

4772

Mark Scheme

June 2012

Question			Answer	Marks	Guidance	
1	(a)	(i)	She should not tick the first box. She should tick the second box.	B1 B1 [2]		
1	(a)	(ii)	She should tick both boxes.	B1B1 [2]		
1	(a)	(iii)	eg To tick neither box would be contradictory, confirming that it is original, but having reason to believe that it is not.	M1 A1 [2]	looking at “neither” case, or equivalent.	
1	(b)		eg I – lunch in Italy F – foggy T – top lift not working $((F \vee T) \Rightarrow I) \Leftrightarrow (\sim F \Rightarrow \sim I)$ (ignore $\sim F \Rightarrow I$ if included) 0 1 1 1 1 0 10 0 01	M1 A1 A1 A1 A1 [6]	identification of propositions Angus’s statement Chloe’s statement equivalence 0/1s for Angus and Chloe 0 for equivalence	SC B1 for examining not foggy and lift not working
1	(c)		$(X \vee \sim Y) \Rightarrow Z$ $\sim Z \Rightarrow \sim(X \vee \sim Y)$ contrapositive $\sim Z \Rightarrow \sim X \wedge Y$ De Morgan $\sim Z$ given $\sim X \wedge Y$ Y	M1A1 B1 B1 [4]	deducing Y from $\sim X \wedge Y$	

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2	(i)		B1 M1 A1 M1 A1 B1 [6]	decision node chance node 3-split rent costs (a correct value) -1 each error decision
2	(ii)	$0.3 \times \sqrt{5625} + 0.5 \times \sqrt{5000} + 0.2 \times \sqrt{4375} = 71.08$ $\sqrt{4800} = 69.28, \text{ so no change}$	M1A1 A1 [3]	

Question	Answer	Marks	Guidance
(iii)		<p>M1 A1</p> <p>M1 A1</p> <p>M1 A1</p> <p>B1</p> <p>[7]</p>	<p>new chance node 3-split</p> <p>“less” (a correct value)</p> <p>“more” (a correct value)</p> <p>4700 (follow through)</p>

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3	(i)	(a)	<table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td>1</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> <td></td> <td></td> <td>1</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> </tr> <tr> <td>1</td> <td>4</td> <td>2</td> <td>5</td> <td>4</td> <td>5</td> <td></td> <td></td> <td>1</td> <td>2</td> <td>2</td> <td>2</td> <td>2</td> <td>5</td> </tr> <tr> <td>2</td> <td>2</td> <td>4</td> <td>3</td> <td>2</td> <td>3</td> <td></td> <td></td> <td>2</td> <td>1</td> <td>1</td> <td>3</td> <td>4</td> <td>4</td> </tr> <tr> <td>3</td> <td>5</td> <td>3</td> <td>6</td> <td>5</td> <td>6</td> <td></td> <td></td> <td>3</td> <td>2</td> <td>2</td> <td>2</td> <td>2</td> <td>2</td> </tr> <tr> <td>4</td> <td>4</td> <td>2</td> <td>5</td> <td>4</td> <td>1</td> <td></td> <td></td> <td>4</td> <td>2</td> <td>2</td> <td>2</td> <td>2</td> <td>5</td> </tr> <tr> <td>5</td> <td>5</td> <td>3</td> <td>6</td> <td>1</td> <td>2</td> <td></td> <td></td> <td>5</td> <td>1</td> <td>4</td> <td>4</td> <td>4</td> <td>4</td> </tr> </table>																1	2	3	4	5			1	2	3	4	5	1	4	2	5	4	5			1	2	2	2	2	5	2	2	4	3	2	3			2	1	1	3	4	4	3	5	3	6	5	6			3	2	2	2	2	2	4	4	2	5	4	1			4	2	2	2	2	5	5	5	3	6	1	2			5	1	4	4	4	4	M1 A2 M1 A2 [6]	(-1 each error) (-1 each error)
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3	(i)	(b)	3 → 2 → 4 → 5	B1 [1]																																																																																																		
3	(i)	(c)		M1 A1 [2]	complete																																																																																																	

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3	(ii)	<p>Lower bound = $(2 + 2 + 3) + (1 + 3) = 11$</p>	M1 A1 A1 [3]	delete vertex 5 plus arcs $(2 + 2 + 3)$ $1 + 3$	
3	(iii)	$1 \rightarrow 2 \rightarrow 4 \rightarrow 5 \rightarrow 3 \rightarrow 1$ of total length 16	M1A1B1 [3]	M1 for $1 \rightarrow 2 \rightarrow 4 \rightarrow 5$	
3	(iv)	$1 \rightarrow 2 \rightarrow 4 \rightarrow 5 \rightarrow (4 \rightarrow 2) \rightarrow 3 \rightarrow (2) \rightarrow 1$	M1A1 [2]	SC 1 id seen elsewhere	
3	(v)	eg $1 \rightarrow 2 \rightarrow 3 \rightarrow 2 \rightarrow 4 \rightarrow 3 \rightarrow 5 \rightarrow 4 \rightarrow 5 \rightarrow 1$ Length = 32	M1A1 B1 [3]	$2 \rightarrow 3$ or $5 \rightarrow 4$ repeated for M1	
4	(i)	Let x be the number of maths books produced ... Line 1 $\Leftrightarrow \max 6x + 3y + 7z$ (10 - 4 = 6 etc.) Line 2 $\Leftrightarrow 2x + 1.5y + 2.5z \leq 10000$ (printing time) Line 3 $\Leftrightarrow x + 0.5y + 1.5z \leq 7500$ (packing time) Line 4 $\Leftrightarrow 300x + 200y + 400z \leq 2000000$ (storage space)	B1 B1 B1 B1 B1 [5]	variable defs. "number of" objective constraints	

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4	(ii)	<table border="1"> <thead> <tr> <th>P</th> <th>x</th> <th>y</th> <th>z</th> <th>$s1$</th> <th>$s2$</th> <th>$s3$</th> <th>RHS</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>-6</td> <td>-3</td> <td>-7</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td>0</td> <td>2</td> <td>1.5</td> <td>2.5</td> <td>1</td> <td>0</td> <td>0</td> <td>10000</td> </tr> <tr> <td>0</td> <td>1</td> <td>0.5</td> <td>1.5</td> <td>0</td> <td>1</td> <td>0</td> <td>7500</td> </tr> <tr> <td>0</td> <td>300</td> <td>200</td> <td>400</td> <td>0</td> <td>0</td> <td>1</td> <td>200000</td> </tr> <tr> <td>1</td> <td>-0.4</td> <td>1.2</td> <td>0</td> <td>2.8</td> <td>0</td> <td>0</td> <td>28000</td> </tr> <tr> <td>0</td> <td>0.8</td> <td>0.6</td> <td>1</td> <td>0.4</td> <td>0</td> <td>0</td> <td>4000</td> </tr> <tr> <td>0</td> <td>-0.2</td> <td>-0.4</td> <td>0</td> <td>-0.6</td> <td>1</td> <td>0</td> <td>1500</td> </tr> <tr> <td>0</td> <td>-20</td> <td>-40</td> <td>0</td> <td>-160</td> <td>0</td> <td>1</td> <td>400000</td> </tr> <tr> <td>1</td> <td>0</td> <td>1.5</td> <td>0.5</td> <td>3</td> <td>0</td> <td>0</td> <td>30000</td> </tr> <tr> <td>0</td> <td>1</td> <td>0.75</td> <td>1.25</td> <td>0.5</td> <td>0</td> <td>0</td> <td>5000</td> </tr> <tr> <td>0</td> <td>0</td> <td>-0.25</td> <td>0.25</td> <td>-0.5</td> <td>1</td> <td>0</td> <td>2500</td> </tr> <tr> <td>0</td> <td>0</td> <td>-25</td> <td>25</td> <td>-150</td> <td>0</td> <td>1</td> <td>500000</td> </tr> </tbody> </table>	P	x	y	z	$s1$	$s2$	$s3$	RHS	1	-6	-3	-7	0	0	0	0	0	2	1.5	2.5	1	0	0	10000	0	1	0.5	1.5	0	1	0	7500	0	300	200	400	0	0	1	200000	1	-0.4	1.2	0	2.8	0	0	28000	0	0.8	0.6	1	0.4	0	0	4000	0	-0.2	-0.4	0	-0.6	1	0	1500	0	-20	-40	0	-160	0	1	400000	1	0	1.5	0.5	3	0	0	30000	0	1	0.75	1.25	0.5	0	0	5000	0	0	-0.25	0.25	-0.5	1	0	2500	0	0	-25	25	-150	0	1	500000	<p>B1 pivot (pivot on x OK)</p> <p>M1 A1 a correct row or column</p> <p>B1 pivot</p> <p>M1 A1 a correct row or column</p> <p>B1 B1</p> <p>[8]</p>	
		P	x	y	z	$s1$	$s2$	$s3$	RHS																																																																																																			
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4	(iii)	£1.50 and 50p respectively.	B1B1 [2]																																																																																																									

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4	(iv)	<table border="1"> <thead> <tr> <th>Q</th> <th>P</th> <th>x</th> <th>y</th> <th>z</th> <th>s1</th> <th>s2</th> <th>s3</th> <th>s4</th> <th>a</th> <th>RHS</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>0</td> <td>0</td> <td>1</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>-1</td> <td>0</td> <td>1000</td> </tr> <tr> <td>0</td> <td>1</td> <td>-6</td> <td>-3</td> <td>-7</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td>0</td> <td>0</td> <td>2</td> <td>1.5</td> <td>2.5</td> <td>1</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>10000</td> </tr> <tr> <td>0</td> <td>0</td> <td>1</td> <td>0.5</td> <td>1.5</td> <td>0</td> <td>1</td> <td>0</td> <td>0</td> <td>0</td> <td>7500</td> </tr> <tr> <td>0</td> <td>0</td> <td>300</td> <td>200</td> <td>400</td> <td>0</td> <td>0</td> <td>1</td> <td>0</td> <td>0</td> <td>2000000</td> </tr> <tr> <td>0</td> <td>0</td> <td>0</td> <td>1</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>-1</td> <td>1</td> <td>1000</td> </tr> </tbody> </table>	Q	P	x	y	z	s1	s2	s3	s4	a	RHS	1	0	0	1	0	0	0	0	-1	0	1000	0	1	-6	-3	-7	0	0	0	0	0	0	0	0	2	1.5	2.5	1	0	0	0	0	10000	0	0	1	0.5	1.5	0	1	0	0	0	7500	0	0	300	200	400	0	0	1	0	0	2000000	0	0	0	1	0	0	0	0	-1	1	1000	<p>B1</p> <p>B1</p> <p>B1</p> <p>B1</p> <p>B1</p> <p>B1</p> <p>[5]</p>	<p>new objective</p> <p>surplus + artificial</p> <p>new constraint</p>
		Q	P	x	y	z	s1	s2	s3	s4	a	RHS																																																																					
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0	0	0	1	0	0	0	0	-1	1	1000																																																																							
		<p>Minimise Q until 0 (if feasible). Then drop Q and a and proceed to optimum.</p>																																																																															