Q1a)

YZ

WX   00   01   11   10

	00	01	11	10
00	1	1	1	X
01	X	0	1	0
11	0	1	X	0
10	1	X	0	1

Essential prime implicants: W'X', X'Z'
minterms 7 and 13 can be covered in multiple ways:
m7 can be covered using W'YZ or XYZ
m13 can be covered using WY'Z or WXZ

F1= W'X' + X'Z' + W'YZ + WY'Z

Q1b)

YZ

WX   00   01   11   10

	00	01	11	10
00	1	1	1	X
01	X	0	1	0
11	0	1	X	0
10	1	X	0	1

(selecting zeros) Essential Prime implicants: (X'+Z), (W+X'+Y)
maxterm 11 can be covered in two ways: (W'+Y'+Z') or (W'+X+Z')

F2= (X'+Z) (W+X'+Y)(W'+X+Z')

F1 = =∑m(0,1,2,3,7,8,9,10,13) ≠ F2=∏ M(4,5,6,9,11,12,14)= ∑m(0,1,2,3,7,8,10,13,15)

It does not have to be equivalent due to different don't cares being used.

Q2.

	A	B	C	D	X	Y	Z
0	0	0	0	0	1	1	1
1	0	0	0	1	0	0	0
2	0	0	1	0	0	0	0
3	0	0	1	1	1	0	0
4	0	1	0	0	0	1	0
5	0	1	0	1	0	0	0
6	0	1	1	0	1	0	0
7	0	1	1	1	0	0	1
8	1	0	0	0	0	1	0
9	1	0	0	1	1	0	0
10	1	0	1	0	0	0	0
11	1	0	1	1	0	0	0
12	1	1	0	0	1	1	0
13	1	1	0	1	0	0	0
14	1	1	1	0	0	0	1
15	1	1	1	1	1	0	0

X   CD

AB

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

$X = A'B'C'D' + A'B'CD + A'BCD' + ABC'D' + ABCD + AB'C'D$
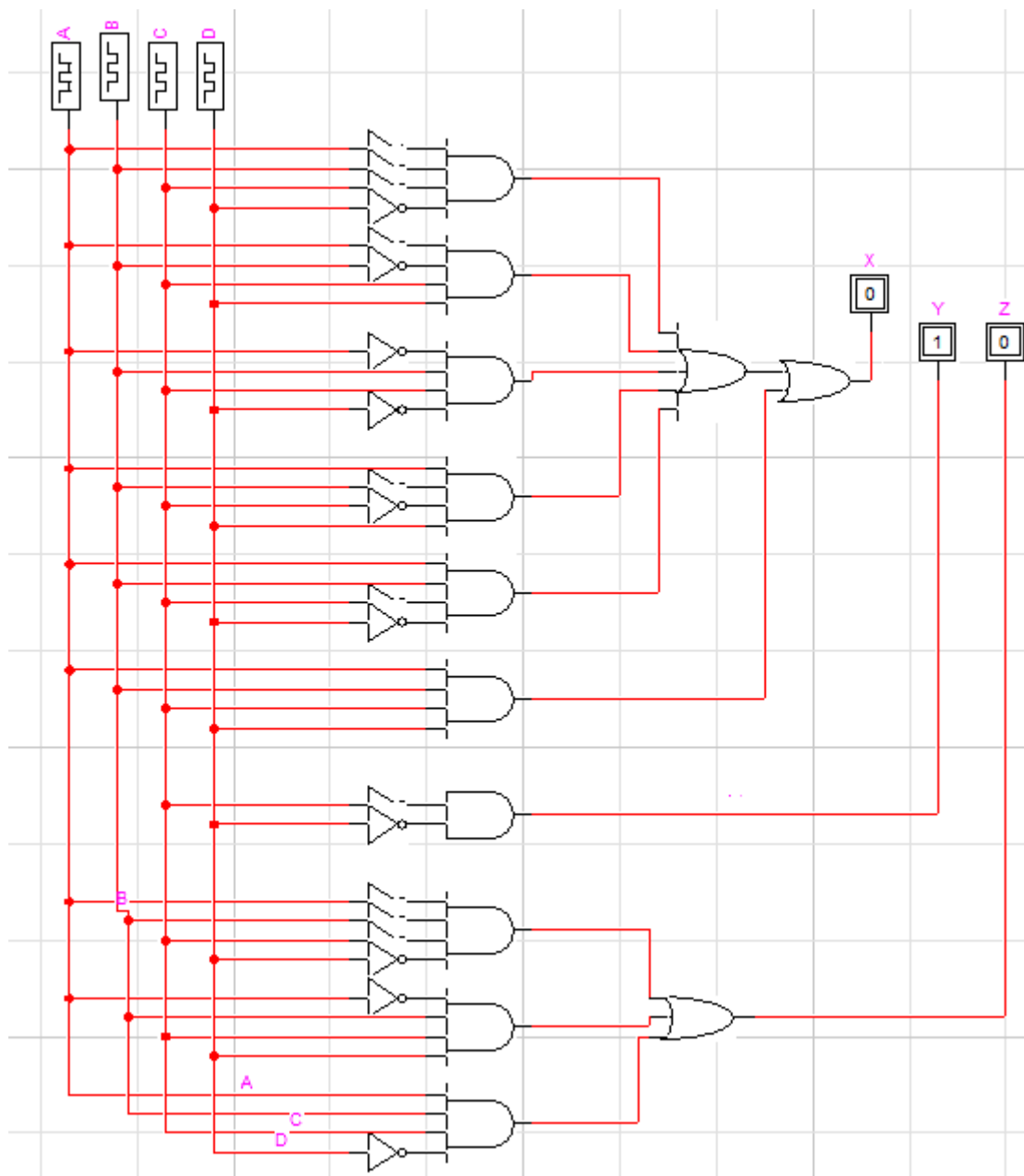$= A'B'(C \text{ XOR } D)' + BC(A \text{ XOR } D)' + AC'(B \text{ XOR } D)$

Y   CD

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

$Y = C'D'$

Z   CD

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

$Z = A'B'C'D' + A'BCD + ABCD'$
$= BC(A \text{ XOR } D) + A'B'C'D'$
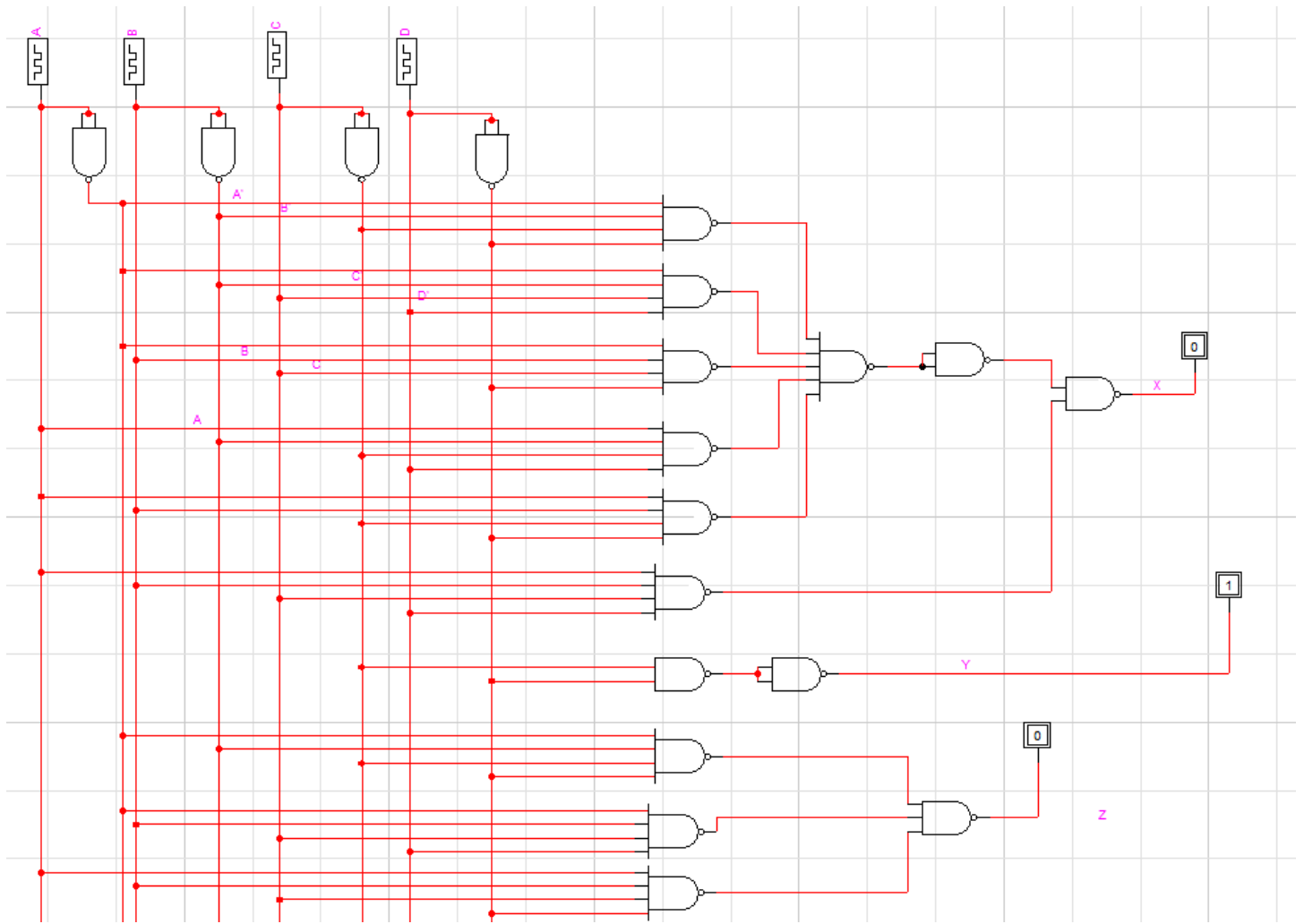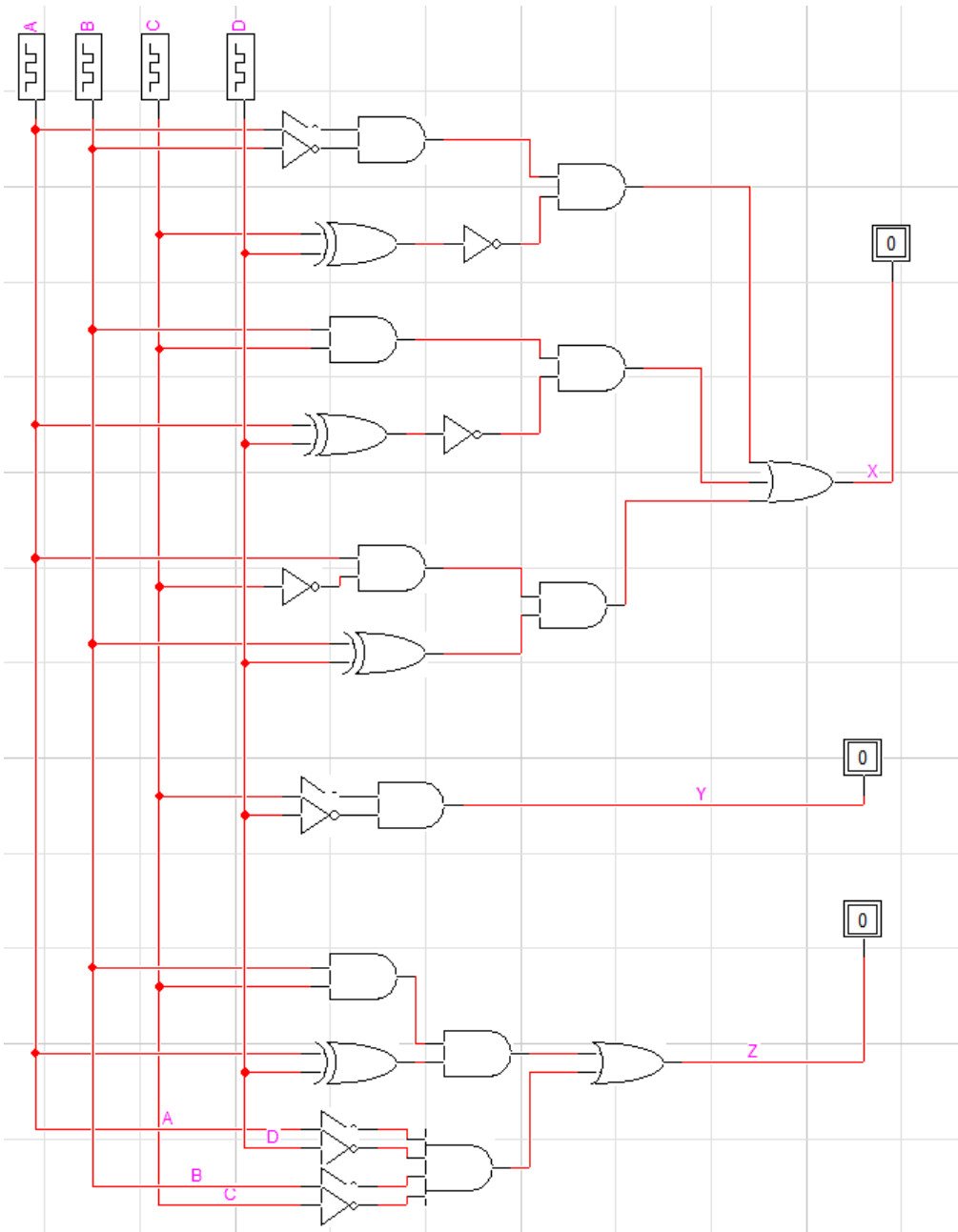
Q3

X	Y	Cin	Cout	S
0	0	0	0	0
0	0	1	0	1
0	1	0	0	1
0	1	1	1	0
1	0	0	0	1

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

When X=0
Let Y=A, Cin=B
Cout = AB --------------------------------AND gate

When X=1
Let Y=A, Cin=B
Cout = A+B -----------------------------OR gate

When X=0, Y=1 (Or X=1, Y=0)
Let Cin = A
S= A' --------------------------------------NOT gate

So a full adder can be a universal Device