

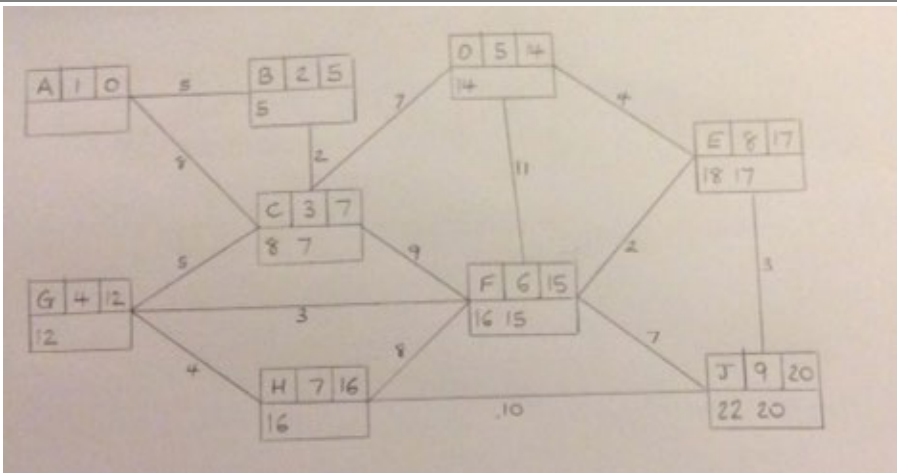
AS Further Mathematics 8FM0

Specimen Paper – Decision Mathematics 1 Mark Scheme

Question	Scheme	Marks	AOs																														
1(a)	<p>(i)</p> <table border="1"> <thead> <tr> <th>n</th> <th>A</th> <th>B</th> <th>C</th> <th>Is $B > 0$?</th> </tr> </thead> <tbody> <tr> <td>6</td> <td>1</td> <td>4</td> <td>4</td> <td>–</td> </tr> <tr> <td></td> <td>2</td> <td>3</td> <td>11</td> <td>Yes</td> </tr> <tr> <td></td> <td>3</td> <td>2</td> <td>19</td> <td>Yes</td> </tr> <tr> <td></td> <td>4</td> <td>1</td> <td>26</td> <td>Yes</td> </tr> <tr> <td></td> <td>5</td> <td>0</td> <td>30</td> <td>No</td> </tr> </tbody> </table>	n	A	B	C	Is $B > 0$?	6	1	4	4	–		2	3	11	Yes		3	2	19	Yes		4	1	26	Yes		5	0	30	No	M1	1.1b
	n	A	B	C	Is $B > 0$?																												
6	1	4	4	–																													
	2	3	11	Yes																													
	3	2	19	Yes																													
	4	1	26	Yes																													
	5	0	30	No																													
	<p>(ii) Final output = 30</p>	A1	1.1b																														
		(4)																															
(b)	$\frac{1}{6}(6)^3 + 6k + 1 = 30$	M1	3.1a																														
	$k = -\frac{7}{6}$	A1ft	2.2a																														
		(2)																															
(c)	Prim's algorithm is of cubic order/has cubic complexity	B1	2.2b																														
		(1)																															
(7 marks)																																	
Notes:																																	
<p>(a)(i) M1: At least three rows of cells in columns A, B and C completed with a correct first row for A, B and C only A1: Cao – second and third rows correct A1: Cao – fourth and fifth rows correct</p> <p>(ii) A1: Cao (output = 30)</p> <p>(b) M1: Using $f(n)$ with $n = 6$ and their final output A1ft: Cao following through their final output</p> <p>(c) B1: Cao</p>																																	

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Question	Scheme	Marks	AOs
2(a)			
(i)		M1 A1 A1	1.1b 1.1b 1.1b
(ii)	<p>Shortest path from A to J is ABCGFEJ</p> <p>Length of shortest path is 20</p>	A1 A1ft	1.1b 1.1b
		(5)	
(b)	<p>$G(FE)D + EJ = 9 + 3 = 12$ $G(F)E + D(E)J = 5 + 7 = 12$ $G(FE)J + DE = 8 + 4 = 12$ Repeat arcs: DE, EF, FG, EJ</p>	M1 A1 A1 A1	3.1b 1.1b 1.1b 2.2a
		(4)	
(c)	<p>Length of route = $88 + 6 + 12 = 106$</p>	B1ft	1.1b
		(1)	
(10 marks)			
Notes:			
<p>(a)(i) M1: For a larger number replaced by a smaller one in the working values boxes at C, E, F or J A1: For all values correct (and in correct order) at A, B, C, G and D A1: For all values correct (and in correct order) at F, H, E and J A1: Cao of ABCGFEJ</p> <p>(ii) A1ft: Follow through their final value at J</p> <p>(b) M1: Three pairings of the correct four odd nodes A1: Two pairings correct including correct totals A1: All three pairings correct including correct totals A1: Correct arcs to repeat (DE, EF, FG, EJ)</p> <p>(c)</p>			

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B1ft: Cao following through their smallest repeat (from a choice of at least two totals)

Question	Scheme	Marks	AOs
3(a)		M1 A1 M1 A1 (4)	1.1b 1.1b 1.1b 1.1b
(b)	Critical activities: C, D, G, H and K	B1	2.2a
		(1)	
(c)	Total float for activities A: $(7 + x) - 3$ E: $(11 + x) - 8 - 5$ $(4 + x) + (x - 2) = 21 + x$ $x = 19$ Minimum completion time = $21 + x = 40$ days	B1ft M1 A1 A1 (4)	1.1b 2.1 1.1b 2.2a

(9 marks)

Notes:

(a)

M1: top values generally increasing from left to right (dealing with x correctly at least twice)

A1: top values correct

M1: bottom values generally decreasing from right to left (dealing with x correctly at least twice)

A1: bottom values correct

(b)

B1: Cao

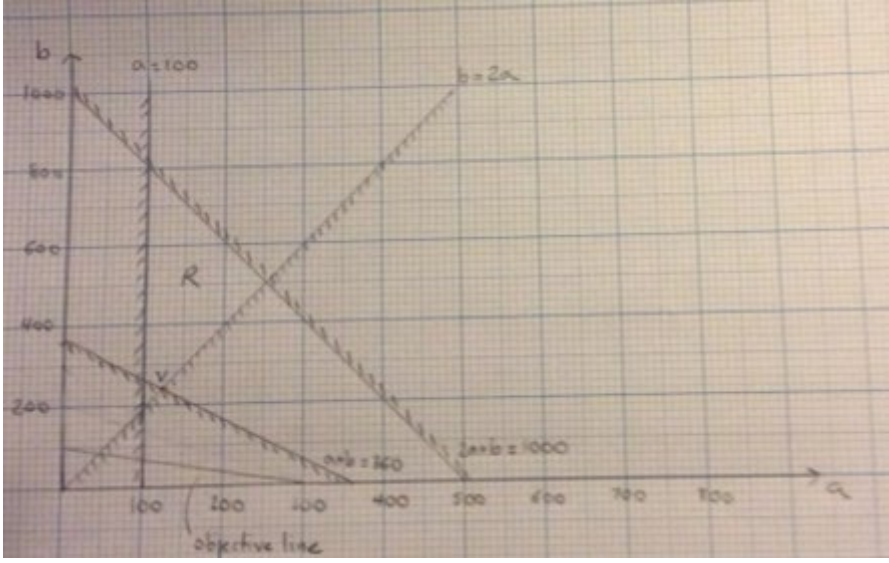
(c)

B1ft: One correct total float following through their values

M1: Constructing a correct equation using their total floats and minimum completion time (all three terms must include x)

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<p>A1: Cao (for x) A1: Cao (minimum completion time)</p>			
Question	Scheme	Marks	AOs
4(a)	Let x be the number of lemon cakes the baker makes and let y be the number of cherry cakes the baker makes	B1	2.5
	Minimise $P = x + 3y$	B1	1.2
	Subject to		
	$x + y \geq 360$	B1	3.3
	$2x + y \leq 1000$	B1	3.3
$y \geq 2x$	B1	3.3	
$x \geq 100$	B1	3.3	
$(y \geq 0)$			
		(6)	
(b)	 <p>(Note to typesetters: change x-axis label to 'number of lemon cakes' and y-axis to 'number of cherry cakes')</p>	B1	1.1b
		B1	1.1b
		B1	1.1b
		B1	2.2a
		Objective line drawn or at least two vertices tested	M1
Solving correct simultaneous equations for their optimal vertex	M1	1.1a	
The baker should make 120 lemon cakes and 240 cherry cakes	A1	3.2a	
		(7)	
(c)	$200 - \frac{2}{5}(120) - \frac{1}{5}(240) = \text{£}104$	B1ft	3.4
		(1)	

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(14 marks)

Notes:

(a)

B1: Defining variables

B1: Cao (for objective) - must contain 'minimise'

B1: Any one correct (accept any equivalent form for each constraint)

B1: Any two correct

B1: Any three correct

B1: All four correct

(b)

B1: Any two correct lines

B1: Any three correct lines

B1: All four correct lines

B1: Deduce correct feasible region distinctly labelled

M1: Selecting an appropriate mathematical process to solve the problem – either drawing an objective line with the correct gradient (or reciprocal gradient), or testing at least two vertices in R

M1: Solving simultaneous equations for their optimal vertex

A1: Cao (in context – so not in terms of e.g. x and y)

(c)

B1ft: Using correct constraint with their optimal vertex