

6(a)

- **One** mark for working, (all four columns P, Q, R and S)
- **One** mark for first four rows of column Z
- **One** mark for second four rows of column Z

			Working space					
A	B	C	P	Q	R	S	Z	
0	0	0	1	1	0	0	1	
0	0	1	1	1	1	1	1	
0	1	0	0	0	1	0	1	
0	1	1	0	0	0	0	0	
1	0	0	1	0	0	0	1	
1	0	1	1	0	1	0	1	
1	1	0	0	1	1	0	1	
1	1	1	0	1	0	0	0	

6(b)(i)

Two marks if no errors present
One mark if only one error present

A \ BC				
	00	01	11	10
0	0	1	1	0
1	0	1	0	1

6(b)(ii)

One mark for each correct loop (**Max 2**)

A \ BC				
	00	01	11	10
0	0	1	1	0
1	0	1	0	1

6(b)(iii)

One mark for each mark point (**Max 2**)

- One correct Boolean term with a + / OR sign
- All Boolean terms and operators correct and no other terms present

$$\bar{A}.C + \bar{B}.C + A.B.\bar{C}$$

6(a)(i)

One mark for each correct loop (**Max 3**)

		AB			
CD		00	01	11	10
	00	0	0	0	0
	01	1	1	1	0
	11	0	1	1	1
	10	0	0	1	1

6(a)(ii)

One mark per mark point (**Max 2**)

MP1 One correct Boolean term with an OR sign

MP2 All three correct Boolean terms connected by OR signs and no other terms present.

$$\bar{A}.\bar{C}.D + B.D + A.C$$

6(b)

One mark for correct use of De Morgan's laws**One** mark for correct use of any other Boolean algebra law

$$X = \overline{A+B+C} + \overline{B+C}$$

$$(X=) \bar{A}.\bar{B}.\bar{C} + \bar{B}.\bar{C} \dots\dots\dots(\text{De Morgan's})$$

$$(X=) \bar{A}.\bar{B}.\bar{C} + B.\bar{C} \dots\dots\dots(\text{Double negation})$$

$$(X=) \bar{C}.(\bar{A}.\bar{B} + B) \dots\dots\dots(\text{Distributive})$$

One mark for correct answer

$$(X=) \bar{C}.(\bar{A} + B) \dots\dots\dots(\text{Redundancy})$$

6(a)	Three marks for all eight correct products and no additional products Two marks for five, six or seven correct products One mark for three or four correct products $(X =) \bar{A} . \bar{B} . \bar{C} . D + \bar{A} . \bar{B} . C . \bar{D} + \bar{A} . B . \bar{C} . D + \bar{A} . B . C . \bar{D} + A . \bar{B} . \bar{C} . D + A . \bar{B} . C . \bar{D} + A . B . \bar{C} . D + A . B . C . \bar{D}$																									
6(b)	Two marks if no errors present One mark if one error present AB CD <table><tr><td></td><td>00</td><td>01</td><td>11</td><td>10</td></tr><tr><td>00</td><td>0</td><td>0</td><td>0</td><td>0</td></tr><tr><td>01</td><td>1</td><td>1</td><td>1</td><td>1</td></tr><tr><td>11</td><td>0</td><td>0</td><td>0</td><td>0</td></tr><tr><td>10</td><td>1</td><td>1</td><td>1</td><td>1</td></tr></table>		00	01	11	10	00	0	0	0	0	01	1	1	1	1	11	0	0	0	0	10	1	1	1	1
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11	0	0	0	0																						
10	1	1	1	1																						
6(c)	One mark for each correct loop (Max 2) AB CD <table><tr><td></td><td>00</td><td>01</td><td>11</td><td>10</td></tr><tr><td>00</td><td>0</td><td>0</td><td>0</td><td>0</td></tr><tr><td>01</td><td>1</td><td>1</td><td>1</td><td>1</td></tr><tr><td>11</td><td>0</td><td>0</td><td>0</td><td>0</td></tr><tr><td>10</td><td>1</td><td>1</td><td>1</td><td>1</td></tr></table>		00	01	11	10	00	0	0	0	0	01	1	1	1	1	11	0	0	0	0	10	1	1	1	1
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10	1	1	1	1																						
6(d)	One mark for each mark point (Max 2) MP1 Any correct relevant Boolean term MP2 Boolean terms with correct operator + and no other terms present $(X =) C . \bar{D} + \bar{C} . D // \bar{C} . D . + C . \bar{D}$																									

7(a)	One mark for every two correct products (Max 3) $(T =) \bar{A}.\bar{B}.\bar{C}.D + \bar{A}.\bar{B}.C.D + A.\bar{B}.\bar{C}.D + A.\bar{B}.C.D + A.B.\bar{C}.D + A.B.C.D$
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7(b)	Two marks if no errors present One mark if one error present AB CD <table><tr><th></th><th>00</th><th>01</th><th>11</th><th>10</th></tr><tr><th>00</th><td>0</td><td>0</td><td>0</td><td>0</td></tr><tr><th>01</th><td>1</td><td>0</td><td>1</td><td>1</td></tr><tr><th>11</th><td>1</td><td>0</td><td>1</td><td>1</td></tr><tr><th>10</th><td>0</td><td>0</td><td>0</td><td>0</td></tr></table>		00	01	11	10	00	0	0	0	0	01	1	0	1	1	11	1	0	1	1	10	0	0	0	0
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7(d)(i)	One mark for each mark point (Max 2) - Any correct Boolean term - Boolean terms and operator correct and no other terms present $(T \Rightarrow) A \cdot D + \bar{B} \cdot D // \bar{B} \cdot D + A \cdot D$
7(d)(ii)	One mark for simplest form (Max 1) $(T \Rightarrow) D \cdot (A \cdot \bar{B})$