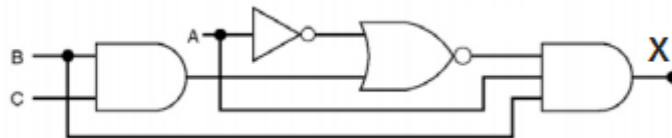# TUTORIAL 5: Combinational Logic Circuit

1. Draw the logic circuit for the following using only **2-input AND gates**, **2-input OR gates** and **inverters.**

    a. $(A\overline{B}C + D\overline{E})$

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

    c. $(\overline{A} + \overline{B} + \overline{C})(\overline{D} + \overline{E} + F)$

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

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

2. Convert the circuits in Question 1a, 1b, and 1d, using only **NAND** gates.

3. Convert the circuits in Question 1c and 1e, using only **NOR** gates.

4. Convert the following circuit to NAND only then prove that the converted circuit is the same as the original circuit.
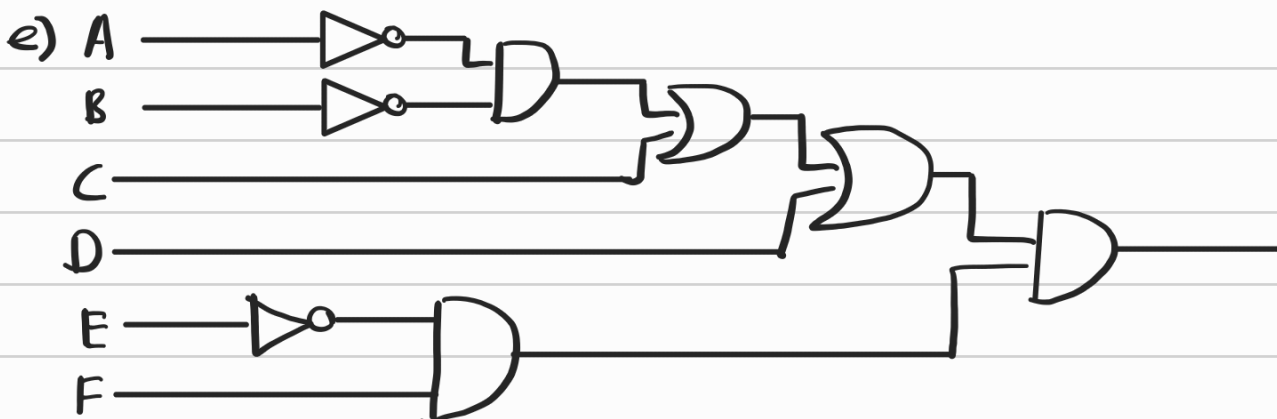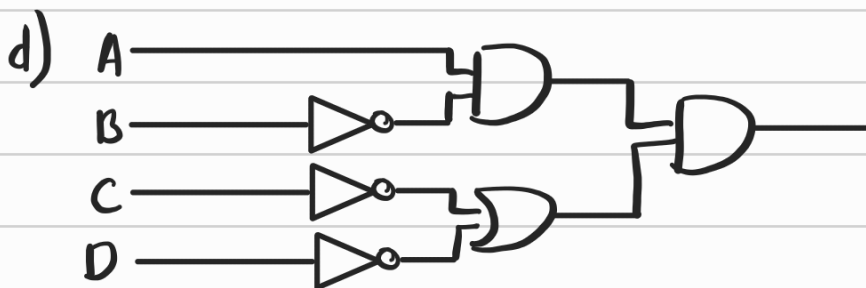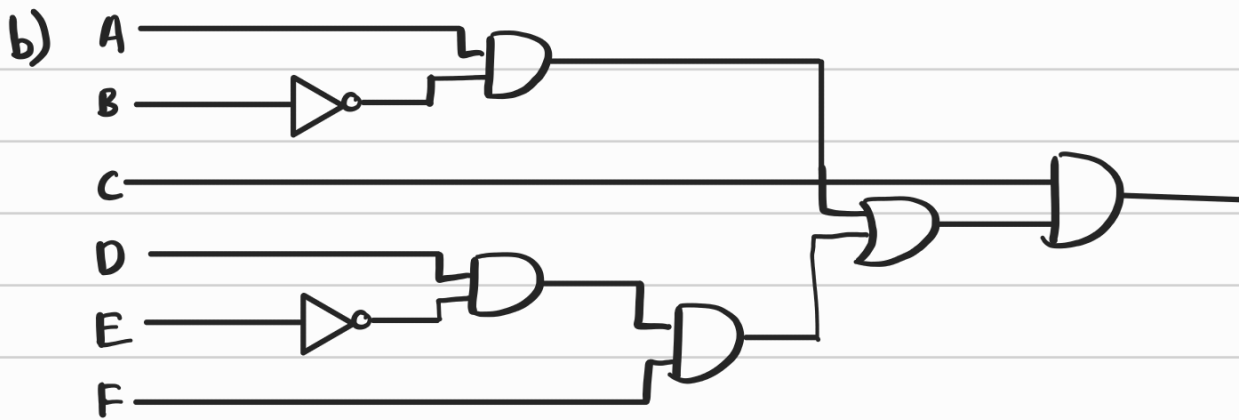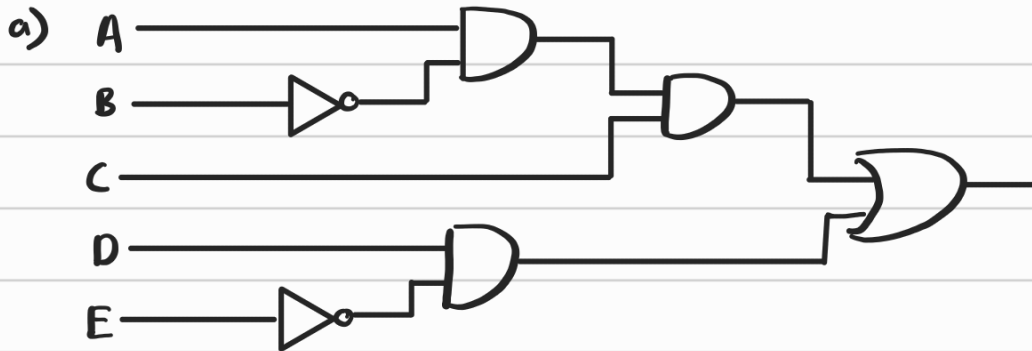

5. Referring to truth table below, draw the circuit to implement the function using

    i) AND-OR

    ii) AND-OR-Invert

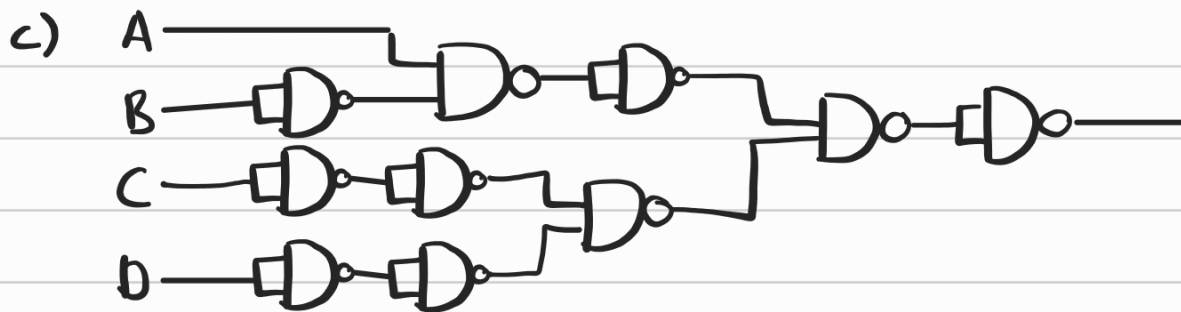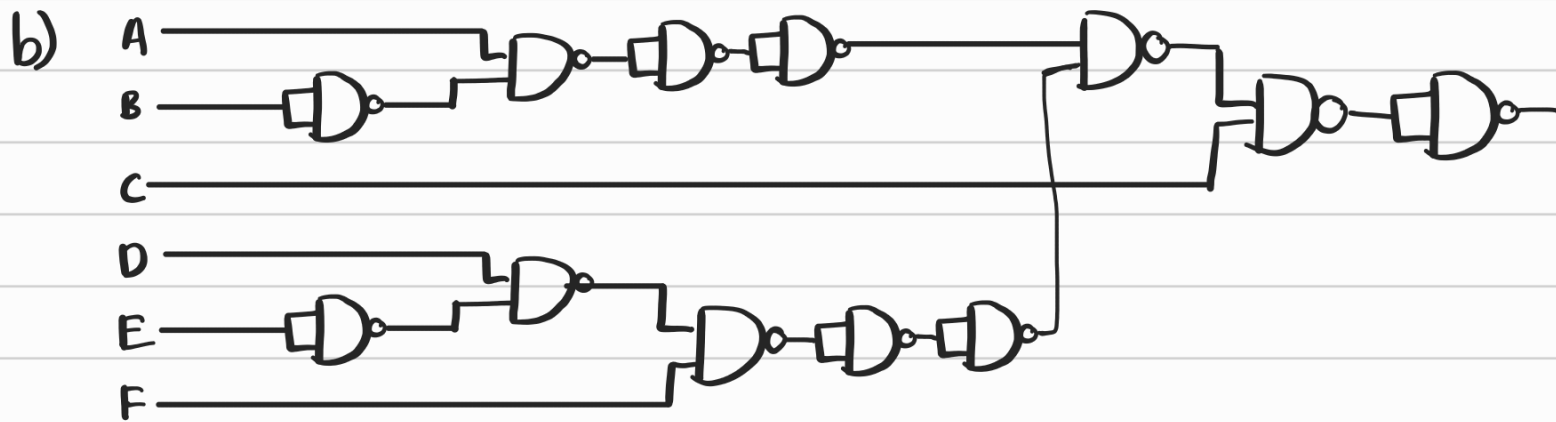| Inputs			Output
A	B	C	X
0	0	0	1
0	0	1	0
0	1	0	1
0	1	1	0
1	0	0	1
1	0	1	0
1	1	0	1
1	1	1	1

1. Draw the logic circuit for the following using only **2-input AND gates**, **2-input OR gates** and **inverters**.

   a. $(A\overline{B}C + D\overline{E})$
   b. $(D\overline{E}F + A\overline{B})C$
   c. $(\overline{A} + \overline{B} + \overline{C})(\overline{D} + \overline{E} + \overline{F})$
   d. $A\overline{B}(\overline{C} + \overline{D})$
   e. $(\overline{AB} + C + D)\overline{E}F$

a)

b)

d)

e)

2. Convert the circuits in Question 1a, 1b, and 1d, using only **NAND** gates.

a)

b)

c)

3. Convert the circuits in Question 1c and 1e, using only **NOR** gates.

5. Referring to truth table below, draw the circuit to implement the function using
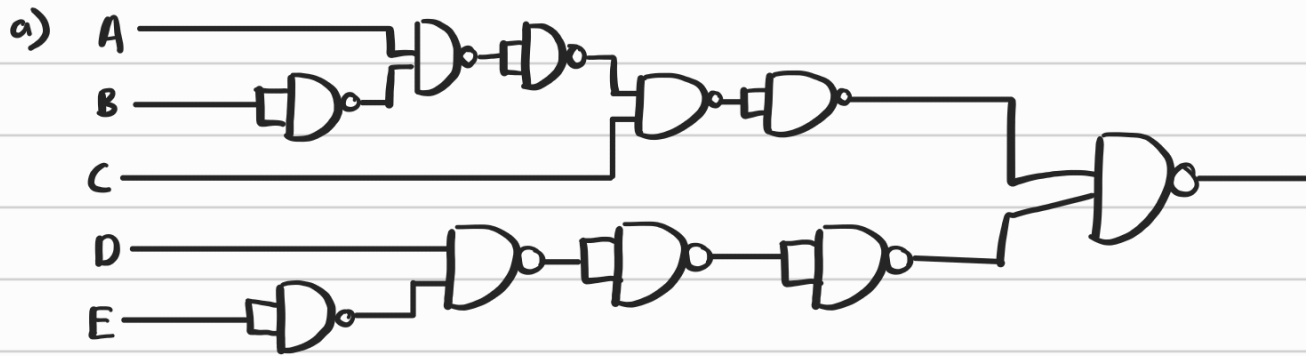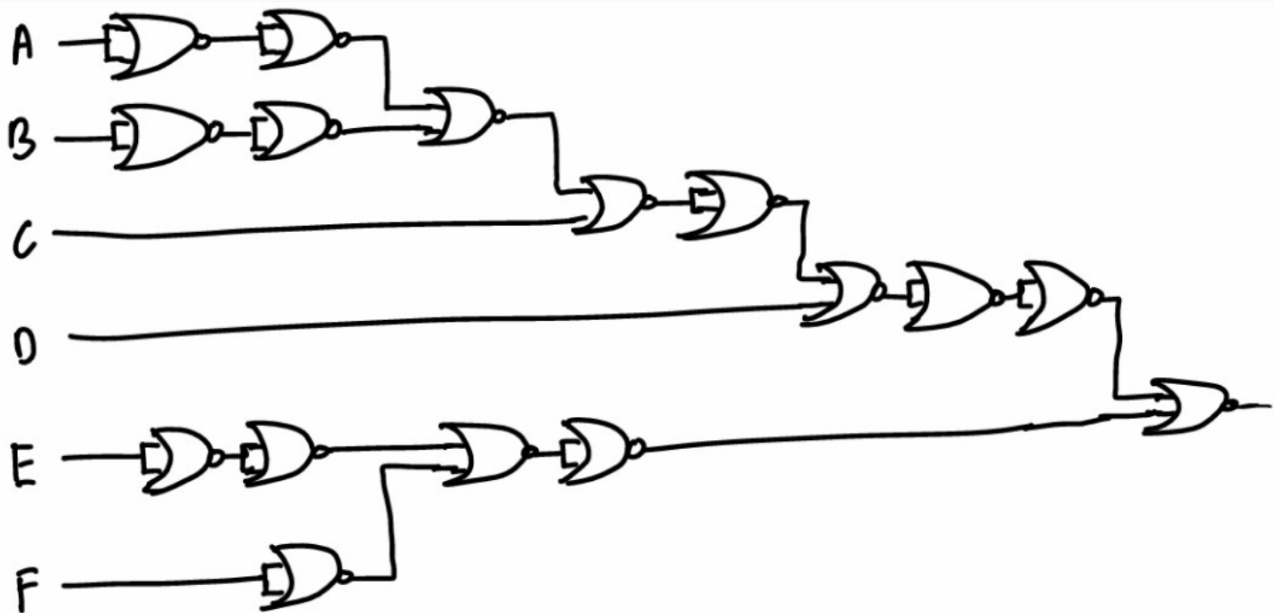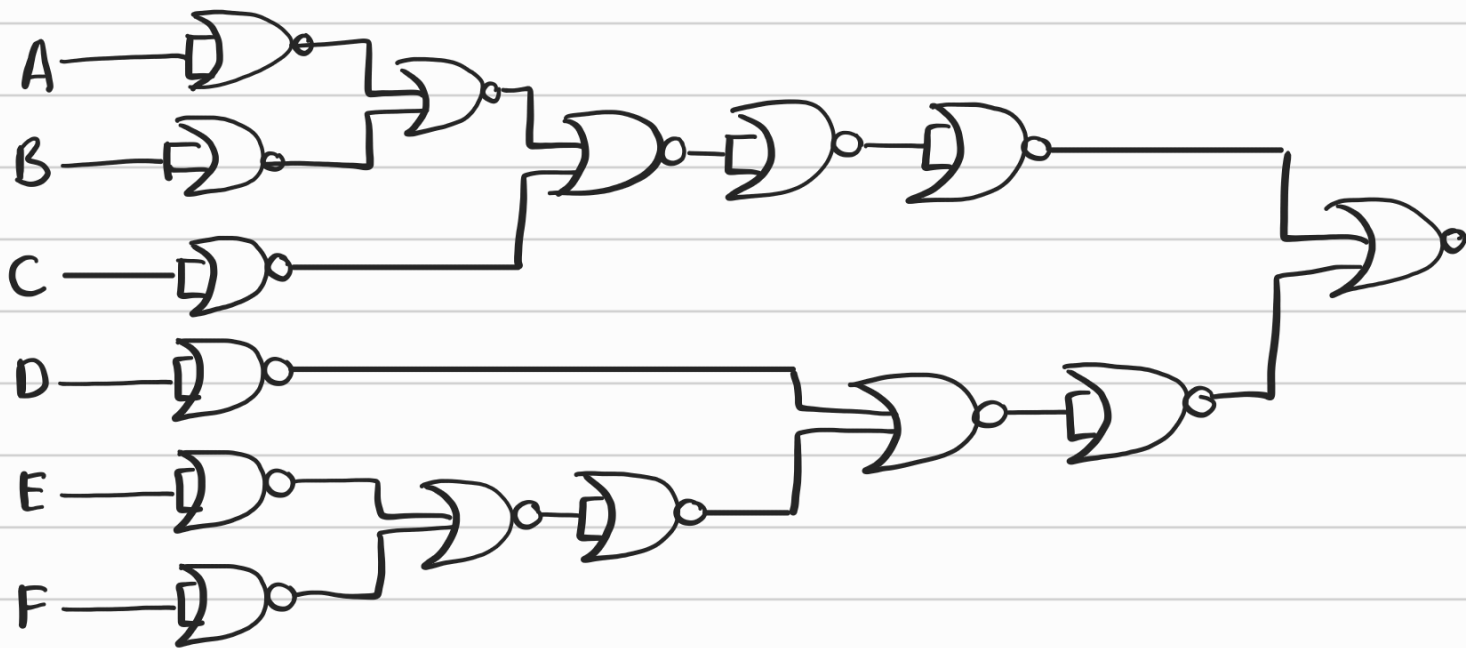
    i) AND-OR

    ii) AND-OR-Invert

Inputs			Output
A	B	C	X
0	0	0	1
0	0	1	0
0	1	0	1
0	1	1	0
1	0	0	1
1	0	1	0
1	1	0	1
1	1	1	1

i)

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

$$X = \overline{C} + AB$$

ii)