OCR
Oxford Cambridge and RSA

GCE

Mathematics (MEI)

Unit **4772**: Decision Mathematics 2

Advanced GCE

Mark Scheme for June 2018

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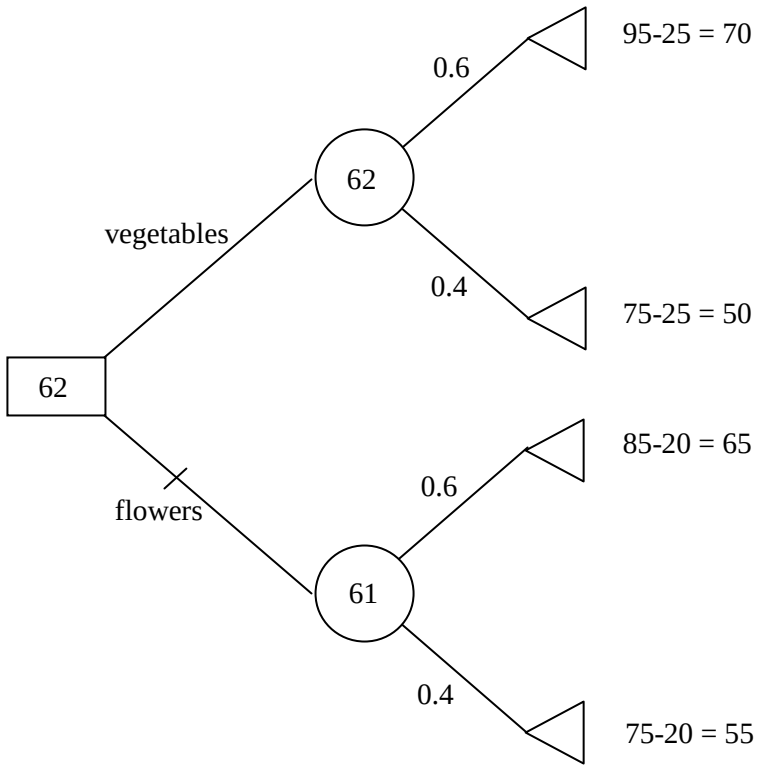
This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

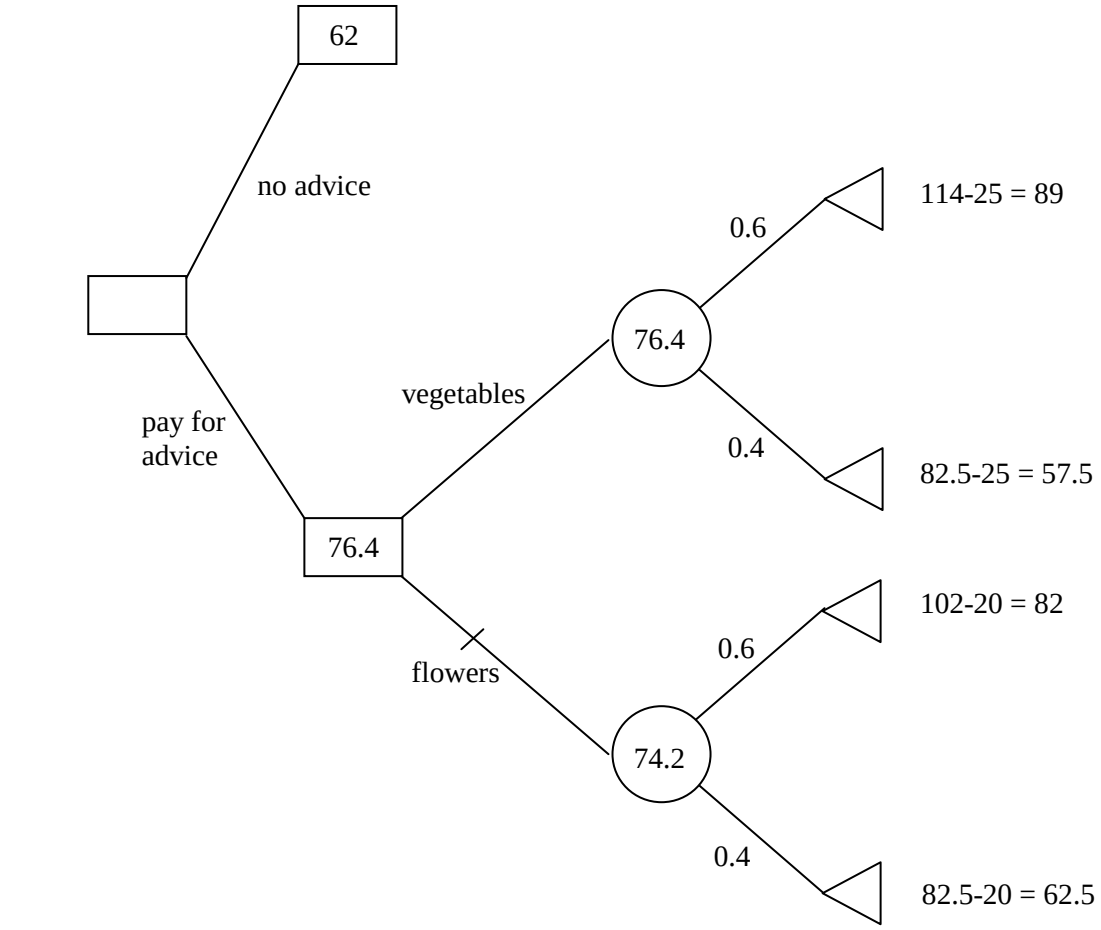
All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

Annotations and abbreviations

Annotation in scoris	**Meaning**
✓and ✖	
BOD	Benefit of doubt
FT	Follow through
ISW	Ignore subsequent working
M0, M1	Method mark awarded 0, 1
A0, A1	Accuracy mark awarded 0, 1
B0, B1	Independent mark awarded 0, 1
SC	Special case
^	Omission sign
MR	Misread
Highlighting	
Other abbreviations in mark scheme	**Meaning**
E1	Mark for explaining
U1	Mark for correct units
G1	Mark for a correct feature on a graph
M1 dep*	Method mark dependent on a previous mark, indicated by *
cao	Correct answer only
oe	Or equivalent
rot	Rounded or truncated
soi	Seen or implied
www	Without wrong working

Question			Answer	Marks	Guidance
1	(i) & (ii)		 Plant vegetables EMV = £62	M1 M1 A1 B1 M1 A1 M1 A1 A1	decision node at first branch chance nodes at second branches all correct payoffs computing OK at a chance node 62 and 61 deciding at the decision node 62 cao action

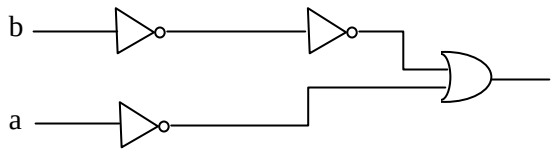
Question	Answer	Marks	Guidance
(iii)	 Value of advice = £14.40	B1 M1 A1 B1	advice or ~advice repeat of structure with new pay-offs (allow if new payoffs incorrect) all calculations cao EMV = £14.40 √

Question			Answer	Marks	Guidance
	(iv)		Without advice … 0.5*62 + 0.5*61 = 61.5	B1	
			With advice … 0.5*76.4 + 0.5*74.2 = 75.3	B1	
			So value of advice is now £13.80.	B1	

Question			Answer	Marks	Guidance
2	(i)		<table><tr><th></th><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th></tr><tr><td>1</td><td>24</td><td>24</td><td>28</td><td>12</td><td>36</td></tr><tr><td>2</td><td>24</td><td>24</td><td>24</td><td>12</td><td>32</td></tr><tr><td>3</td><td>28</td><td>24</td><td>32</td><td>16</td><td>8</td></tr><tr><td>4</td><td>12</td><td>12</td><td>16</td><td>24</td><td>24</td></tr><tr><td>5</td><td>36</td><td>32</td><td>8</td><td>24</td><td>16</td></tr></table> <table><tr><th></th><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th></tr><tr><td>1</td><td>4</td><td>4</td><td>4</td><td>4</td><td>4</td></tr><tr><td>2</td><td>4</td><td>4</td><td>3</td><td>4</td><td>3</td></tr><tr><td>3</td><td>4</td><td>2</td><td>4</td><td>4</td><td>5</td></tr><tr><td>4</td><td>1</td><td>2</td><td>3</td><td>1</td><td>3</td></tr><tr><td>5</td><td>3</td><td>3</td><td>3</td><td>3</td><td>3</td></tr></table>	B1 M1 A1 M1 A1	16 cells unchanged in distance matrix, with corresponding cells unchanged in route matrix 5 to 1 route entry correct 5 to 1 distance correct rest of distance changes rest of route changes
	(ii)		Shortest distance from 1 to 5 in row 1 col 5 of distance matrix = 36 Shortest route from 1 to 5 is 1 to 4 (r1c5 of RM), 4 to 3 (r4c5 of RM), 3 to 5 (r3c5 of RM). (Special case – two correct answers without method(s).)	M1 A1 (B1)	both methods
	(iii)		<table><tr><th></th><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th></tr><tr><td>1</td><td>24</td><td>24</td><td>28</td><td>12</td><td>36</td></tr><tr><td>2</td><td>24</td><td>24</td><td>24</td><td>12</td><td>32</td></tr><tr><td>3</td><td>28</td><td>24</td><td>32</td><td>16</td><td>8</td></tr><tr><td>4</td><td>12</td><td>12</td><td>16</td><td>24</td><td>24</td></tr><tr><td>5</td><td>36</td><td>32</td><td>8</td><td>24</td><td>16</td></tr></table> Select 8, 24 and 24 (details not needed). Add back in 12 and 12. So 8+24+24+12+12 = 80	 B1 B1 B1 √	
	(iv)		**1** 12 **4** 12 **2** 24 **3** 8 **5** 36 **1** so distance = 12+12+24+8+36 = 92 Route is **1 4 2 3 5** (**3 4**) **1**	B1 B1	92

Question			Answer	Marks	Guidance
	(v)		Pairing (**1 2**) (**3 5**) has cost 32 Pairing (**1 3**) (**2 5**) has cost 60 Pairing (**1 5**) (**2 3**) has cost 60 So 169 + 32 = 201 (Special case – correct answer only.)	M1 A1 (B1)	
	(vi)		Need number 3 Minimum connector	M1 A1	

Question			Answer	Marks	Guidance
3	(i)		a represents the volume of feed A in m^3, etc.	M1A1	variables volumes
			Min 250a + 300b + 150c objective	B1	
			st a + b + c = 100 order volume	B1	
			15a + 12b + 10c ≥ 1300 fibre constraint	M1	constraints
			3.5a + 4b + 2c ≥ 300 fat constraint	A1	
			10a + 15b + 10c ≥ 1300 protein constraint		
	(ii)		corresponds to minimum of {100/1, 100/1, 1300/12, 300/4, 1300/15)	B1	
	(iii)&(iv)		P A B C s1 s2 s3 s4 s5 a1 a2 a3 a4 rhs 1 1.5 0 7 0 -1 -1 7 -1 0 0 -8 0 600 0 12.5 0 0 0 0 0 -75 0 0 0 75 0 22500 0 0.125 0 0.5 1 0 0 0.25 0 0 0 -0.25 0 25 0 0.125 0 0.5 0 -1 0 0.25 0 1 0 -0.25 0 25 0 4.5 0 4 0 0 -1 3 0 0 1 -3 0 400 0 0.875 1 0.5 0 0 0 -0.25 0 0 0 0.25 0 75 0 -3.125 0 2.5 0 0 0 3.75 -1 0 0 -3.75 1 175	M1 A1 A1 A1 A1 B1	Use of pivot row to get zeros in B column. infeasibility row objective row equality rows other 3 constraint rows any one of the indicated pivots
	(v)		feasible	B1	
			also optimal	B1	
			cost is £27600	B1	
			$36m^3$ of A, $60m^3$of B and $4m^3$ of C	B1	
			fibre constraint tight	B1	
			protein constraint tight	B1	
			fat constraint slack, with the mix having 3.74% fat content	B1	

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>4</td><td>(a)</td><td>(i)</td><td>Correct</td><td>B1</td><td></td></tr>
<tr><td></td><td></td><td>(ii)</td><td>Incorrect, eg you might have put up your umbrella to keep the sun off your head.</td><td>B1 B1</td><td></td></tr>
<tr><td></td><td></td><td>(iii)</td><td>Correct</td><td>B1</td><td></td></tr>
<tr><td></td><td></td><td>(iv)</td><td>Incorrect, eg other animals might also purr.</td><td>B1 B1</td><td></td></tr>
<tr><td></td><td></td><td>(v)</td><td>Incorrect, eg there may be no snow!</td><td>B1 B1</td><td></td></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td> 
</td><td>B1
B1</td><td>swapping a and b
two negations (this lost if diagram shown with the two negations cancelling out.)</td></tr>
<tr><td></td><td></td><td>(ii)</td><td>
<table>
<tr><td>(a</td><td>⇒</td><td>b)</td><td>⇔</td><td>(~b</td><td>⇒</td><td>~a)</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>1</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td>0</td><td>1</td><td>1</td><td>1</td><td>0</td><td>1</td><td>1</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td><td>0</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td>1</td><td>0</td><td>1</td><td>0</td></tr>
</table>
</td><td>M1

A1
A1</td><td>4 rows, with correct combinations for a & b.
negations correct
implications correct</td></tr>
<tr><td></td><td></td><td>(iii)</td><td>(a ⇒ b) ⇔ ~a ∨ b ⇔ b ∨ ~a ⇔ ~b ⇒ ~a

(special case -1 if assumes what is to be proved)</td><td>B1
B1
B1</td><td>def of ⇒
commutativity
def of ⇒</td></tr>
</table>

Question			Answer	Marks	Guidance
	(c)		Try to re-set the RCCB. If it will not re-set then switch light off and the garage door mechanism off and try to re-set the RCCB. If it re-sets then the problem is either the garage door or the light.	B1	
			Switch on the garage door mechanism. If the RCCB trips then the garage door mechanism has been damaged.	B1	
			If the RCCB does not trip then activate the garage door. If the RCCB trips then the garage door mechanism has been damaged.	B1	
			Whether or not the garage door mechanism has been damaged, switch off the garage door mechanism and re-set the RCCB if necessary and switch on the light. If the RCCB trips then the light control has let water in.	B1	

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