Comparators Circuit

A_1	A_0	B_1	B_0	$A>B$	$A<B$	$A=B$
0	0	0	0	0	0	1
0	0	0	1	0	1	0
0	0	1	0	0	1	0
0	0	1	1	0	1	0
0	1	0	0	1	0	0
0	1	0	1	0	0	1
0	1	1	0	0	1	0
0	1	1	1	0	1	0
1	0	0	0	1	0	0
1	0	0	1	1	0	0
1	0	1	0	0	0	1
1	0	1	1	0	1	0
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	0	1

K-MAP

A>B

A<B

A=B

Equations

A > B

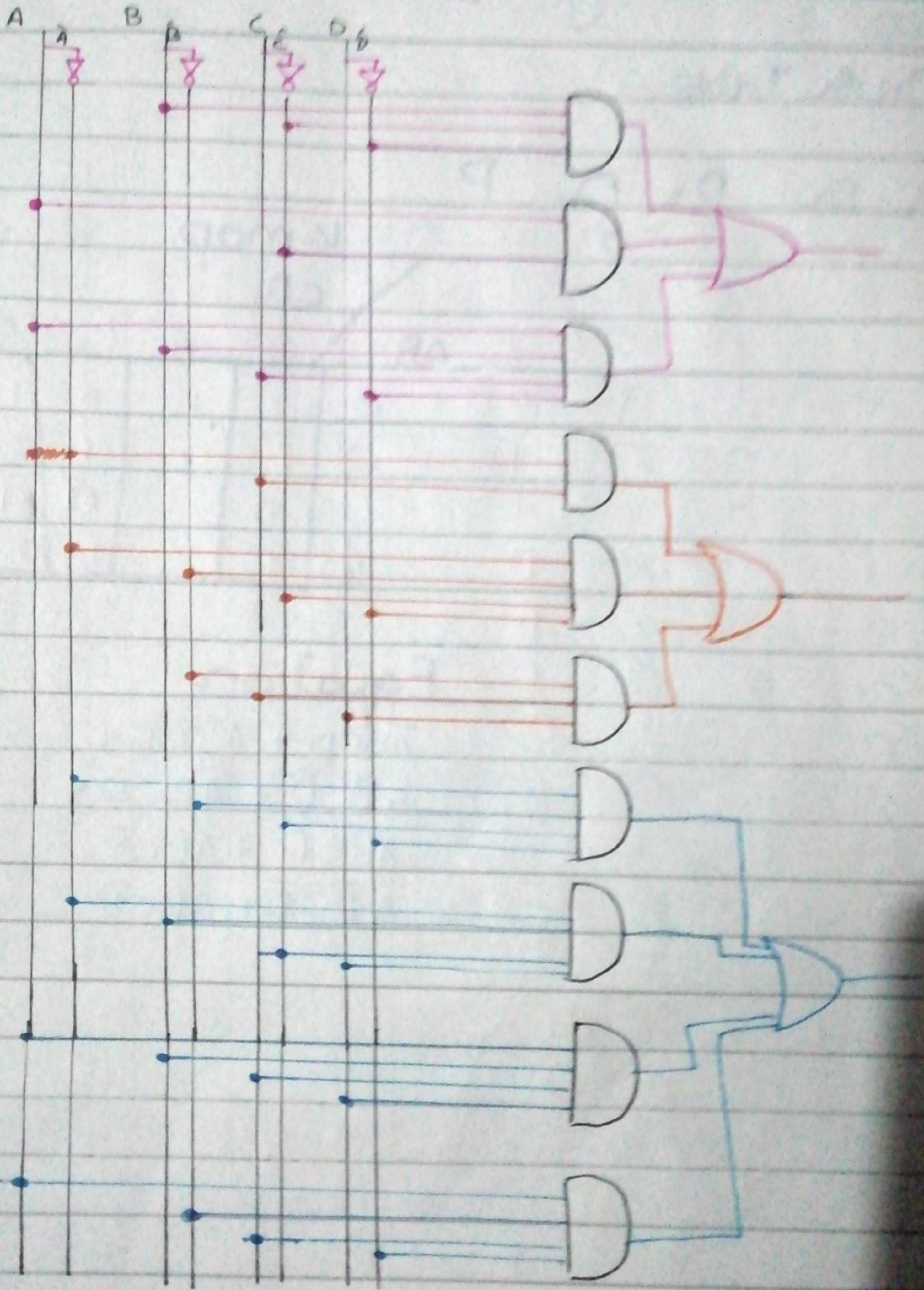$$= \bar{B}\bar{C}\bar{D} + A\bar{C} + ABC\bar{D}$$

A < B

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

A = B

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

Circuit

A   B   C   D

Q1
Adjacent 1's detector function

A	B	C	D	P
0	0	0	0	0
0	0	0	1	0
0	0	1	0	0
0	0	1	1	1
0	1	0	0	0
0	1	0	1	0
0	1	1	0	1
0	1	1	1	1
1	0	0	0	0
1	0	0	1	0
1	0	1	0	0
1	0	1	1	1
1	1	0	0	1
1	1	0	1	1
1	1	1	0	1
1	1	1	1	1

K- map

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

equation:
$$P(A,B,C,D) = AB + CD + BC$$

Circuit:
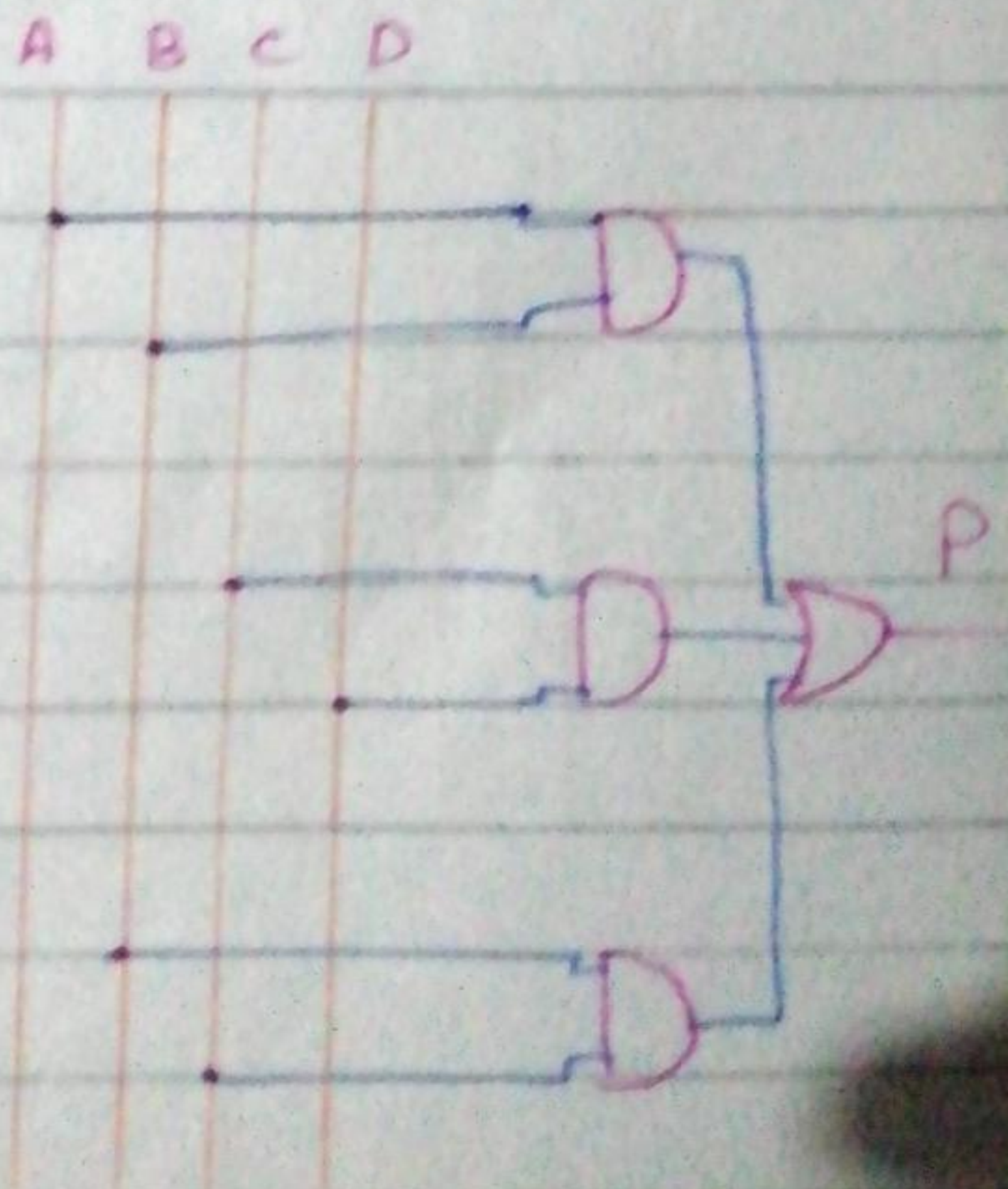
B) Adjacent 0 detector

i) K-Map : (POS)

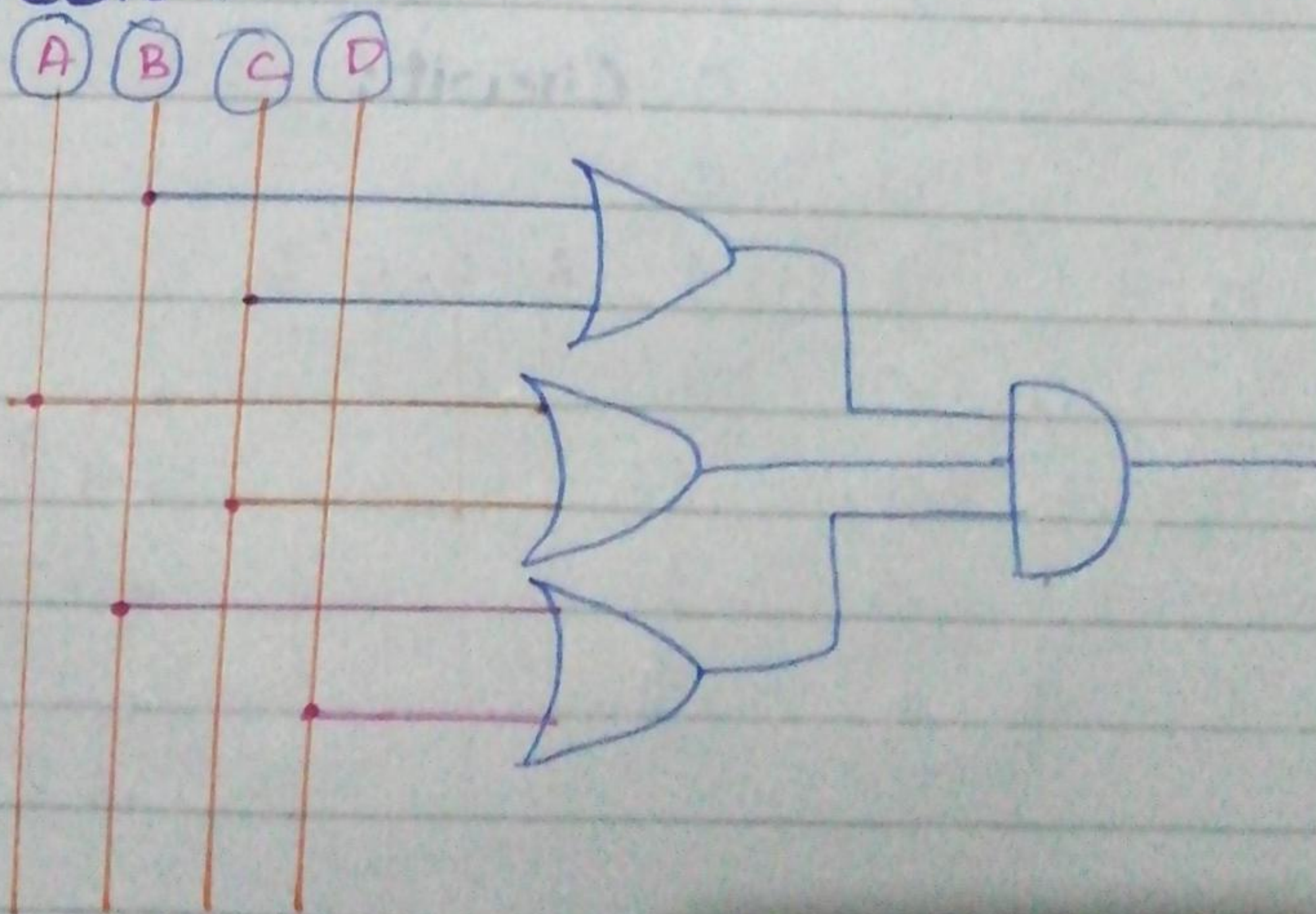|	00	01	11	10
00	0	0	1	0
01	0	0	1	0
11	1	1	1	1
10	0	0	1	0
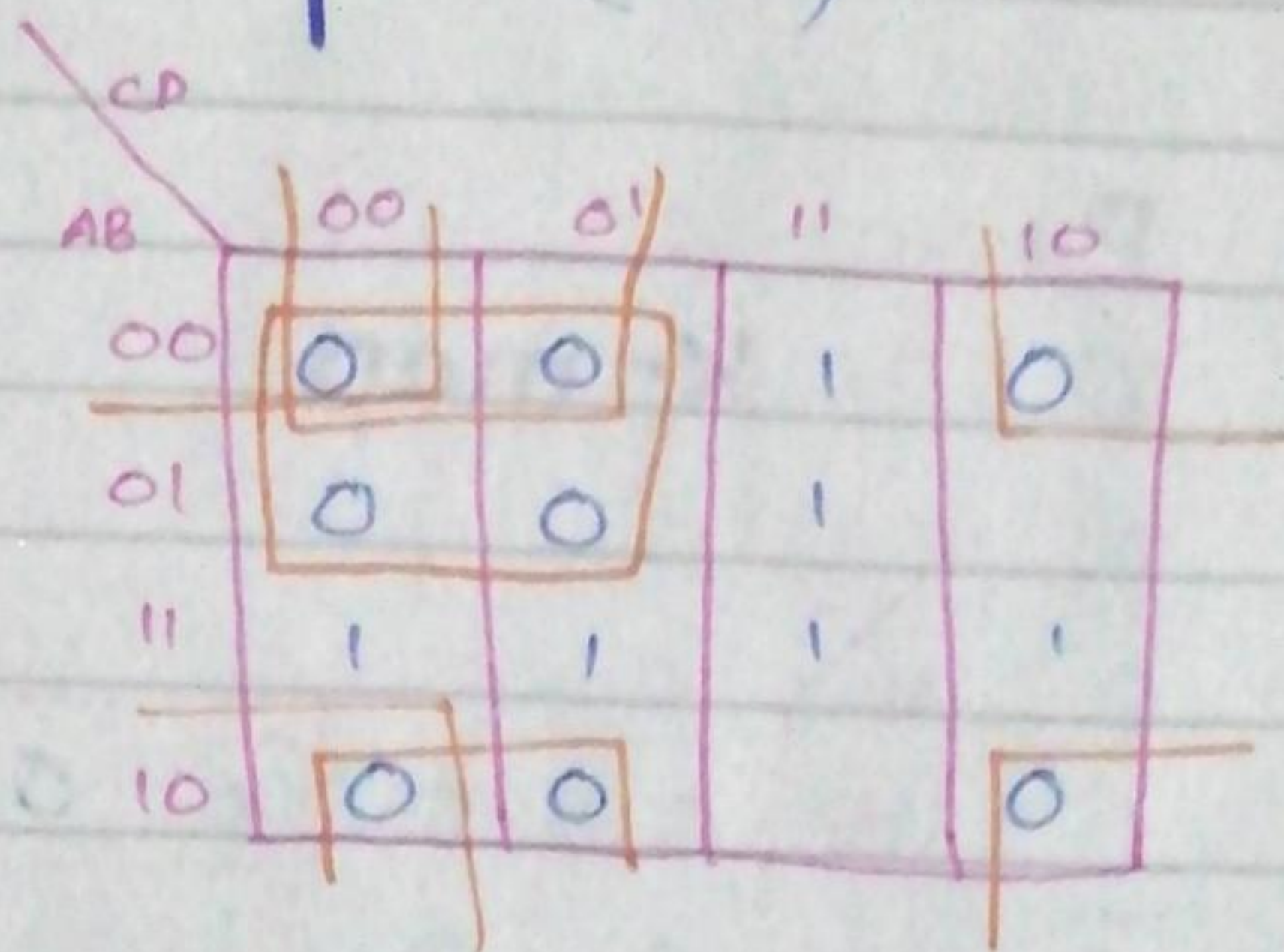
Equation:

$$F(A,B,C,D) = (B+C) \cdot (A+C) \cdot (B+D)$$

Circuit :

USING NAND GATE

A   B   C   D
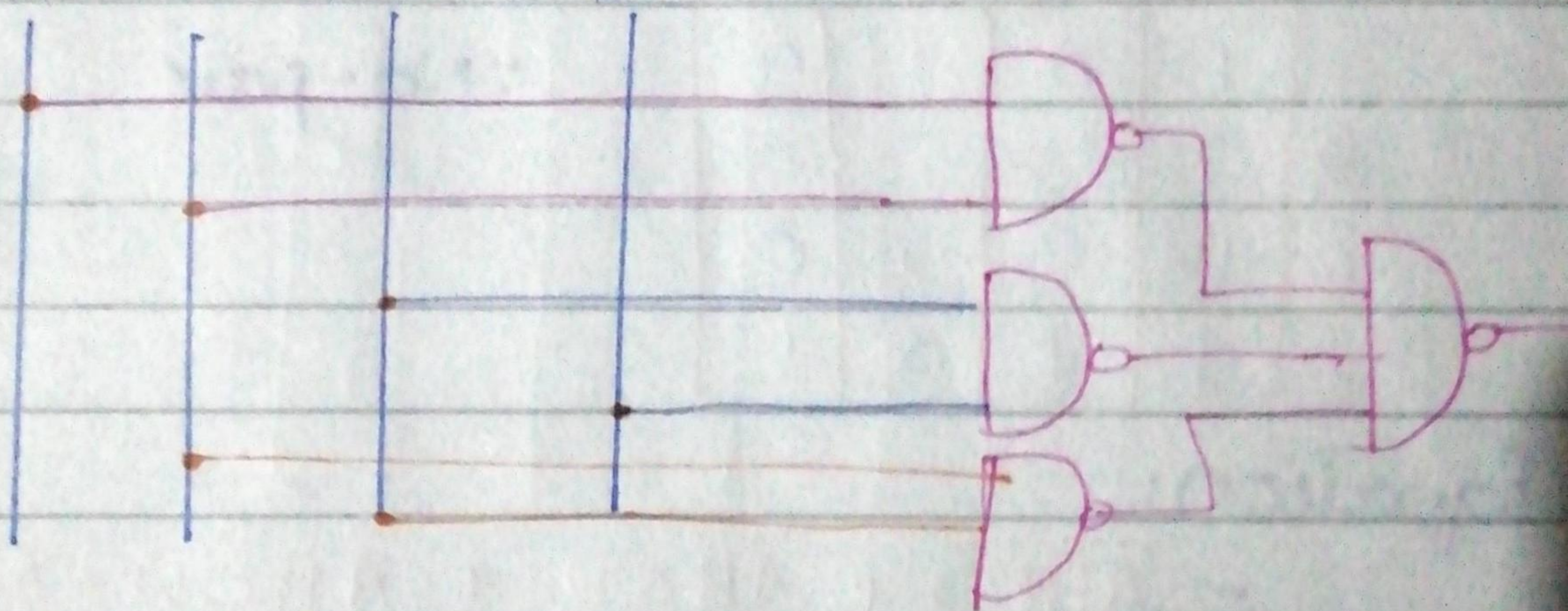
Even Parity Bit

Q2
Truth Table

D_1	D_2	D_3	D_4	P
0	0	0	0	0
0	0	0	1	1
0	0	1	0	1
0	0	1	1	0
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	1
1	1	1	0	1
1	1	1	1	0

K-map

CD

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

Equation

$$\bar{A}\bar{B}\bar{C}D + \bar{A}\bar{B}C\bar{D} +$$
$$\bar{A}B\bar{C}\bar{D} + \bar{A}BCD +$$
$$A B\bar{C}D + ABC\bar{D} +$$
$$A\bar{B}\bar{C}\bar{D} + A\bar{B}CD$$

Circuit

A   B   C   D