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DSM - FISAC

1. Design a two bit multiplier using 74138 IC's and minimum universal gate.

→ Let A_1 A_0 be one number and B_1 B_0 be second number and $F_3 F_2 F_1 F_0$ be output.

A_1	A_0	B_1	B_0	F_3	F_2	F_1	F_0
0	0	0	0	0	0	0	0
0	0	0	1	0	0	0	0
0	0	1	0	0	0	0	0
0	0	1	1	0	0	0	0
0	1	0	0	0	0	0	0
0	1	0	1	0	0	0	1
0	1	1	0	0	0	1	0
0	1	1	1	0	0	1	1
1	0	0	0	0	0	0	0
1	0	0	1	0	0	1	0
1	0	1	0	0	1	0	0
1	0	1	1	0	1	1	0
1	1	0	0	0	0	0	0
1	1	0	1	0	0	1	1
1	1	1	0	0	1	1	0
1	1	1	1	1	0	0	1

F_2:-

0	0	0	0
0	0	0	0
0	0	0	1
0	0	1	1

$F_2 = \pi(10, 11, 14)$

F_1:-

0	0	0	0
0	0	1	1
0	1	0	1
0	1	1	0

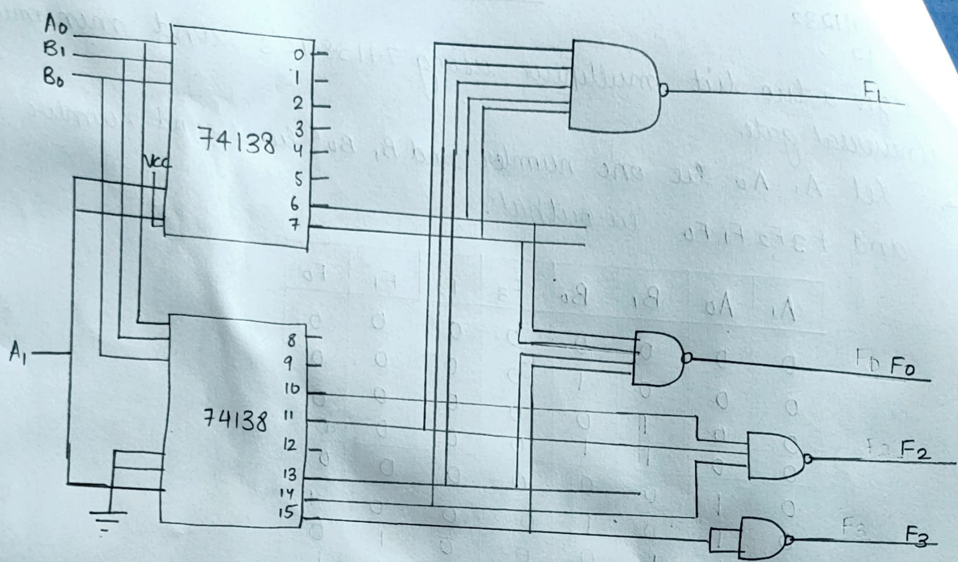
$F_1 = \pi(6, 7, 13, 14, 9, 11)$

F_0:-

0	0	0	0
0	1	1	0
0	1	1	0
0	0	0	0

$F_0 = (6, 7, 13, 15)$

$F_3 = A_1 A_0 B_1 B_0 = \overline{\bar{A_1} + \bar{A_0} + \bar{B_1} + \bar{B_0}}$



2. Design 2-bit magnitude comparator using active high output decoders and minimum universal gates.

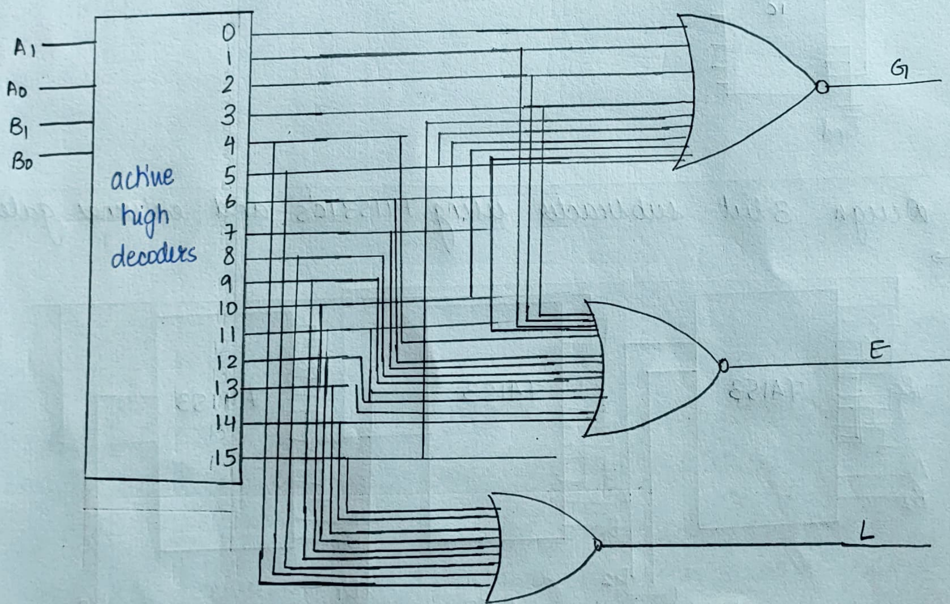
→

A_1	A_0	B_1	B_0	G	E	L
0	0	0	0	0	1	0
0	0	0	1	0	0	1
0	0	1	0	0	0	1
0	0	1	1	0	0	1
0	1	0	0	1	0	0
0	1	0	1	0	1	0
0	1	1	0	0	0	1
0	1	1	1	0	0	1
1	0	0	0	1	0	0
1	0	0	1	1	0	0
1	0	1	0	0	1	0
1	0	1	1	0	0	1
1	1	0	0	1	0	0
1	1	0	1	1	0	0
1	1	1	0	1	0	0
1	1	1	1	0	1	0

$G = \sum(4,8,9,12,13,14) = \sum\overline{(0,1,2,3,5,6,7,10,11,15)}$

$E = \sum(0,5,10,15) = \sum\overline{(1,2,3,4,6,7,8,9,11,12,13,14)}$

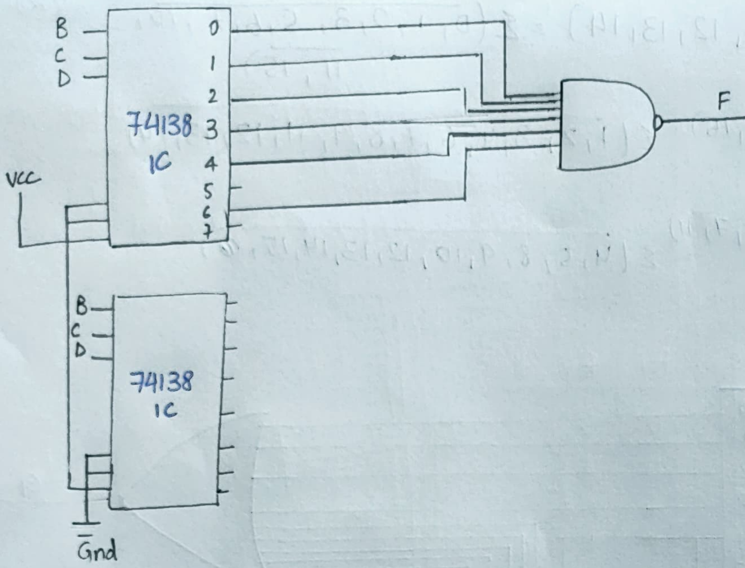
$L = \sum(1,2,3,6,7,11) = \sum\overline{(4,5,8,9,10,12,13,14,15)}$



3 Implement the function $F = (A'BD + AB'C' + A)$ using decoder and minim
external gates.

→ $F = (A'BD + AB'C' + A)$

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



4. Design 3 bit subtractor using 74153 IC's and external gates

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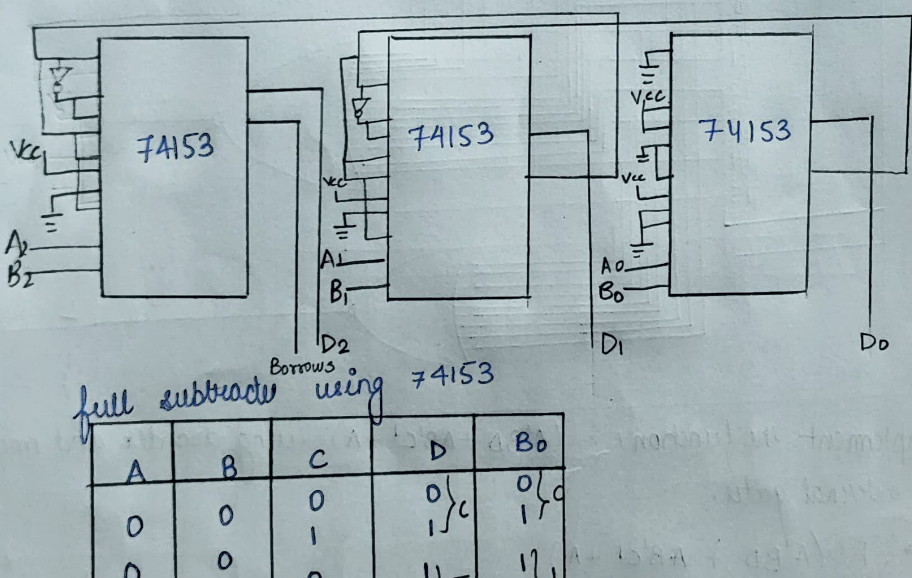


full subtractor using 74153

A	B	C	D	Bo
0	0	0	0 } c	0 } c
0	0	1	1	1
0	1	0	1 } $\bar{c}$	1 } 1
0	1	1	0	1
1	0	0	1 } $\bar{c}$	0 } 0
1	0	1	0	0
1	1	0	0 } c	0 } c
1	1	1	1	1

Write the function (minterms) realised using following circuit. (3)

w	x	y	z	F
0	0	0	0	0
0	0	0	1	0
0	0	1	0	1
0	0	1	1	1
0	1	0	0	1
0	1	0	1	0
0	1	1	0	0
0	1	1	1	1
1	0	0	0	1
1	0	0	1	0
1	0	1	0	0
1	0	1	1	1
1	1	0	0	0
1	1	0	1	0
1	1	1	0	1
1	1	1	1	1

$F(w, x, y, z) = \pi(0,1,5,6,9,10,12,13)$

6. Design a BCD adder to add two single digit decimal numbers represented in excess-3 code the result also in excess-3

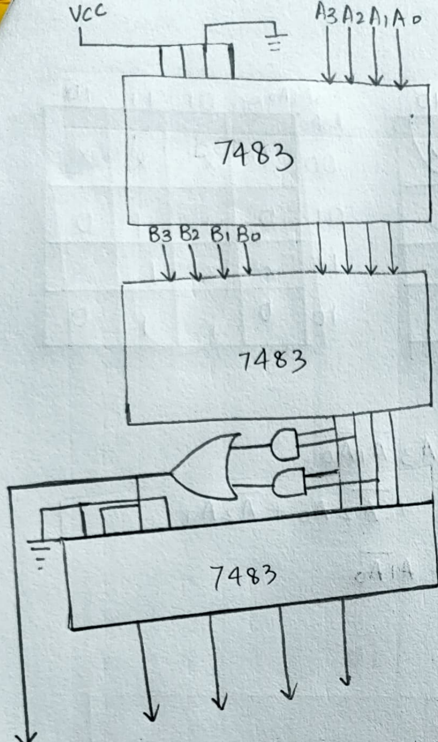
→ let one number represented as $A_3 A_2 A_1 A_0$ and let Bbe represented as $B_3 B_2 B_1 B_0$ in excess 3 code. result is represented in ex-3 and bcd i.e. $A + B + 3$ in excess 3

C	S_3	S_2	S_1	S_0	P
0	0	0	0	0	0
0	0	0	0	1	0
0	0	0	1	0	0
0	0	0	1	1	0
0	0	1	0	0	0
0	0	1	0	1	0
0	0	1	1	0	0
0	0	1	1	1	0
0	1	0	0	0	0
0	1	0	0	1	0
0	1	0	1	0	1
0	1	0	1	1	1
0	1	1	0	0	1
0	1	1	0	1	1
0	1	1	1	0	1
0	1	1	1	1	1
1	0	0	0	1	1

for sum > 15, carry will be one and we need adder so we can take $S_3 S_2 S_1 S_0$ and find p and c for p directly

$S_3S_2 \backslash S_1S_0$	00	01	11	10
00	0	0	0	0
01	0	0	0	0
11	1	1	1	1
10	0	0	1	1

$P = S_3 S_2 + S_3 S_1 + C$



7 Design a code converter that converts a decimal digit from 84-2-1 code to BCD

→ Truth Table

A_3	A_2	A_1	A_0	F_3	F_2	F_1	F_0
0	0	0	0	0	0	0	0
0	0	0	1	x	x	x	x
0	0	1	0	x	x	x	x
0	0	1	1	x	x	x	x
0	1	0	0	0	1	0	0
0	1	0	1	0	0	1	1
0	1	1	0	0	0	1	0
0	1	1	1	0	0	0	1
1	0	0	0	1	0	0	0
1	0	0	1	0	1	1	1
1	0	1	0	0	1	1	0
1	0	1	1	0	1	0	1
1	1	0	0	x	x	x	x
1	1	0	1	x	x	x	x
1	1	1	0	x	x	x	x
1	1	1	1	1	0	0	1

$A_3A_2 \backslash A_1A_0$	00	01	11	10
00	0	X	X	X
01	0	0	0	0
11	X	X	1	X
10	1	0	0	0

$A_3A_2 \backslash A_1A_0$	00	01	11	10
00	0	X	X	X
01	1	0	0	0
11	X	X	0	X
10	0	1	1	1

$A_3A_2 \backslash A_1A_0$	00	01	11	10
00	0	X	X	X
01	0	1	1	0
11	X	X	1	X
10	0	1	1	0

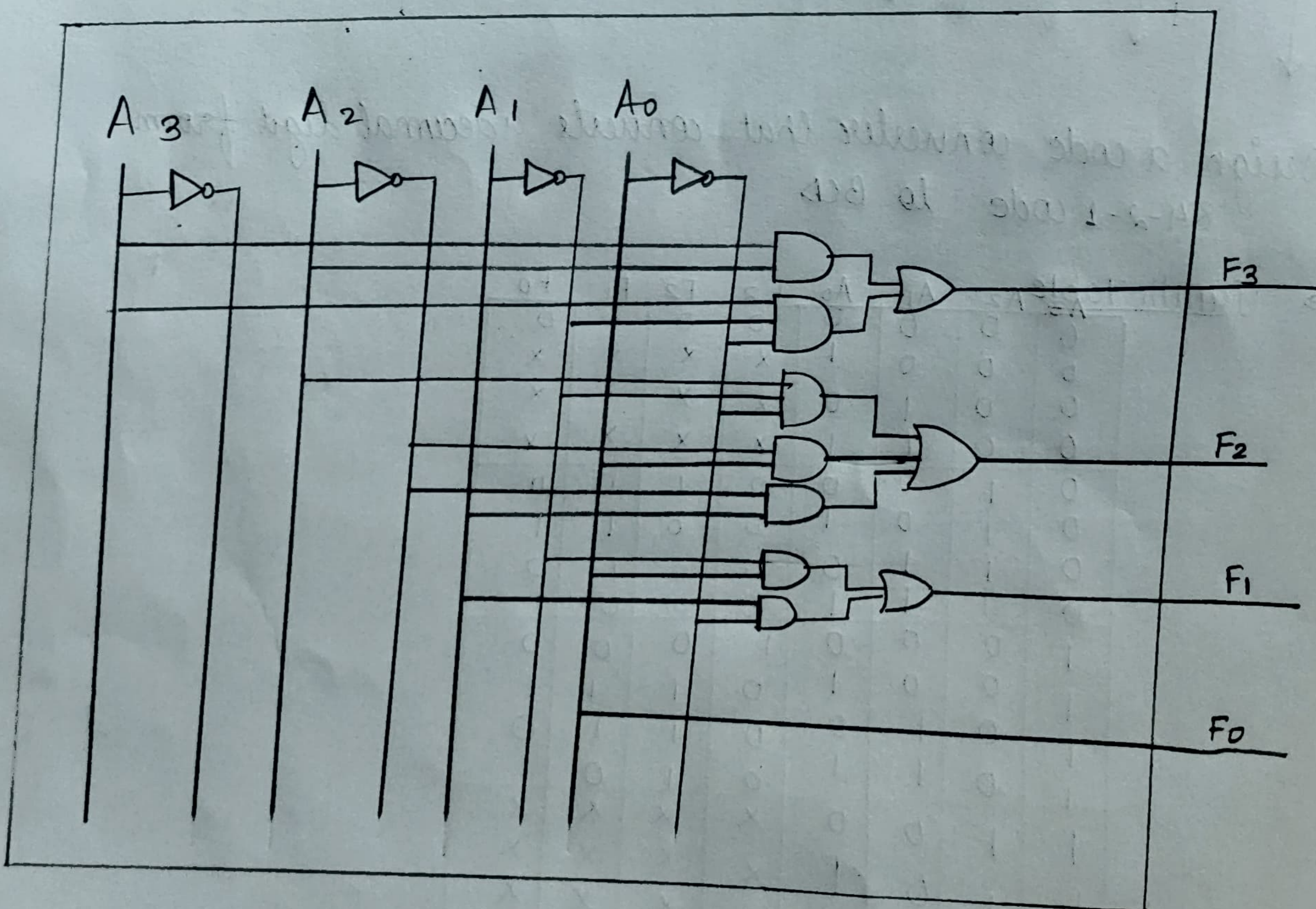
$A_3A_2 \backslash A_1A_0$	00	01	11	10
00	0	X	X	X
01	0	1	0	1
11	X	X	0	X
10	0	1	0	X

$F_3 = A_3A_2 + A_3\bar{A}_1\bar{A}_0$

$F_2 = A_2\bar{A}_1\bar{A}_0 + \bar{A}_2A_0 + \bar{A}_2A_1$

$F_1 = \bar{A}_1A_0 + A_1\bar{A}_0$

$F_0 = A_0$



use truth table and K-Maps design the BCD to seven segment decoder using minimum number of gates. The six invalid combinations should result in a blank display. 5

A	B	C	D	a	b	c	d	e	f	g
0	0	0	0	1	1	1	1	1	1	0
0	0	0	1	0	1	1	0	0	0	0
0	0	1	0	1	1	0	1	1	0	1
0	0	1	1	1	1	1	1	0	0	1
0	1	0	0	0	1	1	0	0	1	1
0	1	0	1	1	0	1	1	0	1	1
0	1	1	0	1	0	1	1	1	1	1
0	1	1	1	1	1	1	0	0	0	0
1	0	0	0	1	1	1	1	1	1	1
1	0	0	1	1	1	1	1	0	1	1
1	0	1	0	0	0	0	0	0	0	0
1	0	1	1	0	0	0	0	0	0	0
1	1	0	0	0	0	0	0	0	0	0
1	1	0	1	0	0	0	0	0	0	0
1	1	1	0	0	0	0	0	0	0	0
1	1	1	1	0	0	0	0	0	0	0

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

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

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

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

$A = (\bar{A}+\bar{B})(\bar{A}+\bar{C})(\bar{B}+C+D)(\bar{A}+B+C+\bar{D})$

$b = \bar{A}\bar{B} + \bar{B}\bar{C} + \bar{A}\bar{C}\bar{D} + \bar{A}CD$

$c = \bar{A}B + \bar{B}\bar{C} + \bar{A}D$

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

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

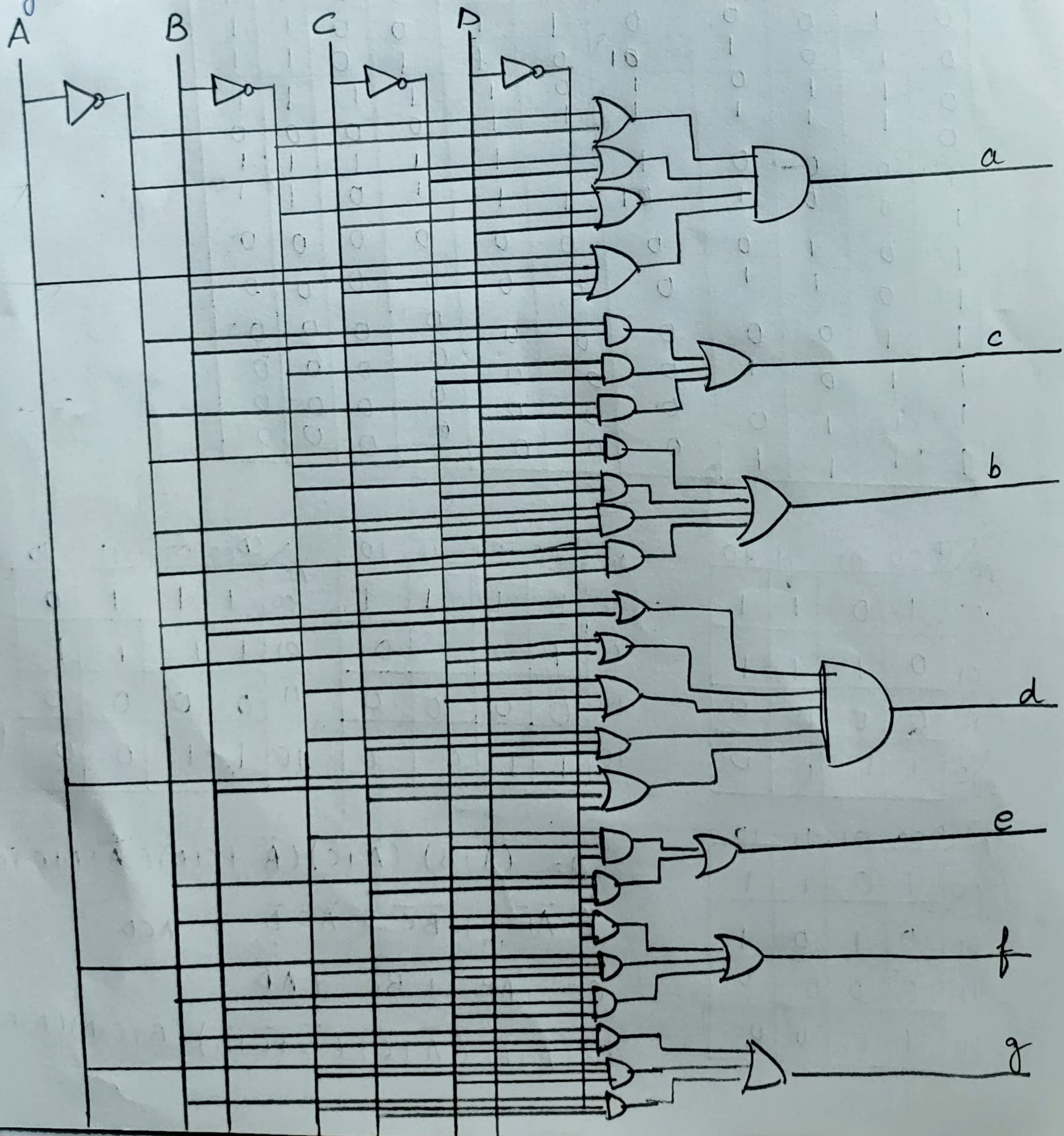
AB \ CD	00	01	11	10
00	1	0	0	0
01	1	1	0	1
11	0	0	0	0
10	1	1	0	0

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

$e = \bar{B}\bar{C}\bar{D} + \bar{A}C\bar{D}$

$f = \bar{A}\bar{C}\bar{D} + A\bar{B}\bar{C} + \bar{A}B\bar{C} + \bar{A}B\bar{D}$

$g = \bar{A}B\bar{C} + A\bar{B}\bar{C} + \bar{A}\bar{B}C + \bar{A}C\bar{D}$



Truth table

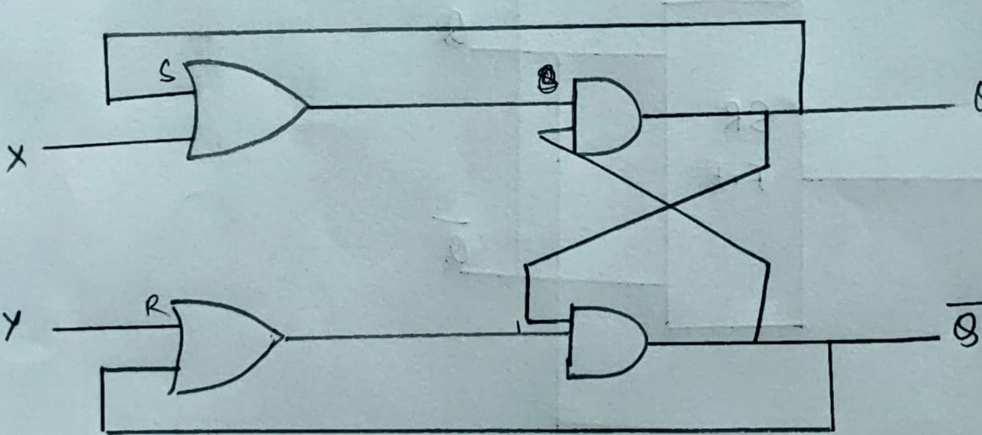
X	Y	Q(t)	Q(t+1)	Set	Reset
0	0	0	1	0	1
0	0	1	0	1	0
0	1	0	1	0	1
0	1	1	1	X	1
1	0	0	0	1	X
1	0	1	0	1	0
1	1	0	0	1	X
1	1	1	1	X	1

x \ yQ	00	01	11	10
0	0	1	X	0
1	1	1	1	X

set = $X + Q$

x \ yQ	00	01	11	10
0	1	0	1	1
1	X	0	X	1

reset = $\bar{Q} + Y$



10. Convert the SR flip flop to XY flip flop.

x	Y	Q(t)	Q(t+1)	S	R
0	0	0	1	1	0
0	0	1	0	0	1
0	1	0	1	1	0
0	1	1	1	X	0
1	0	0	0	0	X
1	0	1	0	0	1
1	1	0	0	0	X
1	1	1	1	X	0

x \ yQ	00	01	11	10
0	1	0	X	1
1	0	0	X	0

S \ yQ	00	01	11	10
0	0	1	0	0
1	X	1	0	X