

# GCE 2005

## *January Series*



ASSESSMENT and  
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ALLIANCE

# Mark Scheme

## Mathematics

MD01

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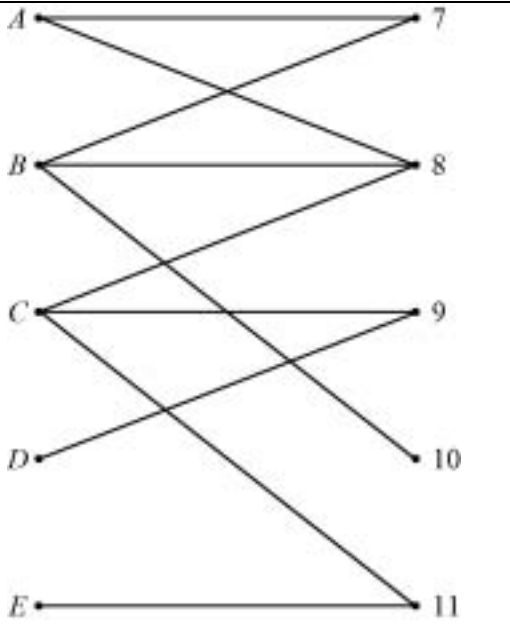
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*Dr Michael Cresswell Director General*

**MD01**

Q	Solution	Marks	Total	Comments																																																
<b>1</b>	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="border-bottom: 1px solid black; width: 10%; text-align: center;">A</td> <td style="border-bottom: 1px solid black; width: 10%; text-align: center;">B</td> <td style="border-bottom: 1px solid black; width: 10%; text-align: center;">C</td> <td style="border-bottom: 1px solid black; width: 10%; text-align: center;">D</td> <td style="border-bottom: 1px solid black; width: 10%; text-align: center;">E</td> <td style="border-bottom: 1px solid black; width: 10%; text-align: center;">F</td> </tr> <tr> <td style="text-align: center;">5</td> <td style="text-align: center;">3</td> <td style="text-align: center;">2</td> <td style="text-align: center;">8</td> <td style="text-align: center;">60</td> <td style="text-align: center;">15</td> </tr> </table>	A	B	C	D	E	F	5	3	2	8	60	15	M1		SCA																																				
	A	B	C	D	E	F																																														
5	3	2	8	60	15																																															
	<b>Total</b>		<b>4</b>	For 2 or 8 For 60 For 15																																																
<b>2(a)</b>	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 10%;">19</td><td style="width: 10%;">3</td><td style="width: 10%;">7</td><td style="width: 10%;">20</td><td style="width: 10%;">2</td><td style="width: 10%;">6</td><td style="width: 10%;">5</td><td style="width: 10%;">15</td> </tr> <tr> <td>3</td><td>7</td><td>19</td><td>2</td><td>6</td><td>5</td><td>15</td><td>20</td> </tr> <tr> <td>3</td><td>7</td><td>2</td><td>6</td><td>5</td><td>15</td><td>19</td><td>20</td> </tr> <tr> <td>3</td><td>2</td><td>6</td><td>5</td><td>7</td><td>15</td><td>19</td><td>20</td> </tr> <tr> <td>2</td><td>3</td><td>5</td><td>6</td><td>7</td><td>15</td><td>19</td><td>20</td> </tr> <tr> <td>(2</td><td>3</td><td>5</td><td>6</td><td>7</td><td>15</td><td>19</td><td>20)</td> </tr> </table>	19	3	7	20	2	6	5	15	3	7	19	2	6	5	15	20	3	7	2	6	5	15	19	20	3	2	6	5	7	15	19	20	2	3	5	6	7	15	19	20	(2	3	5	6	7	15	19	20)	M1 A1 A1 A1		Bubble sort First pass for 19 First pass for 20 2 <sup>nd</sup> pass
	19	3	7	20	2	6	5	15																																												
3	7	19	2	6	5	15	20																																													
3	7	2	6	5	15	19	20																																													
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2	3	5	6	7	15	19	20																																													
(2	3	5	6	7	15	19	20)																																													
<b>(b)</b>	7 comparisons 6 swaps	B1 B1	5 2	All correct																																																
	<b>Total</b>		<b>7</b>																																																	
<b>3(a)</b>	Odd vertices ( <i>ADFI</i> )	E1	1																																																	
<b>(b)</b>	$AD + FI = 14 + 14 = 28$ $AF + DI = 14 + 13 = 27$ $AI + DF = 11 + 17 = 28$  $\therefore$ Repeat $AF + DI$  Distance = $87 + 27 = 114$  Route with $3A, 1B, 2C, 2D, 3E, 2F, 1G, 1H, 2I$	M1  A2,1,0  E1  B1  B1		may be implied      17 vertices																																																
	<b>Total</b>		<b>7</b>																																																	

MD01 (cont)

Q	Solution	Marks	Total	Comments
4(a)		M1 A2	3	(-1 EE)
(b)	Initial A8, B10, C9, E11 Path $D \rightarrow 9 \rightarrow C \rightarrow 8 \rightarrow A \rightarrow 7$ Match A7, B10, C8, D9, E11	M1 A1 A1 B1	4	starting from D7 $D \rightarrow 9 \rightarrow C$ or $7 \rightarrow A \rightarrow 8$
<b>Total</b>			<b>7</b>	

**MD01 (cont)**

Q	Solution	Marks	Total	Comments
<b>5(a)</b>	<i>AB</i> 3	M1		SCA            Kruskal's (no method)
	<i>BC</i> 6			(a)              B1
	<i>BE</i> 13	A1		<i>BE</i> third      (b)              B1
	<i>EF</i> 5			(c)              M1 A2
	<i>FD</i> or      10			
	<i>FG</i> 32			
	<i>GJ</i> 7			
	<i>GH</i> 8	B1		10 edges
	<i>HK</i> 4			
	<i>HI</i> 12	A1	4	All correct
<b>(b)</b>	$\Sigma = 100$	B1	1	
<b>(c)</b>		M1		10 edges
		A2	3	(-1 EE)
<b>(d)</b>	Seventh <i>DF</i>	B1		
	Eighth <i>HI</i>	B1	2	
<b>Total</b>			<b>10</b>	

MD01 (cont)

Q	Solution	Marks	Total	Comments
6(a)	<p>The diagram shows two overlapping triangles, ABC and DEF, with a vertical line segment GH. Triangle ABC has vertices A(0), B(5), and C(7). Triangle DEF has vertices D(6), E(12), and F(20). The vertical line segment GH has vertices G(25) and H(27). The diagram includes various numerical values and labels for points and segments.</p>	<p>M1</p> <p>M1</p> <p>M1</p> <p>M1</p> <p>M1</p> <p>A1</p> <p>M1</p> <p>A1</p> <p>A1</p> <p>B1</p>	<p>6</p> <p>4</p> <p>10</p>	<p>SCA</p> <p>3 values at C</p> <p>3 values at E</p> <p>3 values at H</p> <p>3 values at J</p> <p>30 at J (dependent on first M1)</p>
	<p>(b) Use of <math>x+5</math> or <math>x+11</math>  <math>(AG) \quad 5+x &lt; 25 \quad \text{or} \quad x &lt; 20</math>  <math>(AJ) \quad 11+x \geq 30 \quad \text{or} \quad x \geq 19</math>  <math>x = 19</math></p>			
<b>Total</b>				

**MD01 (cont)**

Q	Solution	Marks	Total	Comments
7(a)(i)	$A \ B \ C \ D \ E \ F \ A$ $8 \ 10 \ 7 \ 15 \ 11 \ 7$ $= 58$	M1 A1	2	6 values
(ii)	$A \rightarrow C \rightarrow D \rightarrow F \rightarrow B \rightarrow E \rightarrow A$ $6 \ 7 \ 5 \ 8 \ 13 \ 12$ $= 51$	M1 M1 A1 B1	4	Tour starting and finishing at $A$ Visits all vertices Correct order
(b)	Delete $A$	M1		SCA (MST plus 2 edges)
		M1		4 edges (not including $A$ )
	Their MST + 6 ( $AC$ ) + 7 ( $AF$ ) Total = 44	M1 A1	5	
(c)	$45 \leq T \leq 51$	M1		Use of inequalities
	Max (45/their(b)) $\leq T \leq$ Min (their (a))	A1F A1F	3	45 51
<b>Total</b>			<b>14</b>	

**MD01 (cont)**

Q	Solution	Marks	Total	Comments
8(a)	$4x + 2y \leq 5 \times 4 \times 60$	B1	1	Condone =
(b)	$x \geq 40, \quad y \geq 40$	B1		Both
	$x + y \geq 120$	B1		Both
	$x + y \leq 400$			
	$(P =) 3x + y$	B1	3	
(c)		B1		$x \geq 40, y \geq 40$
		B1		$120 \leq x + y \leq 400$
		B1		$2x + y \leq 60$
		B1		Correct FR
		B1	5	Correct OL
(d)	Extreme points Max at $x = 280, y = 40$ $P = 840 + 40 = \text{£}880$	M1 A1 B1	3	SC: (280, 20) scores 1/3
(e)(i)	Max at $(200, 200) \rightarrow (40, 360)$ Profit $\text{£}800$	M1 A1	2	
(ii)	No of combinations $200 - 40 = 160$ $\quad + 1$ $\quad \underline{\quad}$ $\quad 161$	B1 B1	2	
	<b>Total</b>		<b>16</b>	
	<b>TOTAL</b>		<b>75</b>	