OCR
RECOGNISING ACHIEVEMENT

Friday 25 January 2013 – Afternoon

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 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 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.

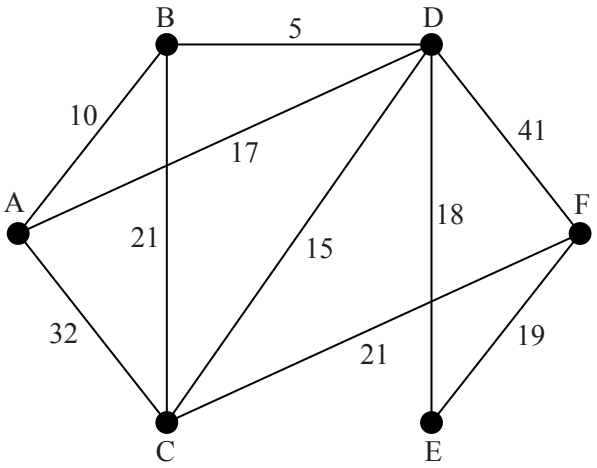
INSTRUCTIONS TO EXAMS OFFICER / INVIGILATOR

- 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.

This paper has been pre modified for carrier language

Section A (24 marks)

1 The weights on the arcs in the network represent times in minutes to travel between vertices.



(i) Use Dijkstra's algorithm to find the fastest route from A to F. Give the route and the time. **[5]**

(ii) Use an algorithm to find the minimum connector for the network, showing your working. Find the minimum time to travel from A to F using only arcs in the minimum connector. **[3]**

2 A small party is held in a country house. There are 10 men and 10 women, and there are 10 dances. For each dance a number of pairings, each of one man and one woman, are formed. The same pairing can appear in more than one dance. A graph is to be drawn showing who danced with whom during the evening, ignoring repetitions.

(i) Name the type of graph which is appropriate. **[1]**

(ii) What is the maximum possible number of arcs in the graph? **[2]**

Dashing Mr Darcy dances with every woman except Elizabeth, who will have nothing to do with him. She dances with eight different men.

Prince Charming only dances with Cinderella. Cinderella only dances with Prince Charming and with Mr Darcy.

The three ugly sisters only have one dance each.

(iii) Add arcs to the graph in your answer book to show this information. **[3]**

(iv) What is the maximum possible number of arcs in the graph? **[2]**

3 The following algorithm computes an estimate of the square root of a number which is between 0 and 2.

Step 1	Subtract 1 from the number and call the result x
Step 2	Set $oldr = 1$
Step 3	Set $i = 1$
Step 4	Set $j = 0.5$
Step 5	Set $k = 0.5$
Step 6	Set $change = x^i \times k$
Step 7	Set $newr = oldr + change$
Step 8	If $-0.005 < change < 0.005$ then go to Step 17
Step 9	Set $oldr = newr$
Step 10	Set $i = i + 1$
Step 11	Set $j = j - 1$
Step 12	Set $k = k \times j \div i$
Step 13	Set $change = x^i \times k$
Step 14	Set $newr = oldr + change$
Step 15	If $-0.005 < change < 0.005$ then go to Step 17
Step 16	Go to Step 9
Step 17	Print out *newr*

(i) Use the algorithm to find an estimate of the square root of 1.44, showing all of the steps. **[6]**

(ii) Consider what happens if the algorithm is applied to 0.56, and then use your four values of *change* from part **(i)** to calculate an estimate of the square root of 0.56. **[2]**

Section B (48 marks)

4 A room has two windows which have the same height but different widths. Each window is to have one curtain. The table lists the tasks involved in making the two curtains, their durations, and their immediate predecessors. The durations assume that only one person is working on the activity.

Task		Duration (minutes)	Immediate predecessor(s)
A	measure windows	5	–
B	calculate material required	5	A
C	choose material	15	–
D	buy material	15	B, C
E	cut material	5	D
F	stitch sides of wide curtain	30	E
G	stitch top of wide curtain	30	F
H	stitch sides of narrow curtain	30	E
I	stitch top of narrow curtain	15	H
J	hang curtains and pin hems	20	G, I
K	hem wide curtain	30	J
L	hem narrow curtain	15	J
M	fit curtains	10	K, L

(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]**

Kate and Pete have two rooms to curtain, each identical to that above. Tasks A, B, C and D only need to be completed once each. All other tasks will have two versions, one for room 1 and one for room 2, eg E1 and E2. Kate and Pete share the tasks between them so that each task is completed by only one person.

(iii) Complete the diagram to show how the tasks can be shared between them, and scheduled, so that the project can be completed in the least possible time. Give that least possible time. **[3]**

(iv) How much extra help would be needed to curtain both rooms in the minimum completion time from part **(ii)**? Explain your answer. **[2]**

5 A chairlift for a ski slope has 160 4-person chairs. At any one time half of the chairs are going up and half are coming down empty. An observer watches the loading of the chairs during a moderately busy period, and concludes that the number of occupants per 'up' chair has the following probability distribution.

number of occupants	0	1	2	3	4
probability	0.1	0.2	0.3	0.2	0.2

(i) Give a rule for using 1-digit random numbers to simulate the number of occupants of an up chair in a moderately busy period. **[2]**

(ii) Use the 10 random digits provided to simulate the number of occupants in 10 up chairs. **[2]**

The observer estimates that, at all times, on average 20% of chairlift users are children.

(iii) Give an efficient rule for using 1-digit random numbers to simulate whether an occupant of an up chair is a child or an adult. **[1]**

(iv) Use the random digits provided to simulate how many of the occupants of the 10 up chairs are children, and how many are adults. **There are more random digits than you will need**. **[2]**

(v) Use your results from part **(iv)** to estimate how many children and how many adults are on the chairlift (ie on the 80 up chairs) at any instant during a moderately busy period. **[1]**

In a very busy period the number of occupants of an up chair has the following probability distribution.

number of occupants	0	1	2	3	4
probability	$\frac{1}{13}$	$\frac{1}{13}$	$\frac{3}{13}$	$\frac{3}{13}$	$\frac{5}{13}$

(vi) Give an efficient rule for using 2-digit random numbers to simulate the number of occupants of an up chair in a very busy period. **[3]**

(vii) Use the 2-digit random numbers provided to simulate the number of occupants in 5 up chairs. There are more random numbers provided than you will need. **[2]**

(viii) Simulate how many of the occupants of the 5 up chairs are children and how many are adults, and thus estimate how many children and how many adults are on the chairlift at any instant during a very busy period. **[2]**

(ix) Discuss the relative merits of simulating using a sample of 10 chairs as against simulating using a sample of 5 chairs. **[1]**

[Question 6 is printed overleaf.]

6 Jean knits items for charity. Each month the charity provides her with 75 balls of wool.

She knits hats and scarves. Hats require 1.5 balls of wool each and scarves require 3 balls each. Jean has 100 hours available each month for knitting. Hats require 4 hours each to make, and scarves require 2.5 hours each.

The charity sells the hats for £7 each and the scarves for £10 each, and wants to gain as much income as possible.

Jean prefers to knit hats but the charity wants no more than 20 per month. She refuses to knit more than 20 scarves each month.

(i) Define appropriate variables, construct inequality constraints, and draw a graph representing the feasible region for this decision problem. **[10]**

(ii) Give the objective function and find the integer solution which will give Jean's maximum monthly income. **[4]**

(iii) If the charity drops the price of hats in a sale to £4 each, what would be an optimal number of hats and scarves for Jean to knit? Assuming that all hats and scarves are sold, by how much would the monthly income drop? **[2]**

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RECOGNISING ACHIEVEMENT

Friday 25 January 2013 – Afternoon

AS GCE MATHEMATICS (MEI)

4771/01 Decision Mathematics 1

PRINTED ANSWER BOOK

Candidates answer on this Printed Answer Book.

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- MEI Examination Formulae and Tables (MF2)

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Duration: 1 hour 30 minutes

Candidate forename		Candidate surname	

Centre number						Candidate number				

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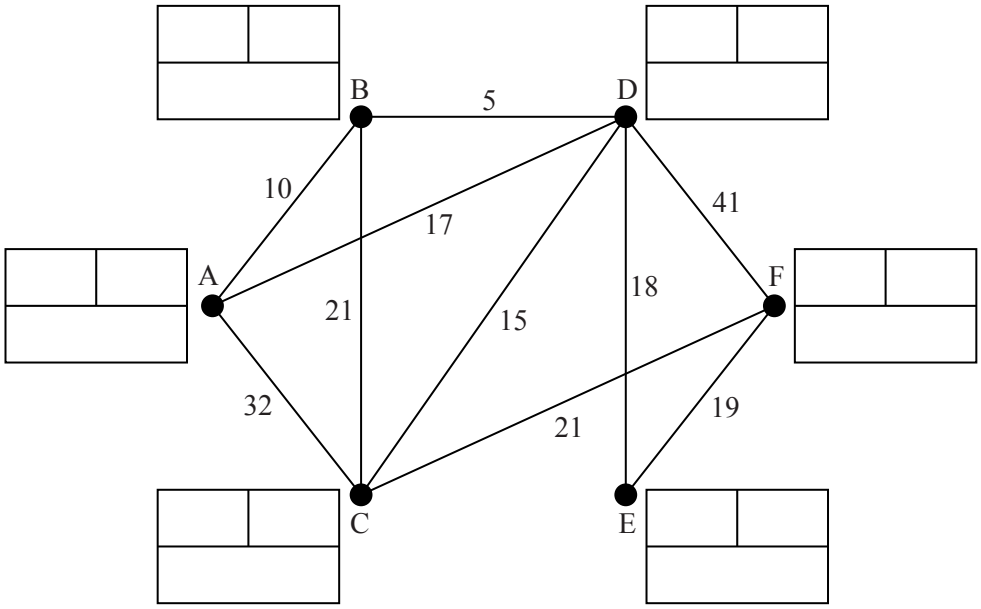
DC (CW/SW) 51934/3

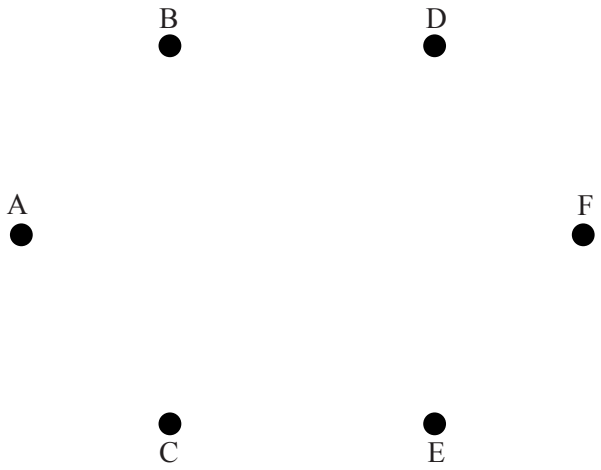
Turn over

Section A (24 marks)

1 (i)



1 (ii)



2 (i)

2 (ii)

2 (iii)

Men	Women
A ●	● V
B ●	● W
Charming ●	● Cinderella
Darcy ●	● Ugly sister 1
E ●	● Ugly sister 2
F ●	● Ugly sister 3
G ●	● Elizabeth
H ●	● X
I ●	● Y
J ●	● Z

A spare copy of this diagram can be found on page 5.

2 (iv)

3 (i)	

3 (ii)	
2 (iii)	**Spare copy of diagram for question 2 (iii)** Men ● ● Women A ● ● V B ● ● W Charming ● ● Cinderella Darcy ● ● Ugly sister 1 E ● ● Ugly sister 2 F ● ● Ugly sister 3 G ● ● Elizabeth H ● ● X I ● ● Y J ● ● Z

Section B (48 marks)

4 (i) & (ii)	

4 (iii) Each cell represents 5 minutes

Kate																			
Pete																			

cont.																			
cont.																			

cont.																			
cont.																			

Time to complete =

4 (iv)

PLEASE DO NOT WRITE IN THIS SPACE.

5 (i)

5 (ii)

chair number	1	2	3	4	5	6	7	8	9	10
random digits	5	3	0	2	4	7	9	1	1	8
number of occupants										

5 (iii)

5 (iv)

random digit

child (C) or adult (A)

	chair 1		chair 2		chair 3		chair 4		chair 5		chair 6		chair 7		chair 8		chair 9		chair 10	
occ1	6		0		9		6		2		9		1		5		6		2	
occ2	2		6		5		2		1		1		4		8		1		9	
occ3	3		7		2		1		3		6		6		5		3		5	
occ4	3		1		1		2		8		0		6		0		5		1	

number of children on 10 chairs =

number of adults on 10 chairs =

5 (v)

5 (vi)

5 (vii) Random numbers: 23 65 07 99 37 45 47 86 71 17

chair number	1	2	3	4	5
number of occupants					

5 (viii)

	chair 1		chair 2		chair 3		chair 4		chair 5	
occ1	1		9		6		8		1	
occ2	2		2		8		0		8	
occ3	6		3		2		2		1	
occ4	4		6		1		9		4	

number of children on 5 chairs =

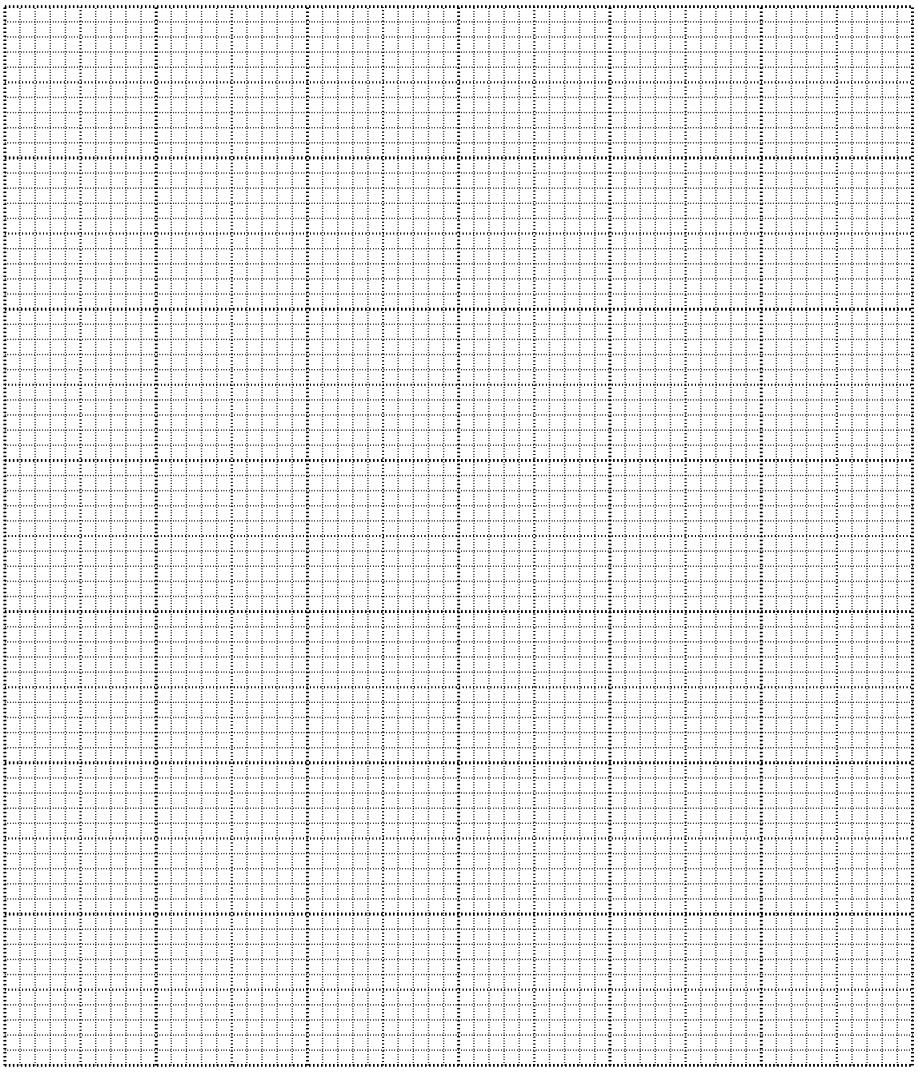
number of adults on 5 chairs =

total number of children on the chairlift =

total number of adults on the chairlift =

5 (ix)

6 (i)

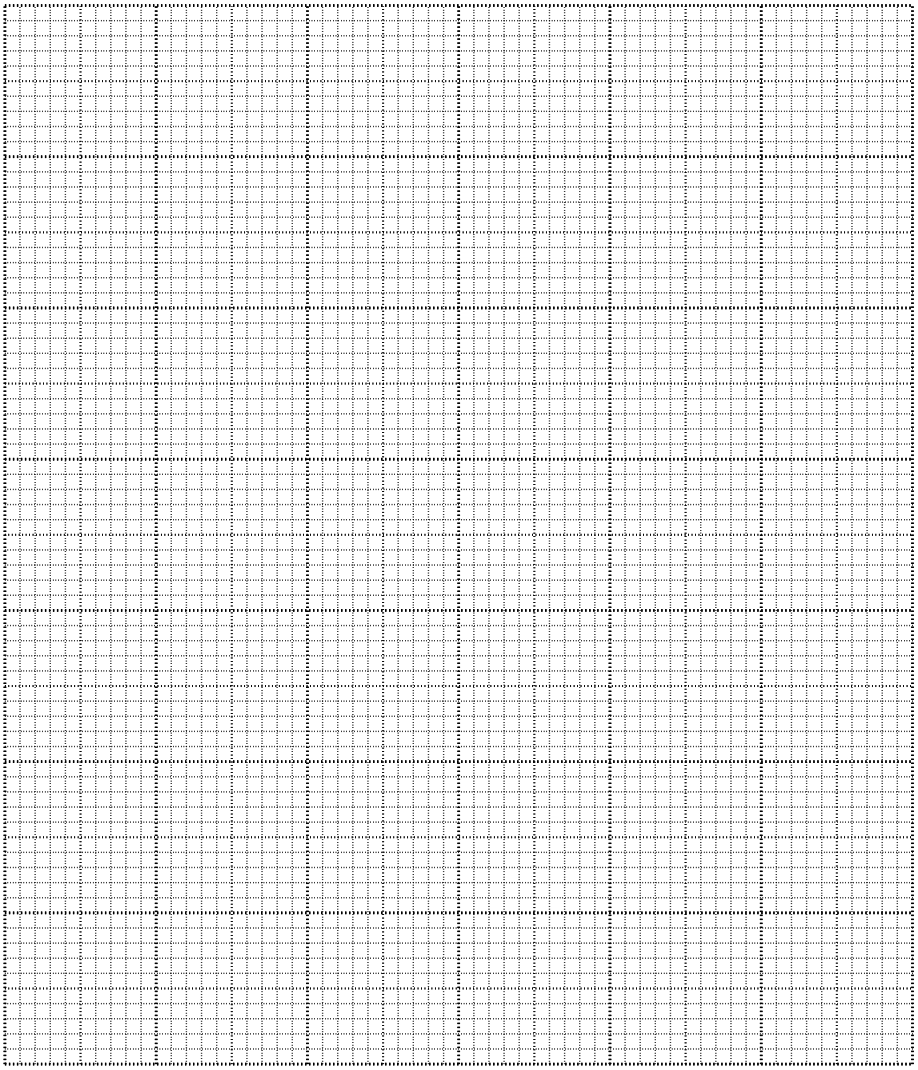


A spare copy of this graph paper can be found on page 12.

6 (ii)

6 (iii)

Spare copy of graph paper for 6(i)



OCR
RECOGNISING ACHIEVEMENT

GCE

Mathematics (MEI)

Advanced Subsidiary GCE

Unit **4771:** Decision Mathematics 1

Mark Scheme for January 2013

Oxford Cambridge and RSA Examinations

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, Cambridge Nationals, Cambridge Technicals, 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.

Annotations and abbreviations

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 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

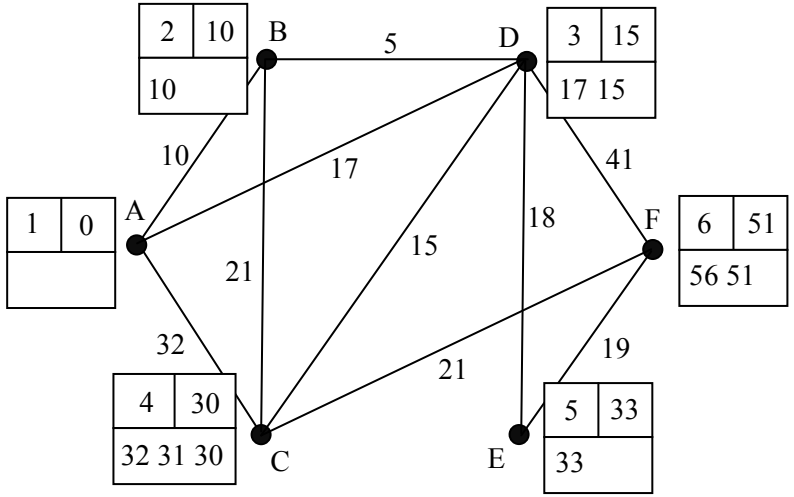
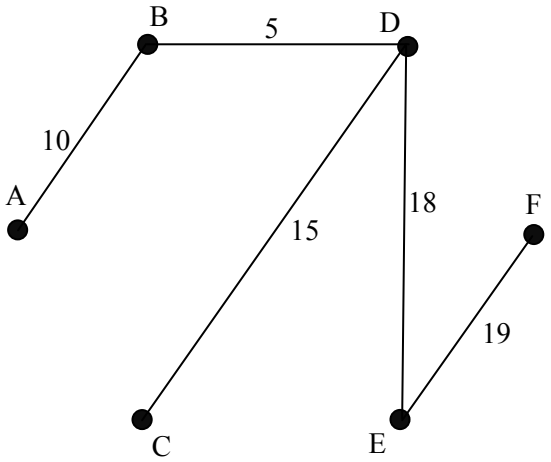
If a candidate attempts a question more than once, and indicates which attempt he/she wishes to be marked, then examiners should do as the candidate requests.

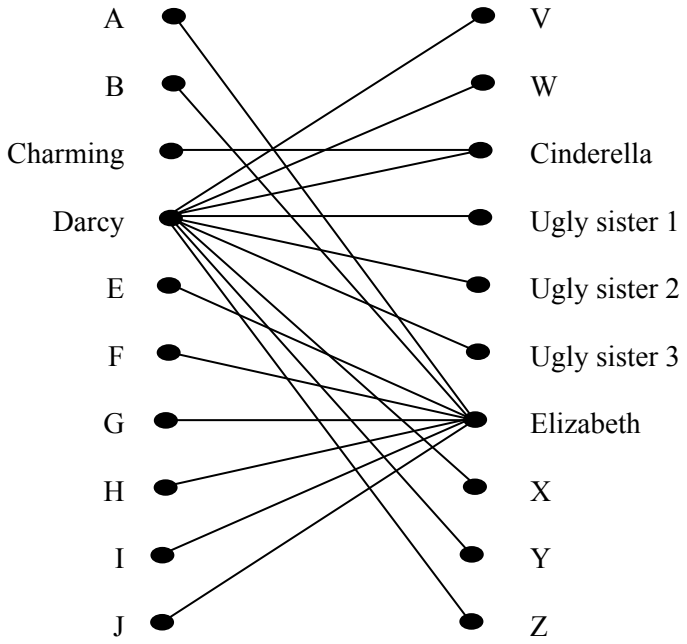
If there are two or more attempts at a question which have not been crossed out, examiners should mark what appears to be the last (complete) attempt and ignore the others.

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

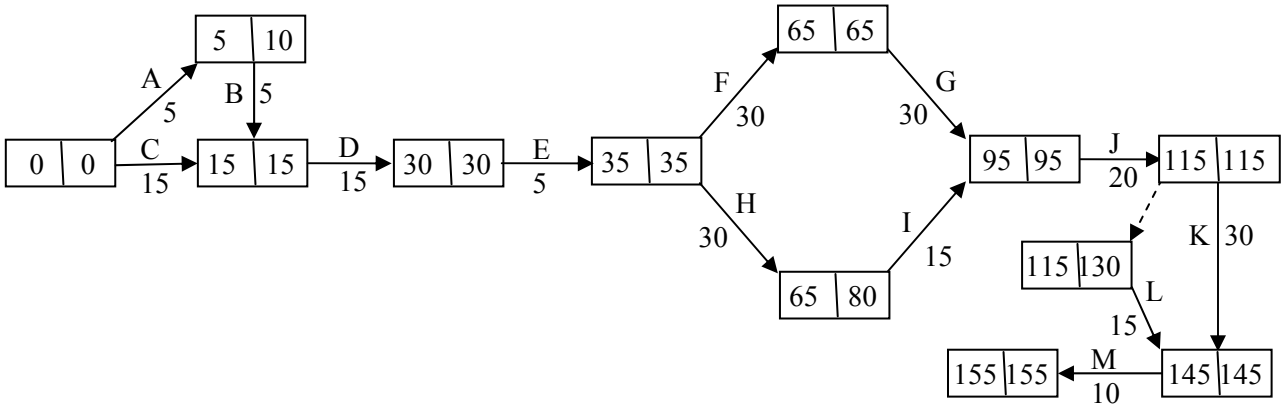
h For a *genuine* misreading (of numbers or symbols) which is such that the object and the difficulty of the question remain unaltered, mark according to the scheme but following through from the candidate's data. A penalty is then applied; 1 mark is generally appropriate, though this may differ for 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)		 Route ... ABDCF Time ... 51 minutes	M1 A1 B1 B1 B1 **[5]**	Dijkstra (if working values correct at D) working values order of labelling labels route and time
	(ii)		 Time ... 52 minutes	B1 B1 B1 **[3]**	methodology indicated correct min connector cao

Question			Answer	Marks	Guidance
2	(i)		bipartite	B1 **[1]**	cao
	(ii)		100	M1 A1 **[2]**	allow for 200 cao
	(iii)			B1 B1 B1 **[3]**	Darcy correct Elizabeth correct Panto characters correct
	(iv)		58	M1 A1 **[2]**	$18 + (8 \times 5)$ allow for 98 cao

Question			Answer		Marks	Guidance
3	(i)		Step 1	$x = 0.44$	B1	cao
			Step 2	$oldr = 1$		
			Step 345	$i = 1, j = 0.5, k = 0.5$		
			Step 6	$change = 0.22$		
			Step 7	$newr = 1.22$	B1	set-up (i.e. as far as 1.22)
			Step 9	$oldr = 1.22$		
			Steps 10 11 12	$i = 2, j = –0.5, k = –0.125$	B1	3 steps correct
			Step 13	$change = –0.0242$		
			Step 14	$newr = 1.1958$	B1	new estimate (1.1958)
			Step 15	$\|change\| = 0.0242$		
			Step 9	$oldr = 1.1958$		
			Steps 10 11 12	$i = 3, j = –1.5, k = 0.0625$		
			Step 13	$change = 0.005324$		
			Step 14	$newr = 1.201124$		
			Step 15	$\|change\| = 0.005324$		
			Step 9	$oldr = 1.201124$	B1	iteration (to 1.201124)
			Steps 10 11 12	$i = 4, j = –2.5, k = –0.03906$		
			Step 13	$change = –0.0014641$		
			Step 14	$newr = 1.1996599$		
			Step 15	$\|change\| = 0.0014641$		
			Step 17	1.1996599	B1	iteration and end
					[6]	
	(ii)		$1 – 0.22 – 0.0242 – 0.005324 – 0.0014641 = 0.7490119$		M1	use of –0.44
					A1	as shown
						SC1 (cao) for algorithm repeated or answer only
					[2]	

Question			Answer	Marks	Guidance
4	(i) & (ii)		 Minimum completion time = 155 minutes Critical activities are C, D, E, F, G, J, K and M	M1 A1 A1 A1 A1 **[5]** M1 A1 M1 A1 B1 B1 **[6]**	activity on arc single start and end A, B, C OK J, K, L OK rest OK forward pass (must have at least one join correct backward pass (must have at least one burst correct) cao cao
4	(iii)		eg Kate: C C C D D D E1 F1 F1 F1 F1 F1 F1 H1 H1 H1 H1 H1 H1 Pete: A B E2 F2 F2 F2 F2 F2 F2 H2 H2 H2 H2 H2 H2 cont.: G1 G1 G1 G1 G1 G1 I1 I1 I1 J1 J1 J1 J1 K1 K1 K1 K1 K1 K1 cont: G2 G2 G2 G2 G2 G2 I2 I2 I2 J2 J2 J2 J2 K2 K2 K2 K2 K2 K2 cont: L1 L1 L1 M1 M1 cont: L2 L2 L2 M2 M2 215 minutes (3 hours and 35 minutes)	 B1 B1 B1 **[3]**	 ABCD rest ... watch for M's after K's and L's cao
4	(iv)		Two more people would be needed, so that the H's and I's could be done at the same time as the F's and G's, and so that the two L's could be done at the same time as the two K's	B1 B1 **[2]**	cao reasoning

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>5</td><td>(i)</td><td></td><td>e.g. 0 → 0

1, 2 → 1
3, 4, 5 → 2
6, 7 → 3
8, 9 → 4</td><td>M1

A1

[2]</td><td>either 0.2 for 1 or 0.3 for 2
all proportions correct</td></tr>
<tr><td>5</td><td>(ii)</td><td></td><td>random number 5 3 0 2 4 7 9 1 1 8
number of occupants 2 2 0 1 2 3 4 1 1 4</td><td>M1
A1
[2]</td><td>8 outcomes correct
all correct</td></tr>
<tr><td>5</td><td>(iii)</td><td></td><td>e.g. 0, 1 → child
2 – 9 → adult</td><td>B1

[1]</td><td>must use all 10 digits
cao</td></tr>
<tr><td>5</td><td>(iv)</td><td></td><td>random number
child (C) or adult (A)
<table><tr><td>chair</td><td colspan="2">1</td><td colspan="2">2</td><td colspan="2">3</td><td colspan="2">4</td><td colspan="2">5</td><td colspan="2">6</td><td colspan="2">7</td><td colspan="2">8</td><td colspan="2">9</td><td colspan="2">10</td></tr><tr><td>occ1</td><td>6</td><td>A</td><td>0</td><td>C</td><td>9</td><td></td><td>6</td><td>A</td><td>2</td><td>A</td><td>9</td><td>A</td><td>1</td><td>C</td><td>5</td><td>A</td><td>6</td><td>A</td><td>2</td><td>A</td></tr><tr><td>occ2</td><td>2</td><td>A</td><td>6</td><td>A</td><td>5</td><td></td><td>2</td><td></td><td>1</td><td>C</td><td>1</td><td>C</td><td>4</td><td>A</td><td>8</td><td></td><td>1</td><td></td><td>9</td><td>A</td></tr><tr><td>occ3</td><td>3</td><td></td><td>7</td><td></td><td>2</td><td></td><td>1</td><td></td><td>3</td><td></td><td>6</td><td>A</td><td>6</td><td>A</td><td>5</td><td></td><td>3</td><td></td><td>5</td><td>A</td></tr><tr><td>occ4</td><td>3</td><td></td><td>1</td><td></td><td>1</td><td></td><td>2</td><td></td><td>8</td><td></td><td>0</td><td></td><td>6</td><td>A</td><td>0</td><td></td><td>5</td><td></td><td>1</td><td>C</td></tr></table>
number of children = 5
number of adults = 15</td><td>M1

A1

[2]</td><td>8 chairs OK

all OK</td></tr>
<tr><td>5</td><td>(v)</td><td></td><td>40 children and 120 adults</td><td>B1
[1]</td><td>FT... × by 8</td></tr>
<tr><td>5</td><td>(vi)</td><td></td><td>e.g. 00 – 06 → 0
07 – 13 → 1
14 – 34 → 2
35 – 55 → 3
56 – 90 → 4
91 – 99 ignore and “redraw”</td><td>M1
A1
A1

[3]</td><td>ignore some
proportions correct
efficient</td></tr>
</table>

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>5</td><td>(vii)</td><td></td><td>random number 23 65 07 99 37 45
number of occupants 2 4 1 – 3 3</td><td>M1
A1
[2]</td><td>3 OK
all correct FT</td></tr>
<tr><td>5</td><td>(viii)</td><td></td><td>
<table>
<tr><td>chair</td><td colspan="2">1</td><td colspan="2">2</td><td colspan="2">3</td><td colspan="2">4</td><td colspan="2">5</td></tr>
<tr><td>occ1</td><td>1</td><td>C</td><td>9</td><td>A</td><td>6</td><td>A</td><td>8</td><td>A</td><td>1</td><td>C</td></tr>
<tr><td>occ2</td><td>2</td><td>A</td><td>2</td><td>A</td><td>8</td><td></td><td>0</td><td>C</td><td>8</td><td>A</td></tr>
<tr><td>occ3</td><td>6</td><td></td><td>3</td><td>A</td><td>2</td><td></td><td>2</td><td>A</td><td>1</td><td>C</td></tr>
<tr><td>occ4</td><td>4</td><td></td><td>6</td><td>A</td><td>1</td><td></td><td>9</td><td></td><td>4</td><td></td></tr>
</table>
number of children = 4
number of adults = 9

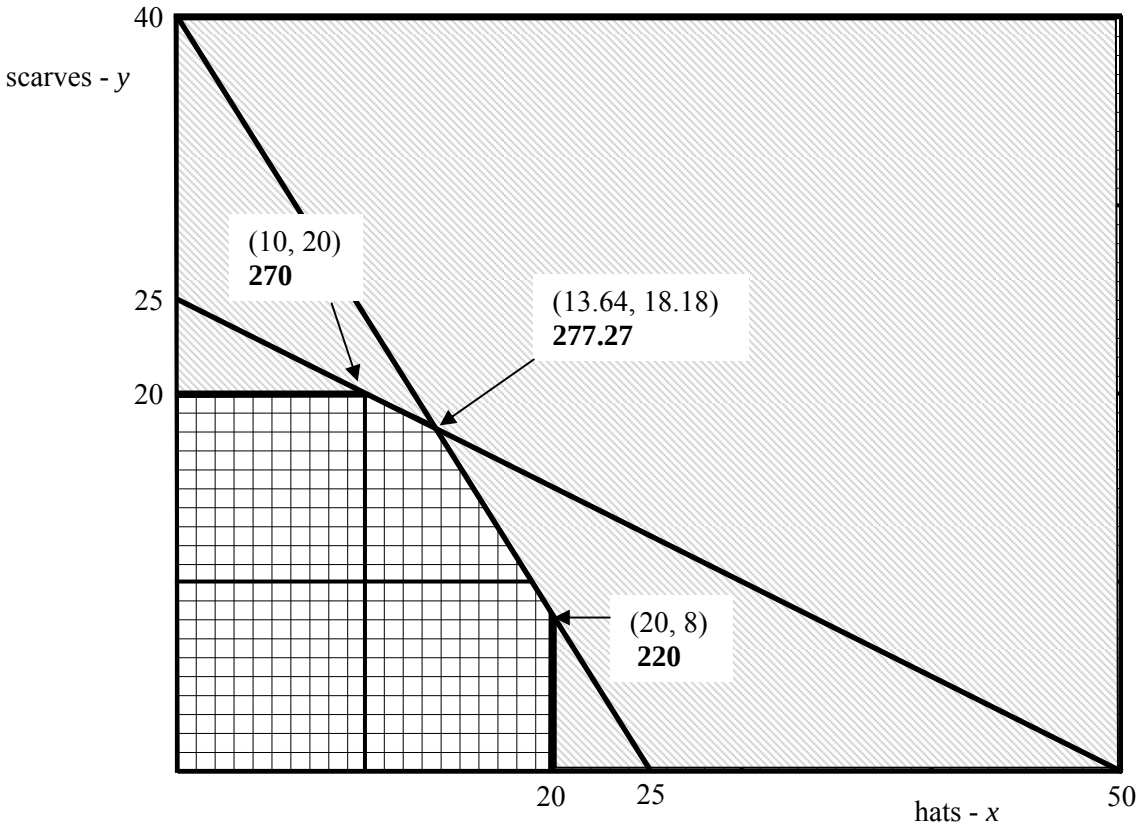
64 children and 144 adults</td><td>

B1

B1
[2]</td><td>

FT ... all correct

FT ... × by 16</td></tr>
<tr><td>5</td><td>(ix)</td><td></td><td>greater reliability or more representative</td><td>B1
[1]</td><td></td></tr>
</table>

Question			Answer	Marks	Guidance
6	(i)		e.g. Let x be the number of hats which Jean knits Let y be the number of scarves which Jean knits $1.5x + 3y \leq 75$, i.e. $x + 2y \leq 50$ $4x + 2.5y \leq 100$, i.e. $8x + 5y \leq 200$ $x \leq 20$ and $y \leq 20$	B1 B1 B1 B1 B1	must say "number of" or vice-versa of course simplification not required both
			 	B1 B1 B1 B1 B1	lines (cao) shading ... follow any set of two horizontal, two vertical and two negatively inclined lines which give a hexagon in the bottom left corner.
				[10]	

Question			Answer	Marks	Guidance
6	(ii)		Objective = $7x + 10y$ Best non-integer point Solution ... (12, 19) **274**, (13, 18) **271** or (14, 17) **268** So 12 hats and 19 scarves	B1 M1 A1 B1 **[4]**	objective considering profits at their three points as indicated cao cao
6	(iii)		10 hats and 20 scarves £34	B1 B1 **[2]**	cao FT ... *their answer* – 240

OCR (Oxford Cambridge and RSA Examinations)
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Cambridge
CB1 2EU

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4771 Decision Maths 1

General Comments

Most candidates were able to make good progress on this paper. Few were able to succeed with all of it. Candidates did well with most of the algorithmic aspects.

Comments on Individual Questions

1 Most candidates did well with the straightforward application of Dijkstra in part (i).
Part (ii) was less well done. Candidates were asked to show their working, and many did not do so.
Many candidates gave the total length of their minimum connector as their answer to the question's final demand. From the structure of the question, candidates might have been expecting an answer which was slightly longer than their 51 from part (i), but most candidates did not make the connection between parts (i) and (ii).

2 There were many interesting variations seen in part (i) on the word "bipartite".
Most candidates were able to draw the graph accurately.
Unsurprisingly many more were correct with the first computation than were correct with the second.

3 Working through the given algorithm required precision. Most candidates made progress, but did not make it to the end.
Part (ii) of the question was challenging. Many could see that x needed to be –0.44, but very few could follow it through to a correct estimate.

4 Parts (i) and (ii) if the CPA question were very well done.
Not very many candidates were successful with the scheduling in part (iii).
Very few collected both marks from part (iv). It was relatively easy to see that 2 extra helpers were needed, but a full explanation had to point out that they were needed to help not only with F, G, H and I, but also with K and L.

5 The simulation question had a carefully detailed structure which helped candidates to make progress, but which may have led to some losing sight of the overall scenario. Thus they were often good at specifying simulation rules, but many did not apply the rules well. For instance, in parts (iv) and (viii) many applied their "child/adult" rule to all of the tabulated cells, instead of only to cells representing their simulated occupants of chairs.
The question was attempting to address the loading of the chairlift, and to do so all 80 "up" chairs need to be simulated. The scaling up from 10 chairs in part (v) and from 5 chairs in part (viii) were necessary compromises given the requirements of an examination question, but it revealed a very surprising weakness. Most candidates were simply unable to scale up their results from 10 chairs to 80, or from 5 chairs to 80.
The final part of the question, part (ix), required candidates to realise that to simulate 10 chairs was a better compromise that to simulate 5. It was expected that many would make a routine reference to "accuracy", when in fact nothing was being estimated, and some duly did so. But it was gratifying to note that many gave more relevant answers, using terminology such as "representative" or "reliable".

6 The LP question was generally done reasonably well.

The summer 2012 report on 4771 contained the following quotation: "Far too many candidates, if they remembered to define their variables, neglected that essential phrase "the number of ...". The issue remains live! Again, in this examination, far too many candidates failed explicitly to define their variables. The phrase "*x* is hats", and variants of it, scored zero.

The insistence on the phrase "number of ..." secures the definition of units in the case of continuous variables, eg "Let *x* be the number of litres of ...", and points to the need for integer values in other cases. In this question most candidates failed adequately to deal with that integer requirement in part (ii). The majority of candidates were happy to round the LP solution to (13, 18). Few looked at nearby lattice points, and only a handful found the optimal integer point, (12, 19).