OCR
Oxford Cambridge and RSA

GCE

Mathematics (MEI)

Unit **4771**: Decision Mathematics 1

Advanced Subsidiary GCE

Mark Scheme for June 2018

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.

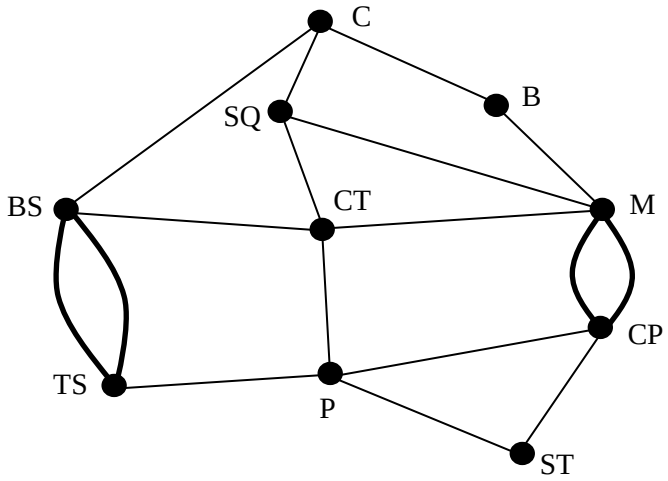
This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

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.

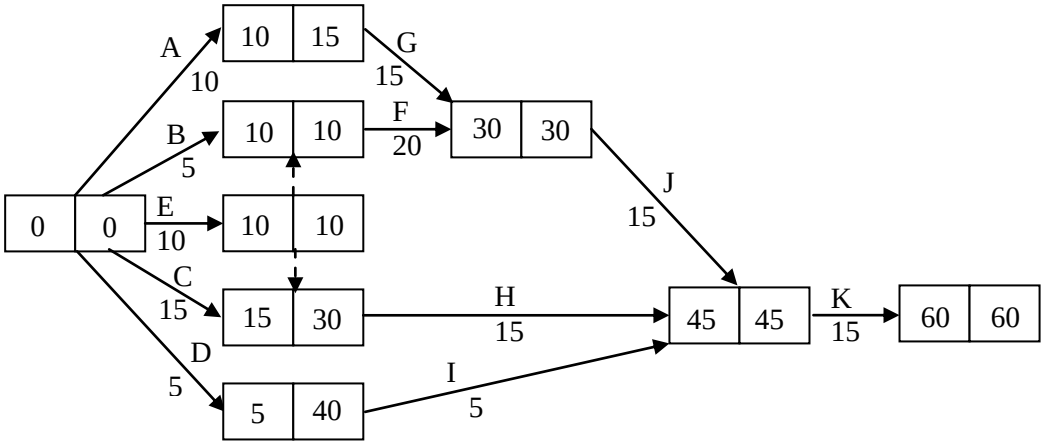
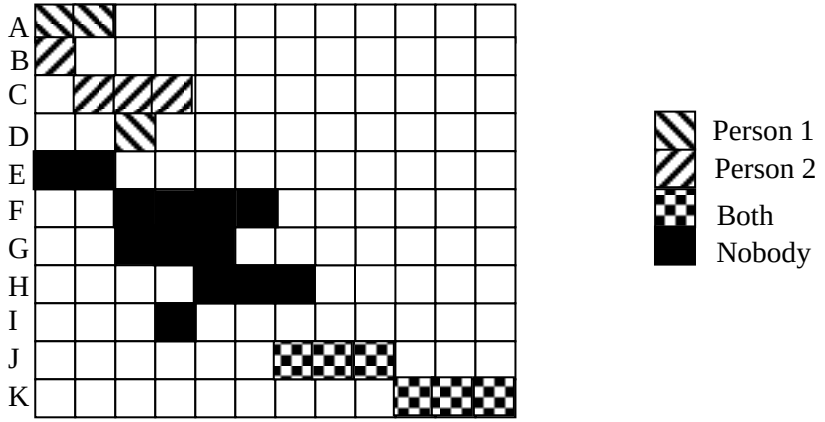
Annotations and abbreviations

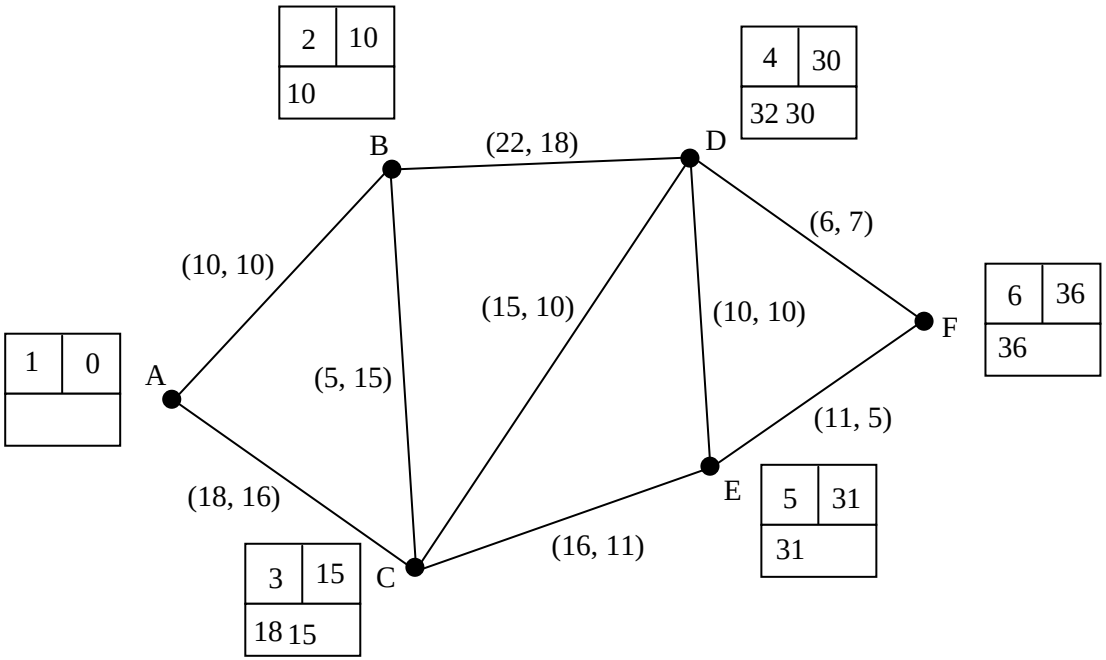
Annotation in scoris	**Meaning**
✓and ✖	
BOD	Benefit of doubt
FT	Follow through
ISW	Ignore subsequent working
M0, M1	Method mark awarded 0, 1
A0, A1	Accuracy mark awarded 0, 1
B0, B1	Independent mark awarded 0, 1
SC	Special case
^	Omission sign
MR	Misread
Highlighting	
Other abbreviations in mark scheme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

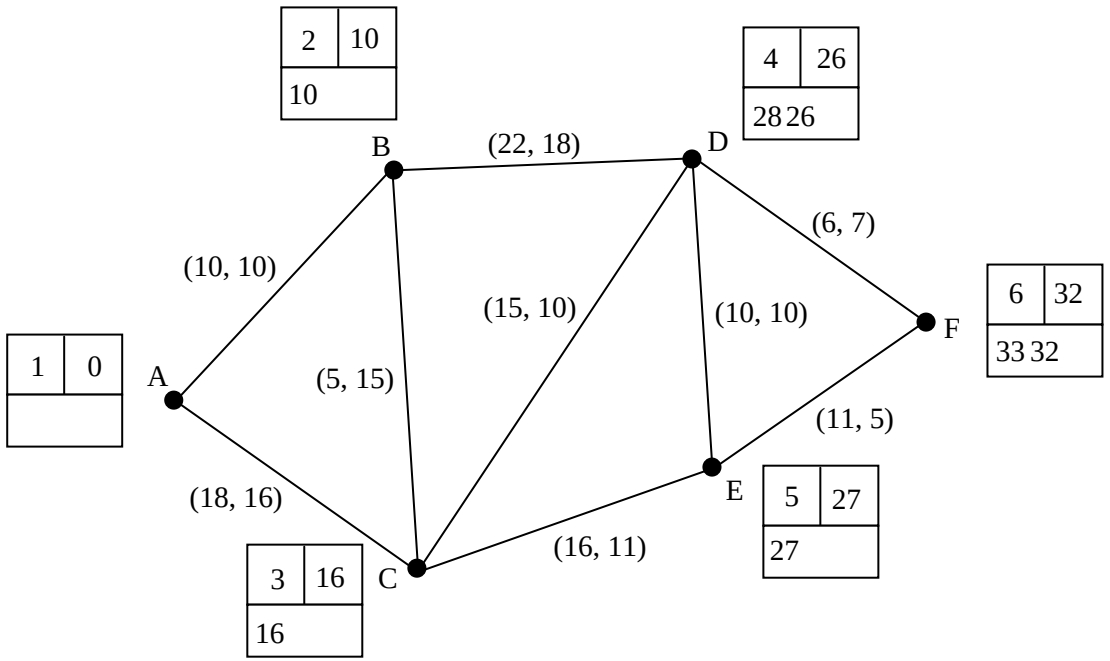
Question			Answer	Marks	Guidance
1	(i)			B1 B1	10 vertices correct 17 arcs correct
	(ii)		4 odd vertices, C, SQ, M, and TS, so neither Eulerian nor semi-Eulerian,	M1 A1	… odd vertices or neither Eulerian nor semiEulerian noting 4 or identifying 4.
	(iii)		Two adjacent odd nodes	B1	
	(iv)		Starting and finishing at odd nodes other than those in (iii).	B1	
	(v)		eg TS BS TS P ST CP P CT BS C SQ M SQ CT M CP M B C eg TS BS TS P ST CP M CP P CT BS C SQ CT M SQ C B M	M1 A1	18 arcs repeating only as per (iii) starting and finishing as per (iv)

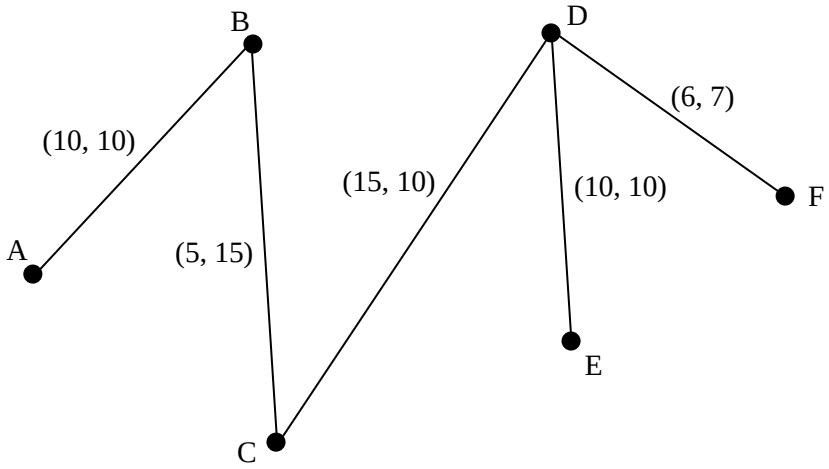
Question			Answer	Marks	Guidance
2	(a)	(i)	crate 1 2 3 items A, B, D C, E F 3 crates are needed.	M1 A1 B1	A, B, C, D correct (condone numbers) rest (letters needed) 3 crates
		(ii)	crate 1 2 or 1 2 or 1 2 items A, B, E C, D, F B, C A, D, E, F B, F A, D, E, C	B1	condone numbers
	(b)	(i)	(i) (C78 G26 H35 S12) G26 H35 S12 C78 (3 comparisons and 3 swaps) G26 S12 H35 C78 (2 comparisons and 1 swap) S12 G26 H35 C78 (1 comparison and 1 swap)	M1 A1	first pass correct all passes correct
		(ii)	(ii) 6 comparisons and 5 swaps	B1 B1	

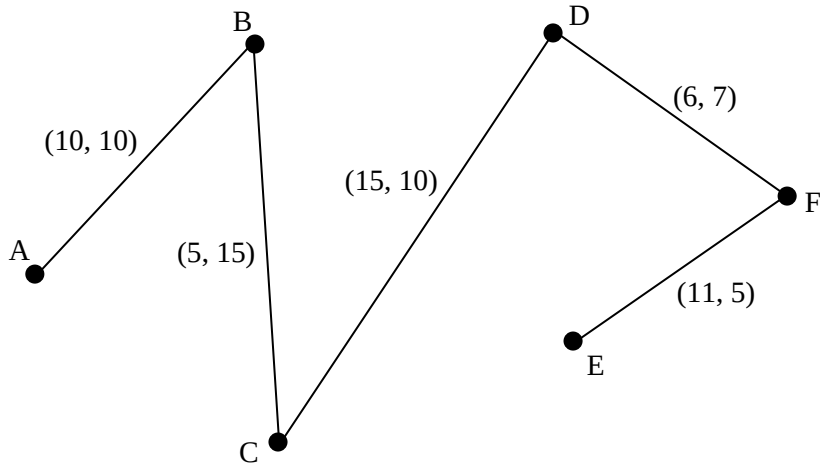
Question			Answer	Marks	Guidance
3	(a)	(i)	eg 0 → reject 1 → 1 2 → 2 3 → 3 4 → 4 5 → 5 6 → 6 7 → reject 8 → reject 9 → reject	B1	Must be complete and explicit … for all 6 numbers.
		(ii)	eg 12 1 10 4 5 11 2 8 2 4	M1 M1 A1	applying sim rule rejects ignored all correct
		(iii)	eg 5.9 (theoretical answer is 6 … Geometric$_1$ distribution)	B1 √	mark lost if answer rounded
	(b)	(i)	eg 00-15 → 1 16-31 → 2 32-47 → 3 48-63 → 4 64-79 → 5 80-95 → 6 96-99 → reject	B1	Must be explicit, complete and maximally efficient
		(ii)	4% rejection versus 40% rejection	B1	fewer rejections expected
		(iii)	More difficult for humans to apply.	B1	

Question			Answer	Marks	Guidance
4	(i) & (ii)		 Minimum completion time = 60 mins Critical activities are E, F, J and K.	M1 A1 A1 A1 A1 M1 A1 M1 A1 B1 B1	activity on arc A, B, C, D, E F and H G, I, J K forward pass backward pass
	(iii)		eg (earliest times) 	B1 B1 B1 B1	4 types indicated and used timing of E, F, J and K A, B, C and D correct G, H, I correct
	(iv)		Explanation in terms of nature of critical activities, which cannot be shortened.	B1	

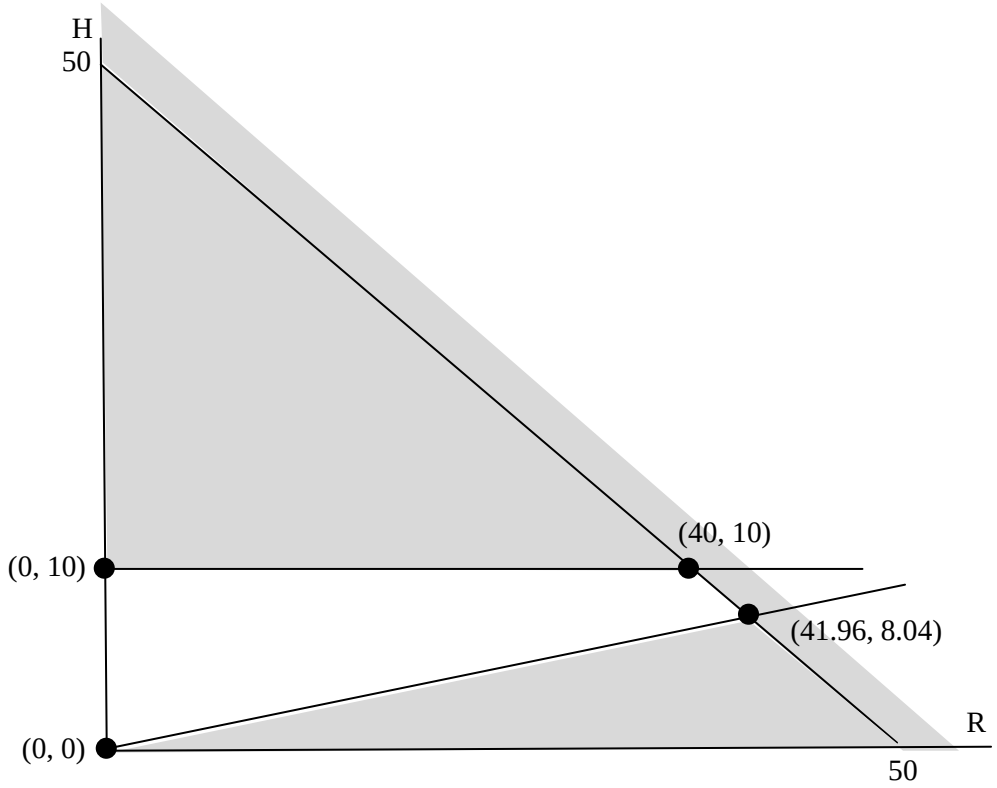
Question	Answer	Marks	Guidance
5 (i)	 Cheapest route – A B C D F Cheapest cost – 36	M1 A1 B1 B1	correct at C all correct

Question	Answer	Marks	Guidance
(ii)	 Shortest route – A C E F Shortest distance – 32	M1 A1 B1 B1	correct at D all correct
(iii)	Europa – 36/42 = 6/7 ≈ 0.857 Milo – 45/32 ≈ 1.406	M1 A1cao	Two costs/distances
(iv)	Cost per unit distance is not additive.	B1	

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td></td><td>(v)</td><td></td><td>
<table>
<tr><th>vertex</th><th>cost</th><th>from</th></tr>
<tr><td>A</td><td></td><td></td></tr>
<tr><td>B</td><td>10</td><td>A</td></tr>
<tr><td>C</td><td>5</td><td>B</td></tr>
<tr><td>D</td><td>15</td><td>C</td></tr>
<tr><td>F</td><td>6</td><td>D</td></tr>
<tr><td>E</td><td>10</td><td>D</td></tr>
</table>


</td><td>M1
A1</td><td>must be clear use of Prim
cao</td></tr>
<tr><td></td><td>(vi)</td><td></td><td>
<table>
<tr><th>arc</th><th>length</th></tr>
<tr><td>EF</td><td>5</td></tr>
<tr><td>DF</td><td>7</td></tr>
<tr><td>CD</td><td>10</td></tr>
<tr><td>AB</td><td>10</td></tr>
<tr><td>BC</td><td>15</td></tr>
</table>


</td><td>M1
A1</td><td>must be clear use of Kruskal
cao</td></tr>
<tr><td></td><td>(vii)</td><td></td><td>Indication of use of arcs from minimum connector(s).</td><td>B1</td><td></td></tr>
</table>

Question			Answer	Marks	Guidance
6	(i)		Let H be the number of acres sold (for housing).	M1	identification of variables
			Let R be the number of acres developed (for recreational use).	A1	definition
			$H + R \leq 50$	A1	
			$H \leq 10$	A1	
			$0.015(200000H - 5000R) \geq 500R$ (ie $H \geq (575/3000)R$ … approximately $H \geq 0.192R$)	B1	LHS
				B1	RHS
6	(ii)			B1	axes labelled and scaled
				B1	H = 10 cao
				B1	H + R = 50 cao
				B1	3000H = 575R cao
				B1	Correct shading for first two inequalities cao

Question			Answer	Marks	Guidance
6	(iii)		R = 0 and H = 0 R = 0 and H = 10 Sell to max amount and develop the rest. (R=40 and H=10) Develop to max with selling the rest. (R = 42 and H = 8 (approx))	 B1 B1 B1√	 for both points
6	(iv)		Intersection of 3000H = 575R and H = 10 (gives R ≈ 52.17) So sell 10 and develop 52 (approx) leaving 3 untouched.	M1 A1cao	 52

OCR (Oxford Cambridge and RSA Examinations)
The Triangle Building
Shaftesbury Road
Cambridge
CB2 8EA

OCR Customer Contact Centre

Education and Learning
Telephone: 01223 553998
Facsimile: 01223 552627
Email: general.qualifications@ocr.org.uk

www.ocr.org.uk

For staff training purposes and as part of our quality assurance programme your call may be recorded or monitored

Oxford Cambridge and RSA Examinations
is a Company Limited by Guarantee
Registered in England
Registered Office; The Triangle Building, Shaftesbury Road, Cambridge, CB2 8EA
Registered Company Number: 3484466
OCR is an exempt Charity

OCR (Oxford Cambridge and RSA Examinations)
Head office
Telephone: 01223 552552
Facsimile: 01223 552553