OCR
Oxford Cambridge and RSA

GCE

Mathematics (MEI)

Unit **4771**: Decision Mathematics 1

Advanced Subsidiary GCE

Mark Scheme for June 2014

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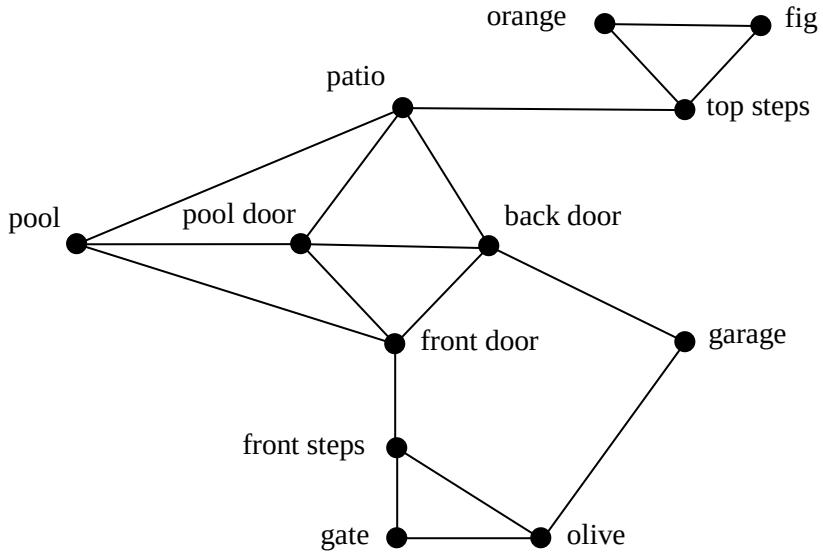
This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

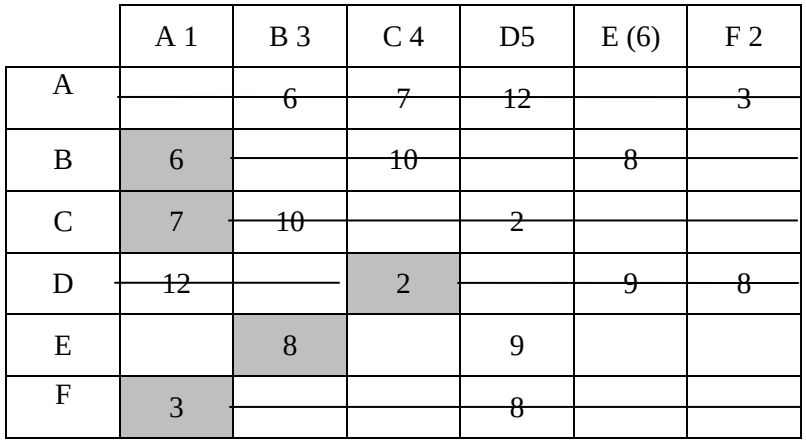
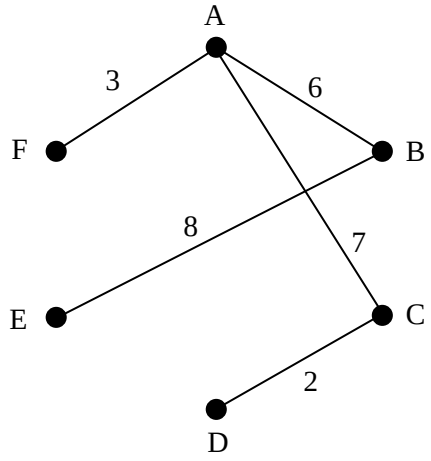
All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

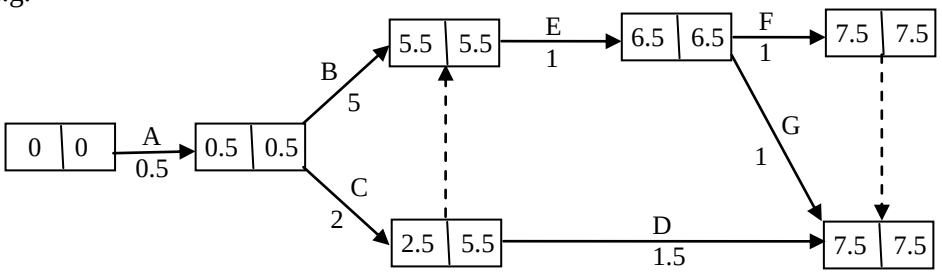
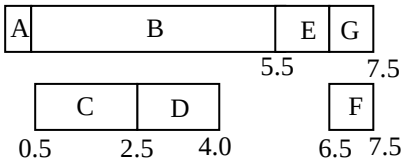
Mark schemes should be read in conjunction with the published question papers and the report on the examination.

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

Question			Answer	Marks	Guidance
1	(i)			M1 A1	12 vertices connectivity (all 18 arcs and no extras)
	(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	
	(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	 must be stated
	(iv)		Possible answer: No repetition of any arc needed Start/stop are front steps/olive Alternative answer: By repeating fs/ol or ol/fs ... can start and stop at same point, e.g. front door.	 M1 A1 (M1) (A1)	

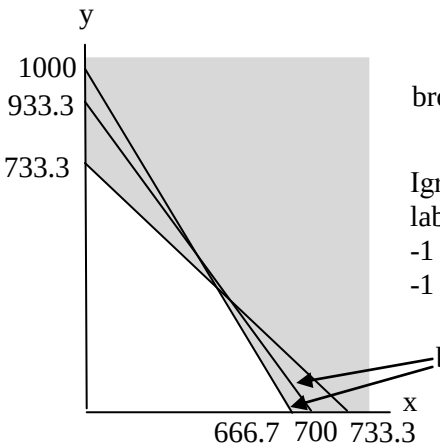
Question			Answer	Marks	Guidance
2	(i)		e.g. 0,1,2 → coffee 3,4,5,6,7,8 → tea (9 → reject and redraw)	M1 A1	reject proportions + efficient, ie using 9 digits (so allow 00, 01, ..., 09)
	(ii)		Ten simulated coffees or teas, corresponding to **their** rule and the given random digits. e.g. T C C T C T T C T C e.g. C T T T T C T T C T	B1	
	(iii)		e.g. Coffee at breakfast 00-54 → coffee 55-99 → tea Tea at breakfast 00-14 → tea 15-99 → coffee	B1 B1	Breakfast drink must be specified. Breakfast drink must be specified.
	(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	first 4, ref part (ii) ft errors in (ii)
	(v)		Accumulating and computing the proportion. e.g. C - 65%	B1	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	needs numerical justification
3	(ii)		 or transpose  26 (miles)	M1 M1 M1 A1 B1 B1	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	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	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	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	$6 \rightarrow 3 \rightarrow 10$
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	$256 \rightarrow 128 \rightarrow 64$
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	ISW, but "Step 35" is wrong.
5	(a)	(iv)	Need to know that all chosen numbers lead to 1.	B1	
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	
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	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	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	 valid example correctly doing it
5	(b)	(v)	$30\times(60/6)^2 = 3000$ secs ... 50 minutes	M1 A1	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.	B1 B1	"number of", referring to soup & stew identification of soup and stew variables
			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	-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	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, giving a profit of £3466.67 (3375 – 3560).	A1 A1	stew and soup (cao) 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	(allow £3658.33 new total) cao

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