

Mathematics (MEI)

Advanced Subsidiary GCE 4771

Decision Mathematics 1

Mark Scheme for June 2010

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1.

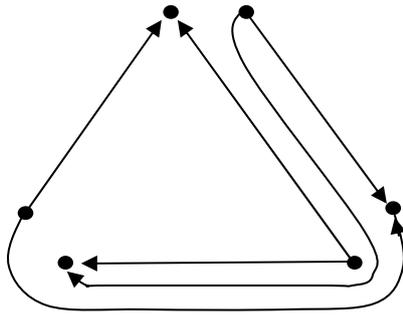
<p>(i)</p> <p style="margin-top: 20px;"> AB 12 AB AC 13 AC AD 29 ABD AE 35 ABDE AF 22 ACF </p> <p>(ii) 5</p>	<p>M1 Dijkstra A1 working values B1 order of labelling B1 labels</p> <p style="margin-top: 20px;"> B1 AB and AC B1 AD and AF B1 AE</p> <p style="margin-top: 20px;">B1</p>
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2.

<p>(i)</p> $ \begin{array}{r} \begin{array}{r} \cancel{3} \quad \quad \quad \cancel{8} \\ \cancel{6} \quad \quad \quad \cancel{4} \\ \cancel{12} \quad \quad \quad \cancel{2} \\ 24 \quad \quad \quad 1 \\ \hline 24 \end{array} \\ \\ \begin{array}{r} \begin{array}{r} \cancel{26} \quad \quad \quad \cancel{42} \\ 52 \quad \quad \quad 21 \\ \cancel{104} \quad \quad \quad \cancel{10} \\ 208 \quad \quad \quad 5 \\ \cancel{416} \quad \quad \quad \cancel{2} \\ 832 \quad \quad \quad 1 \\ \hline 1092 \end{array} \end{array} $ <p>(iii) multiplication</p>	<p>M1 doubling and halving M1 deleting and summing A1 cao</p> <p style="margin-top: 20px;"> M1 doubling and halving M1 deleting DM summing A1 cao</p> <p style="margin-top: 20px;">B1</p>
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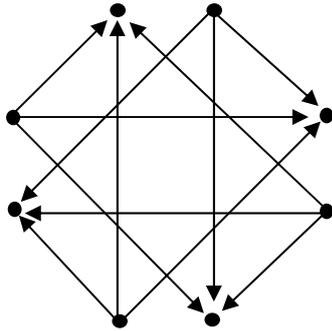
3.

(i)



B1
B1
B1

(ii)



B1 12 arcs
B1 connectivity
B1 3 out of each in vertex
B1 3 into each out vertex

(iii) The graphs represent traffic flows within the junctions.
They do not take account of flows approaching or
leaving the junctions.
(Graphs are not planar if these flows are added, so
traffic flows have to cross.)

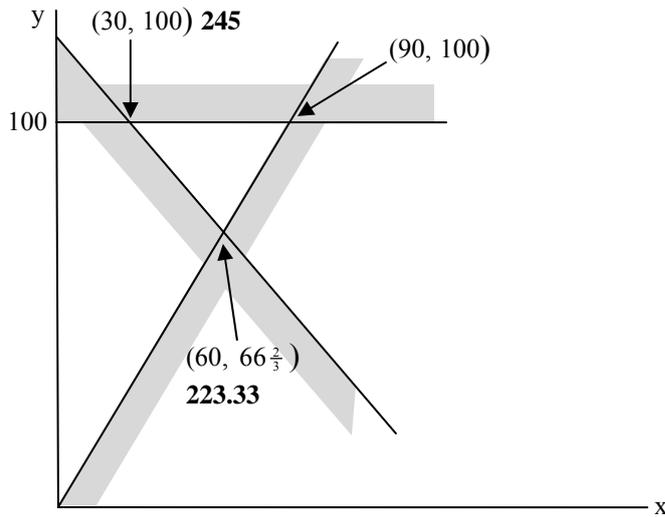
B1

4.

- (i) Each small tile has area 100 cm^2 so $1000x$
 Similarly $900y$
 So $1000x + 900y \geq 400 \times 300 = 120000$

- (ii) $y \leq 100$
 $10x \leq 9y$

- (iii) e.g. minimise $1.5x + 2y$



Integer solution required, so $x=60, y=67, \text{ cost} = 224$

- (iv) wastage or design

M1 areas
 A1 tile areas
 A1

B1
 B1 B1

B1

B3 lines

B1 shading

M1 solving
 A1 $x = 59-61 \quad y = 66-68$
 A1 220-228

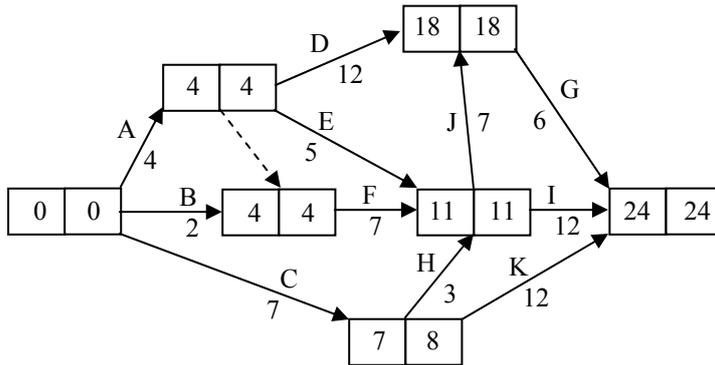
B2

5.

<p>(i) e.g. 0 to 4 → stagger left 5 to 9 → stagger right + accumulation</p> <p>(ii) probably one of:</p> <p>(iii) repeat relative frequency</p> <p>(iv) e.g. 0 to 2 → stagger left 3 to 8 → stagger right 9 reject and redraw</p>	<p>M1 A1 B1</p> <p>M1 A1</p> <p>B1 B1</p> <p>M1 A1 A1</p> <p>reject some proportions efficient</p>																																																																								
<p>(v) e.g.</p> <table border="1"> <tr><td>run 1</td><td>R</td><td>L</td><td>R</td><td>L</td><td>L</td><td>R</td></tr> <tr><td>run 2</td><td>R</td><td></td><td>L</td><td></td><td>R</td><td>R</td><td>L</td><td>R</td></tr> <tr><td>run 3</td><td>R</td><td>R</td><td>L</td><td>L</td><td>L</td><td>L</td></tr> <tr><td>run 4</td><td>L</td><td>L</td><td>R</td><td>L</td><td>R</td><td>R</td></tr> <tr><td>run 5</td><td>R</td><td>R</td><td>R</td><td>*</td></tr> <tr><td>run 6</td><td>L</td><td>R</td><td>R</td><td></td><td>R</td><td></td><td>R</td><td>*</td></tr> <tr><td>run 7</td><td>R</td><td>R</td><td>L</td><td>R</td><td>R</td><td>*</td></tr> <tr><td>run 8</td><td>R</td><td>R</td><td>L</td><td>R</td><td>R</td><td>*</td></tr> <tr><td>run 9</td><td>R</td><td></td><td>R</td><td></td><td>R</td><td>*</td></tr> <tr><td>run 10</td><td>L</td><td>R</td><td>R</td><td>L</td><td>R</td><td>R</td></tr> </table> <p>Probability estimate = 0.5 (Theoretical = $0.7^3 + 5 \times 0.7^4 \times 0.3 = 0.70315$)</p>	run 1	R	L	R	L	L	R	run 2	R		L		R	R	L	R	run 3	R	R	L	L	L	L	run 4	L	L	R	L	R	R	run 5	R	R	R	*	run 6	L	R	R		R		R	*	run 7	R	R	L	R	R	*	run 8	R	R	L	R	R	*	run 9	R		R		R	*	run 10	L	R	R	L	R	R	<p>M1 A2</p> <p>(-1 each wrong row)</p> <p>B1</p> <p>falling in</p> <p>M1 A1</p> <p>probability</p>
run 1	R	L	R	L	L	R																																																																			
run 2	R		L		R	R	L	R																																																																	
run 3	R	R	L	L	L	L																																																																			
run 4	L	L	R	L	R	R																																																																			
run 5	R	R	R	*																																																																					
run 6	L	R	R		R		R	*																																																																	
run 7	R	R	L	R	R	*																																																																			
run 8	R	R	L	R	R	*																																																																			
run 9	R		R		R	*																																																																			
run 10	L	R	R	L	R	R																																																																			

6.

(i) & (ii)



Duration = 24 months

Critical : A; F; J; G

(iii) Crash F by 1 month and G by 1 month at a cost of £6m.

(iv) Crash G by 2 months at a cost of £8m.

M1 activity-on-arc
 A1 D, E, H and K
 A1 F
 A1 I and J
 A1 G

M1 forward pass
 A1
 M1 backward pass
 A1

B1 cao

B1 cao

B1 F by 1 month
 B1 G by 1 month
 B1 £6m

M1 G only
 A1 £8m

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