

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

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

7(a)

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

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

7(b)

- One** mark for correct answer (terms may be in any order)

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

7(c)	One mark for each mark point - Correct application of De Morgan's laws - Correct application of Idempotent, Distributive or Absorption laws - Correct application of Idempotent, Distributive or Absorption laws - Correct final answer $(\overline{A+B}).(\overline{A.B+B.C})$ $(\overline{A.B}).(\overline{A+B+B.C})$ DeMorgan's laws $(\overline{A.B}).(\overline{A+B+C})$ Idempotent laws $(\overline{A.A+A.B+A.C}).(\overline{B.A+B.B+B.C})$ Distributive laws $(\overline{A+A.B+A.C}).(\overline{A.B+B+B.C})$ Idempotent laws $(\overline{A+A.C}).(\overline{B+B.C})$ Absorption laws $\overline{A.B} // \overline{A+B}$ Absorption laws / Final Answer
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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 $(X =) \bar{A} \cdot \bar{B} \cdot \bar{C} \cdot D + \bar{A} \cdot \bar{B} \cdot C \cdot \bar{D} + \bar{A} \cdot B \cdot \bar{C} \cdot D + \bar{A} \cdot B \cdot C \cdot \bar{D} + A \cdot \bar{B} \cdot \bar{C} \cdot D + A \cdot \bar{B} \cdot C \cdot \bar{D} + A \cdot B \cdot \bar{C} \cdot D + A \cdot B \cdot C \cdot \bar{D}$																									
6(b)	Two marks if no errors present One mark if one error present AB <table border="1"> <tr> <td>CD \</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>	CD \	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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00	0	0	0	0																						
01	1	1	1	1																						
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6(c)	One mark for each correct loop (Max 2) AB <table border="1"> <tr> <td>CD \</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>	CD \	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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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 $(X =) C \cdot \bar{D} + \bar{C} \cdot D // \bar{C} \cdot D + C \cdot \bar{D}$																									

8	One mark per mark point (Max 4) MP1 many instruction formats possible MP2 large instruction set MP3 many addressing modes available MP4 uses variable length/multi-operation instructions MP5 multi-clock cycle instructions MP6 complex decoding of instructions MP7 uses complex circuits MP8 makes frequent use of cache memory MP9 uses programmable control unit // uses micro-programmed control unit // uses hardwired control unit MP10 hardware needs to be able to handle more complex instructions convert into sub-instructions // Design emphasis is on the hardware.
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2	One mark per mark point (Max 4) MP1 low number of instruction formats //low number of instruction sets MP2 uses single-clock cycle instructions MP3 uses fixed length instructions MP4 uses many general-purpose registers MP5 works well with pipelining MP6 hard-wired control unit MP7 makes extensive use of RAM MP8 uses a low number of addressing modes MP9 the design emphasis is on the software.
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