 \rightarrow 2 \rightarrow 1 \rightarrow$ ... (as above, or can note repetition from "16")	M1 A1 **[2]**	$256 \rightarrow 128 \rightarrow 64$
5	(a)	(iii)	e.g. Step 25 If *n* is 1 then stop. (Any step number between 21 and 29, or indicated in some other way.)	B1 **[1]**	ISW, but "Step 35" is wrong.
5	(a)	(iv)	Need to know that all chosen numbers lead to 1.	B1 **[1]**	
5	(b)	(i)	Box 1: 2 1 6 A B C Box 2: 3 3 D E Box 3: 5 F 3 boxes	 B1 B1 **[2]**	
5	(b)	(ii)	1 2 3 3 5 6 B A D E F C B A E D F C Box 1: 1 2 3 3 B A D E Box 2: 5 F Box 3: 6 C	B1 B1 **[2]**	sorted increasing
5	(b)	(iii)	(6 5 3 3 2 1) (C F D E A B) (C F E D A B) Box 1: 6 3 1 C D B Box 2: 5 3 2 F E A	 M1 A1 **[2]**	placing a "3" or D or E into box 1

Question			Answer	Marks	Guidance
5	(b)	(iv)	e.g. (for fitting into boxes of size 10) 6 3 3 2 2 2 2 Reducing order/first fit: Box 1: 6 3 Box 2: 3 2 2 2 Box 3: 2 Optimal: Box 1: 6 2 2 Box 2: 3 3 2 2	M1 A1 **[2]**	valid example correctly doing it
5	(b)	(v)	$30\times(60/6)^2 = 3000$ secs ... 50 minutes	M1 A1 **[2]**	multiplying 30 by a squared value

Question			Answer	Marks	Guidance
6	(i)		Let x be the number of (10s of) litres of stew and y the number of (10s of) litres of soup that Ian makes. Carrots: $0.15x + 0.1y < 100$, i.e. $3x + 2y < 2000$ Beans: $0.1x + 0.075y < 70$, i.e, $4x + 3y < 2800$ Tomatoes: $0.15x + 0.15y < 110$, i.e. $3x + 3y < 2200$	B1 B1 B1 B1 B1 **[5]**	"number of", referring to soup & stew identification of soup and stew variables -1 each scaling or systematic error, e.g. equalities
6	(ii)		Intercepts are (666.7,0) and (0,1000) (700,0) and (0,933.3) (733.3,0) and (0,733.3)  broken axis scores 0 for 6(ii) Ignore "soup" and "stew" labelling on axes unless no variable labelling. -1 if variables swapped in error. -1 if systematic scaling error (following inequalities in 6(i). bod shading here	B1 B1 B1 B1 B1 **[5]**	axes consistently labelled and scaled line 1 line 2 line 3 all √ subject to negative gradients shading giving feasible quadrilateral bounded by axes ... or identified by vertices

Question			Answer	Marks	Guidance
6	(iii)		Line 2 irrelevant. Comparing at (0, 733.3), (533.3±10, 200±10) and (666.7, 0) (accuracy quoted is for graphical solutions). Max profit at intersection of lines 1 and 3 (533.33,200) with profit £3466.67 (accuracy from 3375 to 3560) (cf £3333.33 and £2933.33)	M1	comparing 3 vertices (not origin) or profit line with approximately correct gradient (–5/4)
			So make 533.33 litres of stew and 200 litres of soup,	A1	stew and soup (cao)
			giving a profit of £3466.67 (3375 – 3560).	A1 **[3]**	profit (cao)
6	(iv)		Best solution now at (0, 933.3) ... profit £3733.33 (£373.33)	M1	
			So best new solution uses 30 kg extra tomatoes (140 kg total)	A1	30kg (allow 140 new total) cao
			Extra profit is £(3733.33 – 3466.67 – 30*2.5) = £191.67	A1 **[3]**	(allow £3658.33 new total) cao

4771 Decision Mathematics 1

General Comments:

There are a few general points regarding candidate performances in the 2014 examination

- Candidates should ensure they write their answers in the allocated section of the answer book, where this is not possible a continuation sheet should be used.

- The quality of written communication is often very poor, and when that is combined with losing sight of the maths, it usually fails to gain credit. There are times when interpretation is required, so that some description of the circumstances is needed. Such writing needs to be concise and precise. There are other times when modelling is needed, when mathematics is to be extracted from the given scenario; see comments on Qu1 (ii) below, and on Qu3 (i).

Comments on Individual Questions:

Question No 1.

(i) Quite a lot of candidates omitted arcs.

(ii) Very few students thought about translating the problem into mathematics. Almost all will have heard about odd nodes, but they either failed to enter into the modelling, or harboured confusions, as indicated by quotes such as ... "*There's an even number of vertices*".
Some of the writing was very poor indeed, e.g. "*ts is looped turns to get out of that loop you must use that entrance again (ts to pa), As you go in and come back*"

(iii) Many candidates were unable to put into practice what is in the specification. Without essential structuring, using odd nodes, it will have been very difficult for them. With it, it was easy.

(iv) As above ... with the extra path, Joanna can either avoid repeating any path by starting/finishing at fs/ol, or she can start and finish at a vertex of her choice by repeating fs to ol. Candidates usually gave amended stories about parts of her walk, failing to make any reference as to how her implied objective would be affected.

Question No 2.

(i) Most candidates could do this.

(ii) Again, most could do this, although one or two ended up with 9 drinks as a consequence of having to reject a random number.

(iii) A small minority failed to understand the question, and failed to give two rules.

(iv) Candidates who did not have two rules in part (iii) could not gain any credit here.

(v) Candidates who had, say 5/10 coffees in part (ii) and 8/10 coffees in part (iv), mostly successfully manipulated this to 13/20 in part (v). Given these inputs, a few well-drilled candidates (drilled, that is, in the addition of fractions) produced a proportion (!) of 13/10. Others who knew something about probability (and how to multiply fractions) gave an answer of 0.4.

Question No 3.

(i) There were two marks for this, and two things to do to get them. Few candidates failed both to give a shorter indirect route, and to make an appropriate comment regarding the triangle inequality. Candidates were not expected to quote the triangle inequality, but the essential maths is that for straight connections AD £ AC + CD (or AD £ AF + FD). But then roads are not often straight! That observation would have been enough.

(ii) This was answered well by a substantial majority of candidates. The most common failing was the failure to number columns as they were included in the set of columns under consideration.

Question No 4.

(i) The CPA network was generally well constructed. The most common error was to have activities F and G share the same i node and same j node.

(ii) The forward and backward passes were also well done. The common error was to have a late time of 6 at C's j-node / D's i-node.

(iii) Some candidates failed to answer the question in this part. Schedules and cascade diagrams were seen, but without indication of who was doing what. In some cases that might have been due to candidates attempting to use colouring, or other shading, which could not be seen on scanned scripts.

(iv) The question could have been phrased as "*Give the new minimum completion time, critical activities and ...*", and it is probable that a better response would have followed. But there are no apologies for having asked "*How does this delay affect the minimum completion time, critical activities and ... ?*" There is a little bit of modelling implicit in that, and it certainly found some candidates wanting.

Question No 5.

(a)(i/ii) A surprisingly large number of candidates failed with this simple algorithm. Some terminated after two passes around the loop. It was very common to see 24 following 8 in (i), presumably because up to that point the two rules had been alternating. Others seemed not to be able to do the arithmetic.

(a)(iii) Very few succeeded in locating their stop instruction in an appropriate place, i.e. with a step number between 21 and 29.

(a)(iv) Many candidates took an almost moral stance to this question ... they required an algorithm to have a purpose! Others were concerned about a stopping condition, even though they had just provided one in part (iii), and had that clarified in the question. Few correct answers were seen.

(b)(i) Most succeeded in answering the question, which included a requirement to state how many boxes had been used.

(b)(ii/iii)Most candidates continued to score well on these two packing questions, but some forfeited all marks by getting their “increasing” and “decreasing” confused. It’s not always the case that questions can have a good storyline, but most do, including this question. Candidates sensitive to that might have spotted such an error.

(b)(iv)Most candidates found this challenging. It is to their credit that they realised what was needed, but many generated large random sets of weights, and hoped. Few thought it through to minimalist sets such as 3, 3, 3, 3, 2, 2, 2, 2.

(b)(v) Fewer correct solutions were seen than might have been hoped for. Of course, there were those who scaled up in proportion, but there were several who modelled quartic complexity instead of quadratic, and many others who confused items and times in trying to compute scale factors.

Question No 6.

(i) Many candidates failed to get to grips with the underlying variables, confusing stew and soup with carrots, beans and tomatoes. To add to their confusion there were both litres and tens of litres to handle.
Through it all shone those who had the clarity of thought to identify and define their variables clearly and unambiguously. As in every report, it is repeated here that the identification should start with “Let ... be the number of ...”

(ii) Many candidates who struggled through part (i) managed to score well in part (ii). Quite a lot failed to label and scale their axes. A few produced broken scales, and scored zero.

(iii) The usual optimisation requirement had a sting in the tail for those who had chosen their variables to represent tens of litres of the products ... they had to do some interpreting ... not 20 litres of soup, but 200.

(iv) A challenging last part question. A few candidates succeeded with it.

For a description of how UMS marks are calculated see:
www.ocr.org.uk/learners/ums_results.html

Unit level raw mark and UMS grade boundaries June 2014 series

AS GCE / Advanced GCE / AS GCE Double Award / Advanced GCE Double Award

GCE Mathematics (MEI)

			Max Mark	a	b	c	d	e	u
4751/01	(C1) MEI Introduction to Advanced Mathematics	Raw	72	61	56	51	46	42	0
		UMS	100	80	70	60	50	40	0
4752/01	(C2) MEI Concepts for Advanced Mathematics	Raw	72	57	51	45	39	33	0
		UMS	100	80	70	60	50	40	0
4753/01	(C3) MEI Methods for Advanced Mathematics with Coursework: Written Paper	Raw	72	58	52	47	42	36	0
4753/02	(C3) MEI Methods for Advanced Mathematics with Coursework: Coursework	Raw	18	15	13	11	9	8	0
4753/82	(C3) MEI Methods for Advanced Mathematics with Coursework: Carried Forward Coursework Mark	Raw	18	15	13	11	9	8	0
4753	(C3) MEI Methods for Advanced Mathematics with Coursework	UMS	100	80	70	60	50	40	0
4754/01	(C4) MEI Applications of Advanced Mathematics	Raw	90	68	61	54	47	41	0
		UMS	100	80	70	60	50	40	0
4755/01	(FP1) MEI Further Concepts for Advanced Mathematics	Raw	72	63	57	51	45	40	0
		UMS	100	80	70	60	50	40	0
4756/01	(FP2) MEI Further Methods for Advanced Mathematics	Raw	72	60	54	48	42	36	0
		UMS	100	80	70	60	50	40	0
4757/01	(FP3) MEI Further Applications of Advanced Mathematics	Raw	72	57	51	45	39	34	0
		UMS	100	80	70	60	50	40	0
4758/01	(DE) MEI Differential Equations with Coursework: Written Paper	Raw	72	63	56	50	44	37	0
4758/02	(DE) MEI Differential Equations with Coursework: Coursework	Raw	18	15	13	11	9	8	0
4758/82	(DE) MEI Differential Equations with Coursework: Carried Forward Coursework Mark	Raw	18	15	13	11	9	8	0
4758	(DE) MEI Differential Equations with Coursework	UMS	100	80	70	60	50	40	0
4761/01	(M1) MEI Mechanics 1	Raw	72	57	49	41	34	27	0
		UMS	100	80	70	60	50	40	0
4762/01	(M2) MEI Mechanics 2	Raw	72	57	49	41	34	27	0
		UMS	100	80	70	60	50	40	0
4763/01	(M3) MEI Mechanics 3	Raw	72	55	48	42	36	30	0
		UMS	100	80	70	60	50	40	0
4764/01	(M4) MEI Mechanics 4	Raw	72	48	41	34	28	22	0
		UMS	100	80	70	60	50	40	0
4766/01	(S1) MEI Statistics 1	Raw	72	61	53	46	39	32	0
		UMS	100	80	70	60	50	40	0
4767/01	(S2) MEI Statistics 2	Raw	72	60	53	46	40	34	0
		UMS	100	80	70	60	50	40	0
4768/01	(S3) MEI Statistics 3	Raw	72	61	54	47	41	35	0
		UMS	100	80	70	60	50	40	0
4769/01	(S4) MEI Statistics 4	Raw	72	56	49	42	35	28	0
		UMS	100	80	70	60	50	40	0
4771/01	(D1) MEI Decision Mathematics 1	Raw	72	51	46	41	36	31	0
		UMS	100	80	70	60	50	40	0
4772/01	(D2) MEI Decision Mathematics 2	Raw	72	46	41	36	31	26	0
		UMS	100	80	70	60	50	40	0
4773/01	(DC) MEI Decision Mathematics Computation	Raw	72	46	40	34	29	24	0
		UMS	100	80	70	60	50	40	0
4776/01	(NM) MEI Numerical Methods with Coursework: Written Paper	Raw	72	54	48	43	38	32	0
4776/02	(NM) MEI Numerical Methods with Coursework: Coursework	Raw	18	14	12	10	8	7	0
4776/82	(NM) MEI Numerical Methods with Coursework: Carried Forward Coursework Mark	Raw	18	14	12	10	8	7	0
4776	(NM) MEI Numerical Methods with Coursework	UMS	100	80	70	60	50	40	0
4777/01	(NC) MEI Numerical Computation	Raw	72	55	47	39	32	25	0
		UMS	100	80	70	60	50	40	0
4798/01	(FPT) Further Pure Mathematics with Technology	Raw	72	57	49	41	33	26	0
		UMS	100	80	70	60	50	40	0

GCE Statistics (MEI)

			Max Mark	a	b	c	d	e	u
G241/01	(Z1) Statistics 1	Raw	72	61	53	46	39	32	0
		UMS	100	80	70	60	50	40	0
G242/01	(Z2) Statistics 2	Raw	72	55	48	41	34	27	0
		UMS	100	80	70	60	50	40	0
G243/01	(Z3) Statistics 3	Raw	72	56	48	41	34	27	0
		UMS	100	80	70	60	50	40	0