

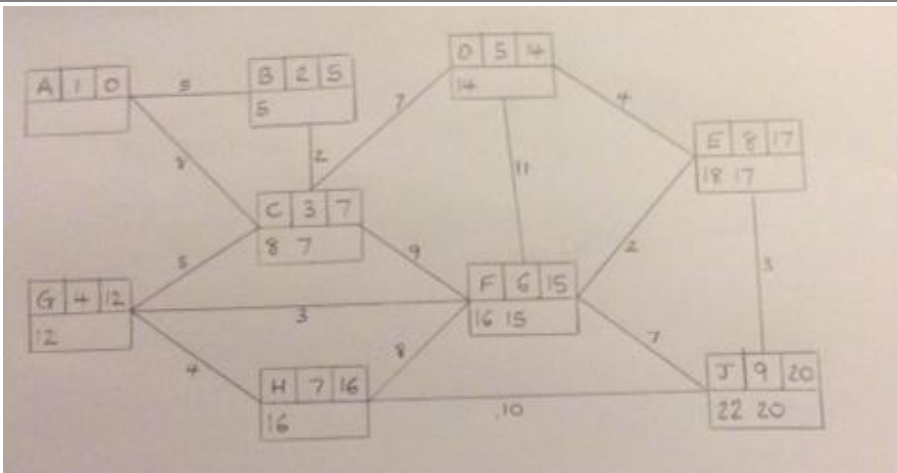
# AS Further Mathematics 8FM0

## Specimen Paper – Decision Mathematics 1 Mark Scheme

Question	Scheme	Marks	AOs																														
1(a)	(i) <table border="1" style="margin-left: 40px;"> <thead> <tr> <th><math>n</math></th> <th>A</th> <th>B</th> <th>C</th> <th>Is B &gt; 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																													
	(ii) Final output = 30	A1	1.1b																														
		<b>(4)</b>																															
(b)	$\frac{1}{6}(6)^3 + 6k + 1 = 30$ $k = -\frac{7}{6}$	M1	3.1a																														
		A1ft	2.2a																														
		<b>(2)</b>																															
(c)	Prim's algorithm is of cubic order/has cubic complexity	B1	2.2b																														
		<b>(1)</b>																															
			<b>(7 marks)</b>																														
<b>Notes:</b>																																	
<p><b>(a)(i)</b>  <b>M1:</b> At least three rows of cells in columns A, B and C completed with a correct first row for A, B and C only  <b>A1:</b> Cao – second and third rows correct  <b>A1:</b> Cao – fourth and fifth rows correct</p> <p><b>(ii)</b>  <b>A1:</b> Cao (output = 30)</p> <p><b>(b)</b>  <b>M1:</b> Using <math>f(n)</math> with <math>n = 6</math> and their final output  <b>A1ft:</b> Cao following through their final output</p> <p><b>(c)</b>  <b>B1:</b> Cao</p>																																	

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

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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

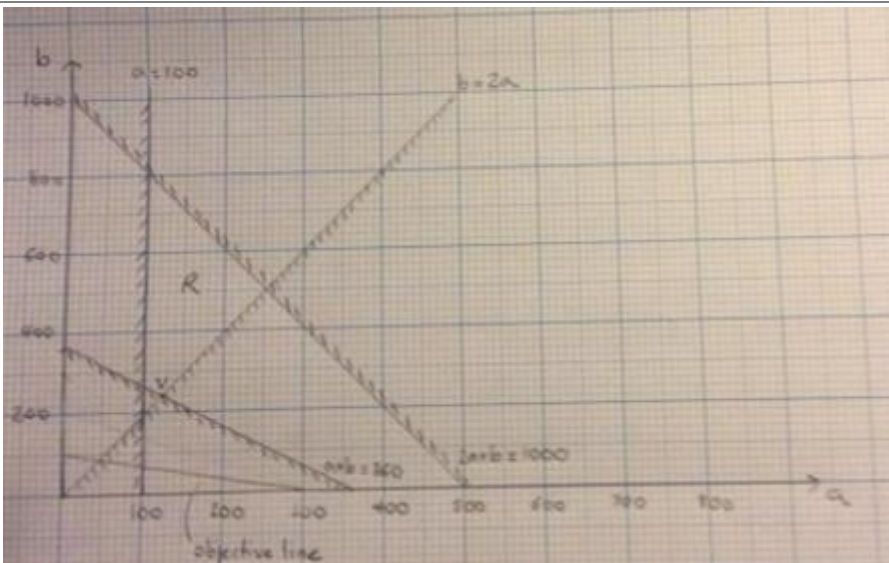
**M1:** Constructing a correct equation using their total floats and minimum completion time (all three terms must include  $x$ )

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## Specimen Paper – Decision Mathematics 1 Mark Scheme

A1: Cao (for  $x$ )

A1: Cao (minimum completion time)

Question	Scheme	Marks	AOs
4(a)	<p>Let <math>x</math> be the number of lemon cakes the baker makes and let <math>y</math> be the number of cherry cakes the baker makes</p> <p>Minimise <math>P = x + 3y</math></p> <p>Subject to</p> <p><math>x + y \geq 360</math></p> <p><math>2x + y \leq 1000</math></p> <p><math>y \geq 2x</math></p> <p><math>x \geq 100</math></p> <p>(<math>y \geq 0</math>)</p>	<p>B1 2.5</p> <p>B1 1.2</p> <p>B1 3.3</p> <p>B1 3.3</p> <p>B1 3.3</p> <p>B1 3.3</p>	
		(6)	
(b)	 <p>(Note to typesetters: change <math>x</math>-axis label to 'number of lemon cakes' and <math>y</math>-axis to 'number of cherry cakes')</p> <p>Objective line drawn or at least two vertices tested</p> <p>Solving correct simultaneous equations for their optimal vertex</p> <p>The baker should make 120 lemon cakes and 240 cherry cakes</p>	<p>B1 1.1b</p> <p>B1 1.1b</p> <p>B1 1.1b</p> <p>B1 2.2a</p> <p>M1 3.1a</p> <p>M1 1.1a</p> <p>A1 3.2a</p>	
		(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