1.(a) $\overline{\overline{A} \cdot B(\overline{C} + \overline{D})} = \overline{\overline{\overline{A}} \cdot B} + \overline{\overline{C} + D} = \overline{\overline{A}} + \overline{B} + \overline{\overline{C}} \cdot \overline{D} = A + \overline{B} + C \cdot \overline{D}$

(b) $\overline{A \cdot B(C \cdot D + E \cdot F)} = \overline{A \cdot B} + \overline{C \cdot D + E \cdot F} = \overline{A} + \overline{B} + \overline{(C \cdot D)}\overline{(E \cdot F)} = \overline{A} + \overline{B} + (\overline{C} + \overline{D})(\overline{E} + \overline{F})$

(c) $\overline{(A + B + \overline{C} + D)} + \overline{A \cdot \overline{B} \cdot C \cdot D} = \overline{A} \cdot \overline{B} \cdot \overline{\overline{C}} \cdot \overline{D} + \overline{A} + \overline{\overline{B}} + \overline{C} + \overline{D} = \overline{A} \cdot \overline{B} \cdot C \cdot \overline{D} + \overline{A} + B + \overline{C} + \overline{D}$

(d) $\overline{\overline{(A + B + \overline{C} + D)(A \cdot \overline{B} \cdot C \cdot D)}} = \overline{\overline{(A + B + \overline{C} + D)}} + \overline{\overline{(A \cdot \overline{B} \cdot C \cdot D)}} = A + B + \overline{C} + D + A \cdot \overline{B} \cdot C \cdot D$

(e) $\overline{\overline{A \cdot B}(C \cdot D + E \cdot \overline{F})(A \cdot B + \overline{C \cdot D})} = \overline{\overline{A \cdot B}} + \overline{C \cdot D + E \cdot \overline{F}} + \overline{\overline{A \cdot B + C \cdot D}} = A \cdot B + \overline{(C \cdot D)}\overline{(E \cdot \overline{F})} +$

$\overline{(\overline{A \cdot B})}\overline{(C \cdot D)} = A \cdot B + (\overline{C} + \overline{D})(\overline{E} + F) + A \cdot B \cdot C \cdot D$

2.(a)

Inputs			Outputs
A	B	C	X
0	0	0	0
0	0	1	1
0	1	0	1
0	1	1	1
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	1

(b)

Inputs			Outputs
A	B	C	X
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	0
1	0	0	0
1	0	1	0
1	1	0	0
1	1	1	1

(c)

Inputs			Outputs
A	B	C	X
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	1
1	1	0	1
1	1	1	1

(d)

Inputs			Outputs
A	B	C	X
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	1
1	1	0	1
1	1	1	1

(e)

Inputs			Outputs
A	B	C	X
0	0	0	0
0	0	1	1
0	1	0	1
0	1	1	1
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	0

3.(a)B·C+D·E(B·C+D·E)=B·C+(D·E)(B·C)+(D·E)(D·E)=B·C+D·E

(b)$B \cdot C(\overline{C} \cdot D + C \cdot E) = B \cdot (C \cdot \overline{C}) \cdot D + B \cdot (C \cdot C) \cdot E = B \cdot 0 \cdot D + B \cdot C \cdot E = B \cdot C \cdot E$

(c)$B + C[B \cdot D + (C + \overline{D})E] = B + C \cdot B \cdot D + C \cdot C \cdot E + C \cdot \overline{D} \cdot E = B + B \cdot C \cdot D + C \cdot E + C \cdot \overline{D} \cdot E = B + C \cdot E$

4.(a)

CD / AB	00	01	11	10
00			1	
01			1	1
11	1	1	1	1
10	1	1	1	1

from the Karnaugh map, the minimum SOP form is A+C·D+B·C

(b)

CD / AB	00	01	11	10
00				
01	1	1		
11			1	1
10				

from the Karnaugh map, the minimum SOP form is $\overline{A} \cdot B \cdot \overline{C} + A \cdot B \cdot C$

(c) $(\overline{A} \cdot \overline{B} + A \cdot \overline{B})(C \cdot D + C \cdot \overline{D}) = \overline{A} \cdot \overline{B} \cdot C \cdot D + A \cdot \overline{B} \cdot C \cdot D + \overline{A} \cdot \overline{B} \cdot C \cdot \overline{D} + A \cdot \overline{B} \cdot C \cdot \overline{D}$

CD / AB	00	01	11	10
00			1	1
01				
11				
10			1	1

from the Karnaugh map, the minimum SOP form is $\overline{B} \cdot C$

(d)

CD / AB	00	01	11	10
00	1	1	1	1
01	1			1
11	1			1
10	1	1	1	1

from the Karnaugh map, the minimum SOP form is $\overline{D} + \overline{B}$

(e) $\overline{A} \cdot B(\overline{C} \cdot \overline{D} + \overline{C} \cdot D) + A \cdot B(\overline{C} \cdot \overline{D} + \overline{C} \cdot D) + A \cdot \overline{B} \cdot \overline{C} \cdot D = \overline{A} \cdot B \cdot \overline{C} \cdot \overline{D} + \overline{A} \cdot B \cdot \overline{C} \cdot D + A \cdot B \cdot \overline{C} \cdot \overline{D} + A \cdot B \cdot \overline{C} \cdot D + A \cdot \overline{B} \cdot \overline{C} \cdot D$

CD / AB	00	01	11	10
00				
01	1	1		
11	1	1		
10		1		

from the Karnaugh map, the minimum SOP form is $B \cdot \overline{C} + A \cdot \overline{C} \cdot D$

5.(a)

C / AB	0	1
00	0	0
01		
11		0
10		

from the Karnaugh map, the minimum POS form is $(A + B)(\overline{A} + \overline{B} + \overline{C})$

(b)

C / AB	0	1
00		
01	0	0
11	0	
10	0	

from the Karnaugh map, the minimum POS form is $(\overline{A} + C)(A + \overline{B})$

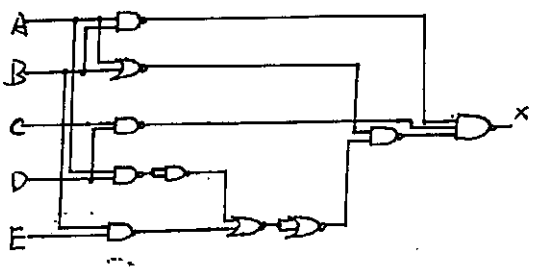
(c)

AB \ C	0	1
00	0	0
01	0	0
11	0	
10	0	0

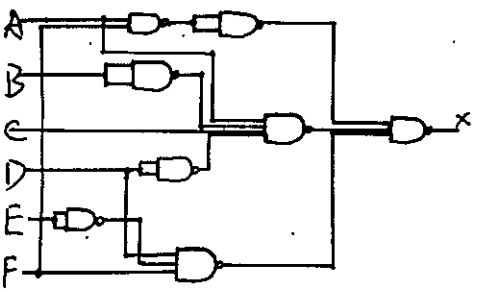
from the Karnaugh map, the minimum POS form is $A \cdot B \cdot C$

6.(a) $\overline{A} + \overline{A} \cdot B + A \cdot C$ (b) $\overline{\overline{A} \cdot B + \overline{A} \cdot C \cdot D + D \cdot B \cdot \overline{D}}$

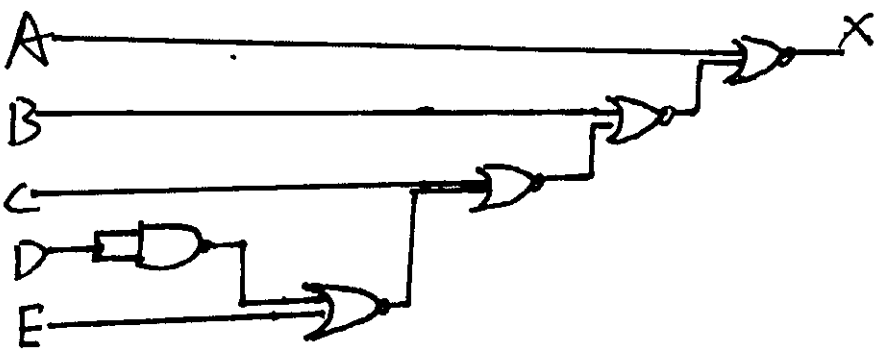
7.(a)



(b)

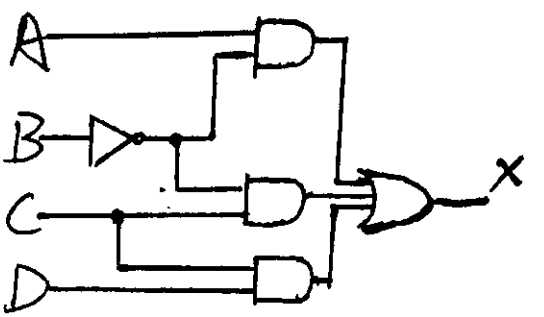


(c)



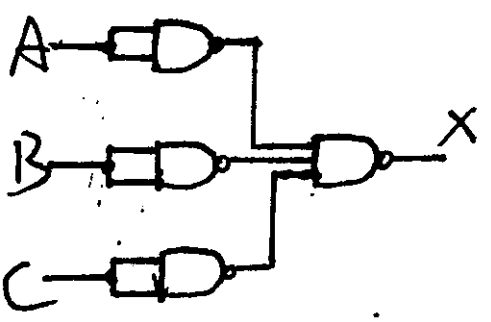
8.

AB \ CD	00	01	11	10
00			1	1
01			1	
11			1	
10	1	1	1	1

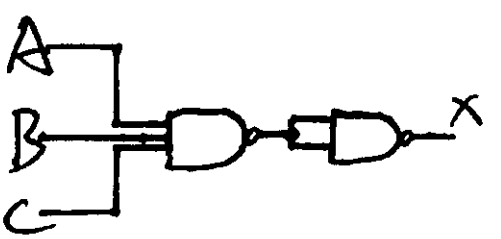


from the Karnaugh map, the minimum SOP form is $A \cdot \overline{B} + CD + C\overline{B}$

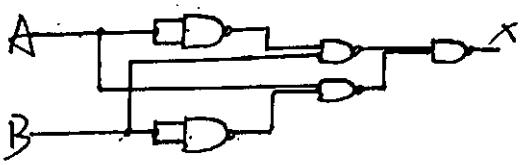
9.(a)



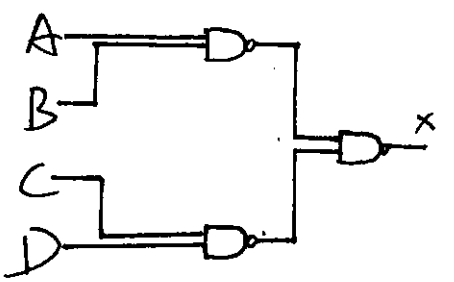
(b)



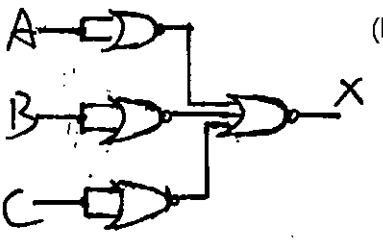
(c)



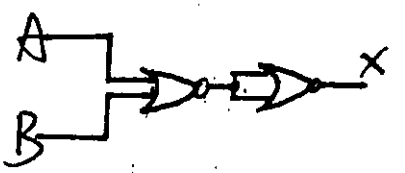
(d)



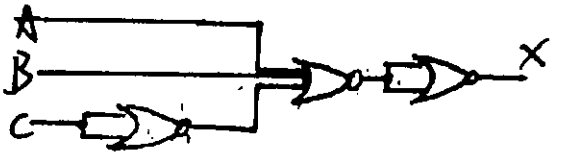
10.(a)



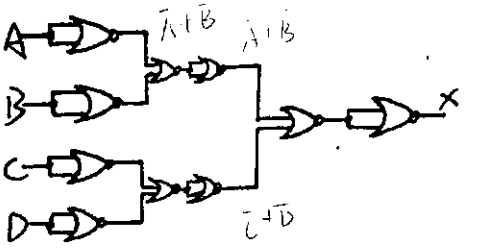
(b)



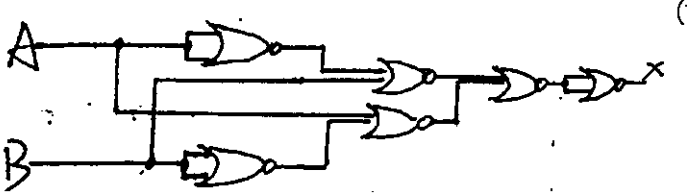
(c)



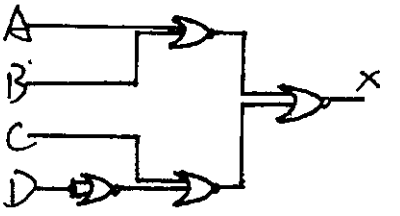
(d)



(e)



(f)



(g)