

# Mark Scheme (Pre-Standardisation)

## Summer 2008

GCE

GCE Mathematics (6689/01)

## General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

**June 2008**  
**6689 Decision Mathematics D1**  
**Mark Scheme**

Question Number	Scheme	Marks
Q1		
(a)	$\frac{502}{100} = 5.02$ so 6 tapes.	M1 A1 (2)
(b)	Bin 1: 29, 52      Bin 5: 47, 38 Bin 2: 73          Bin 6: 61 Bin 3: 87          Bin 7: 41 Bin 4: 74	M1  A1  A1 (3)
(c)	Bin 1: 87          Bin 4: 61, 38 Bin 2: 74          Bin 5: 52, 47 Bin 3: 73          Bin 6: 41, 29	M1  A1  A1 (3)
	<b>Notes:</b>	<b>Total 8</b>
	(a) 1M1: $(502 \pm 40) \div 100$ (maybe implicit) 1A1: cao 6 tapes	
	(b) 1M1: Bin 1 correct and at least 8 values put in bins 1A1: Condone one error, (e.g. extra, omission, 'balanced' swap). 2A1: All correct	
	(c) 1M1: Bin 1 correct and at least 8 values put in bins 1A1: Condone one error, (e.g. extra, omission, 'balanced' swap). 2A1: All correct	

Question Number	Scheme	Marks
Q2	<p>(a) <math>G - 5 = W - 3</math> change status <math>G = 5 - W = 3</math></p> <p>(b) A – no match  <math>E = 2</math>  <math>G = 5</math>  <math>R = 4</math>  <math>W = 3</math></p> <p>(c) e.g. R is the only person who can do 1 and the only person who can do 4</p> <p>(d) <math>A - 2 = E - 3 = W - 4 = R - 1</math>  change status <math>A = 2 - E = 3 - W = 4 - R = 1</math></p> <p><math>A = 2</math>  <math>E = 3</math>  <math>G = 5</math>  <math>R = 1</math>  <math>W = 4</math></p> <p><b>Notes:</b>  (a) 1M1: Path from G to 3  1A1: CAO including change status ( stated or shown)  (b) 2A1: CAO  (c) 1B1: Correct answer, may be imprecise or muddled (bod gets B1)  2B1: Good, clear, correct answer.  (d) 1M1: Path from A to 1  1A1: CAO including change status (stated or shown)  1A1: CAO</p>	<p>M1 A1 (2)</p> <p>A1 (1)</p> <p>B 2, 1, 0 (2)</p> <p>M1 A1</p> <p>A1 (3)</p> <p><b>Total 8</b></p>

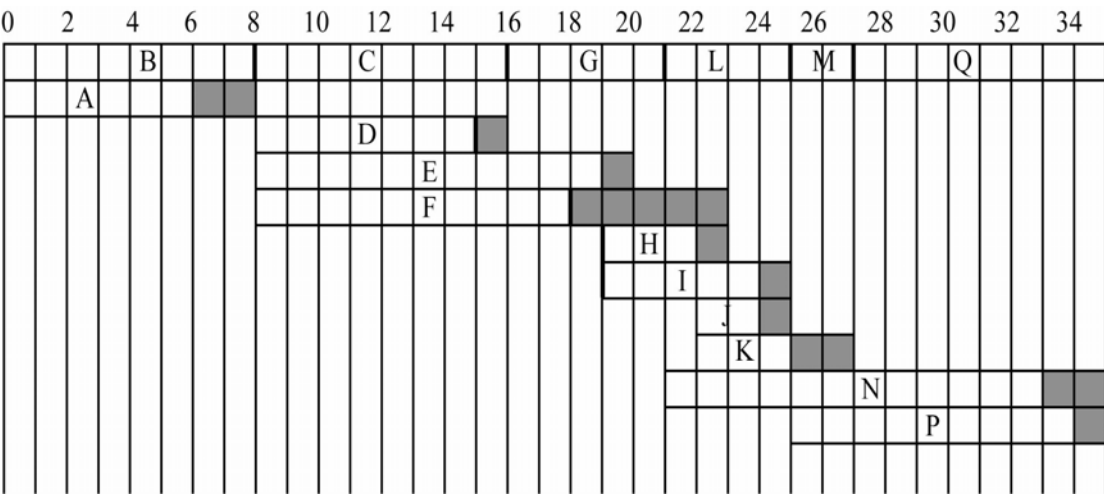
Question Number	Scheme	Marks
<p>Q3</p> <p>(a)</p>	<p>Route: ADGHI Length: 48 (km)</p>	<p>M1</p> <p>A1</p> <p>A1ft</p> <p>A1 A1ft (5)</p> <p>B1 M1 A1ft A1 (4)</p> <p><b>Total 9</b></p>
	<p>(b) Odd vertices are A and H Attempt to find shortest route from A to H = ADGH New length: <math>197 + 36 = 233</math> Route: e.g. ADGHGDACEDHIFHEFBA <b>Notes:</b> (a) 1M1: Smaller number replacing larger number in the working values at E or F or H or I. (generous – give bod) 1A1: All values in boxes A to E and G correct 2A1ft: All values in boxes F, H and I correct (ft) 3A1: CAO (not ft) 4A1ft: Follow through from their I value, condone lack of units here.</p> <p>(f) 1B1: A and H identified in some way – allow recovery from M mark. 1M1: Accept path, or its length. Accept attempt if finding shortest. 1A1ft: <math>197 + \text{their } 36</math> 2A1: A correct route.</p>	

Question Number	Scheme	Marks
Q4	<p>(a) e.g.</p> <ul style="list-style-type: none"> <li>• Prim's starts with any vertex, Kruskal starts with the shortest arc.</li> <li>• It is not necessary to check for cycles when using Prim.</li> <li>• Prim's adds nodes to the growing tree, Kruskal adds arcs.</li> <li>• The tree 'grows' in a connected fashion when using Prim.</li> <li>• Prim can be used when data in a matrix form.</li> </ul> <p>Other correct statements also get credit.</p> <p>(b)(i) e.g. AC, CF, FD, DE, DG, AB.</p> <p>(ii) CF, DE, DF, not CD, not EF, DG, not FG, not EG, AC, not AD, AB.</p> <p><b>Notes:</b></p> <p>(a) 1B1: one correct difference. If bod give B1  2B1: two distinct, correct differences.</p> <p>(b) 1M1: Prim's algorithm – first three arcs chosen correctly, in order, or first four nodes chosen correctly, in order.  1A1: First five arcs chosen correctly; all 7 nodes chosen correctly, in order.  2A1: All correct and arcs chosen in correct order.  2M1: Kruskal's algorithm – first 4 arcs selected chosen correctly.  1A1: All six non-rejected arcs chosen correctly.  2A1: All rejections correct and in correct order and at correct time.</p>	<p>B 2, 1, 0 (2)</p> <p>M1, A1, A1 (3)</p> <p>M1, A1, A1 (3)</p> <p><b>Total 8</b></p>

Question Number	Scheme	Marks
Q5	<p>(a) <math>x = 9, y = 11</math></p> <p>(b) AC DC DT ET</p> <p>(c) 36</p> <p>(d) <math>C_1 = 49, C_2 = 48, C_3 = 39</math></p> <p>(e) e.g. SAECT – 1</p> <p>(f) maximum flow = minimum cut cut through DT, DC, AC and AE</p> <p><b>Notes:</b></p> <p>(a) 1B1: cao (permit B1 if 2 correct answers, but transposed) 2B1: cao</p> <p>(b) 1B1: correct (condone one error – omission or extra) 2B1: all correct (no omissions or extras)</p> <p>© 1B1: cao</p> <p>(d) 1B1: cao 2B1: cao 3B1: cao</p> <p>(e) 1B1: A correct route and flow</p> <p>(f) 1M1: Must have found max flow, theorem stated (3 words out of 4) An attempt at a cut. 1A1: cut correct – may be drawn.</p>	<p>B1,B1 (2)</p> <p>B2,1,0 (2)</p> <p>B1 (1)</p> <p>B1,B1,B1 (3)</p> <p>B1 (1)</p> <p>M1 A1 (2)</p> <p><b>Total 11</b></p>

Question Number	Scheme								Marks																																													
Q6	(a)	<table border="1"> <thead> <tr> <th>b.v</th> <th>x</th> <th>y</th> <th>z</th> <th>r</th> <th>s</th> <th>t</th> <th>value</th> </tr> </thead> <tbody> <tr> <td>r</td> <td>4</td> <td><math>\frac{7}{3}</math></td> <td><math>\frac{5}{2}</math></td> <td>1</td> <td>0</td> <td>0</td> <td>64</td> </tr> <tr> <td>s</td> <td>1</td> <td>3</td> <td>0</td> <td>0</td> <td>1</td> <td>0</td> <td>16</td> </tr> <tr> <td>t</td> <td>4</td> <td>2</td> <td>2</td> <td>0</td> <td>0</td> <td>1</td> <td>60</td> </tr> <tr> <td>P</td> <td>-5</td> <td><math>-\frac{7}{2}</math></td> <td>-4</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> </tr> </tbody> </table>							b.v	x	y	z	r	s	t	value	r	4	$\frac{7}{3}$	$\frac{5}{2}$	1	0	0	64	s	1	3	0	0	1	0	16	t	4	2	2	0	0	1	60	P	-5	$-\frac{7}{2}$	-4	0	0	0	0						
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b.v	x	y	z	r	s	t	value	Row ops																																														
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b.v	x	y	z	r	s	t	value	Row ops																																														
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P	0	0	0	3	0	$-\frac{7}{4}$	87	$R_4 + \frac{3}{2}R_1$																																														
	(b)	<p>There is still a negative number in the profit row.</p>								B1 (1)																																												
									<b>Total 10</b>																																													



Question Number	Scheme	Marks
Q7	<p>(a) <math>v = 16 \quad w = 25 \quad x = 23 \quad y = 20 \quad z = 8</math></p> <p>(b) B C G L M Q</p> <p>(c) Float on H = <math>23 - 19 - 3 = 1</math>  Float on J = <math>25 - 22 - 2 = 1</math></p> <p>(d) </p>	<p>B3,2,1,0 (3)</p> <p>B1 (1)</p> <p>B1 B1 (2)</p> <p>M1 A1 A1 A1 (4)</p> <p>B2,1,0 (2)</p> <p>B2,1,0 (2)</p> <p><b>Total 14</b></p>
(e)	E has one day of float, so project can still be completed on time.	B2,1,0 (2)
(f)	e.g At time $23 \frac{1}{2}$ activities L, I, J, K and N must be taking place so 5 workers needed.	B2,1,0 (2)

Question Number	Scheme	Marks
Q8	<p>Maximise (P=) <math>0.2 a + 0.15 b</math> or <math>20 a + 15 b</math> <b>o.e.</b></p> <p>Subject to</p> $a + b \leq 800$ $a \geq 2b$ $50 \leq b \leq 100$ $a \geq 0$ <p><b>Notes:</b>  1B1: 'Maximise'  2B1: ratio of coefficients correct  3B1: cao  4B1: coefficients of <math>a</math> and <math>b</math> correct.  5B1: inequality correct  6B1: cao accept &lt;  7B1: cao</p>	<p>B1 B1 (2)</p> <p>B1  B2,1,0  B1  B1  (5)</p> <p><b>Total 7</b></p>

## June 2008 6689 Decision Mathematics D1 Mark Scheme Notes

### Question 4 (b)(i)

Prim starting at A: AC CF DF DE DG AB  
Prim starting at B: BA AC CF DF DE DG  
Prim starting at C: CF FD DE DG CA AB  
Prim starting at D: DE DF CF DG CA AB  
Prim starting at E: ED DF CF DG CA AB  
Prim starting at F: FC FD DE DG CA AB  
Prim starting at G: GD DE DF FC CA AB

### Question 6

#### Notes:

- (a) 1M1: correct pivot located, attempt to divide row  
1A1: pivot row correct including change of b.v.  
2M1: (ft) Correct row operations used at least once or stated correctly.  
1A1ft: Looking at non zero-and-one columns, one column ft correct  
2A1: cao.  
3M1: (ft) Correct pivot identified  
1A1: ft pivot row correct including change of bv.  
4M1: (ft) Correct row operations used at least once or stated correctly.  
1A1: cao  
(b) 1B1: cao

## June 2008 6689 Decision Mathematics D1 Mark Scheme Notes

### Question 7

#### Notes:

- (a) 1B1: ft ( $y = \text{their } x - 3$ ) all correct condone two original errors.  
2B1: ft ( $y = \text{their } x - 3$ ) all correct condone one original error.  
3B1: all correct
- (b) 1B1: cao
- (c) 1B1: ft cao for H  
2B1: cao for J
- (d) 1M1: At least 10 activities placed  
1A1: critical activities correct.  
2A1: condone one error on non-critical activities.  
3A1: non-critical activities correct.
- (e) 1B1: A correct explanation  
2B1: A second mark depending on above mark for 'yes'.
- (f) 1B1: A correct statement, details of time or activities, bod gets B1  
2B1: A correct, complete full statement details of time and activities.