**CMSC 130 – Logic Design and Digital Computer Circuits**
Handout # 6: ANALYSIS OF COMBINATIONAL CIRCUITS

Derivation of Boolean Functions From a Logic Diagram

1. Label all gate outputs that are a function of input variables with arbitrary symbols.

2. Label the gates that are a function of input variables and previously labeled gates with different arbitrary symbols. Find the boolean functions for these gates.

3. Repeat step 2 until the outputs of the circuits are obtained in terms of the input variables.
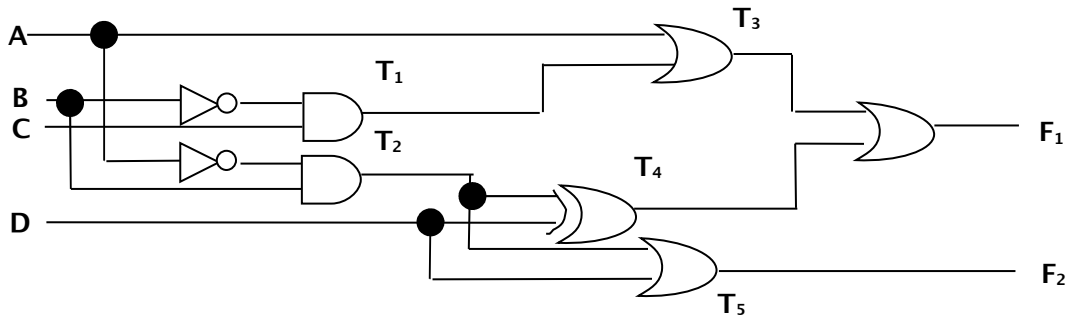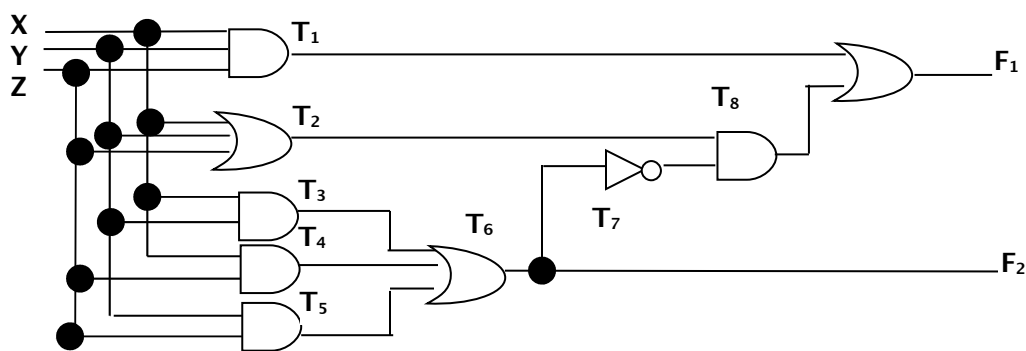

Logic Diagram 1

Boolean Functions:

$T_1 = B'C$
$T_2 = A'B$
$T_3 = A + T_1 \quad = A + B'C$
$T_4 = T_2 \text{ xor } D = (A'B) \text{ xor } D$
$T_5 = T_2 + D \quad = A'B + D$
$F_1 = T_3 + T_4 \quad = A + B'C + (A'B) \text{ xor } D$
$F_2 = T_5 \quad\quad = A'B + D$

Derivation of the Truth table

1. Determine the number of input variables in the circuit. List binary numbers 0 to 2^n – 1, where n = number of inputs.

2. Label the outputs of selected gates with arbitrary symbols.

3. Obtain the truth table for the outputs of those gates that are a function of the input variables only.

4. Proceed to obtain the truth table for the outputs of those gates that are a function of previously defined values until the columns for all the outputs are determined.

Logic Diagram 2

Truth Table:

X	Y	Z	T1	T2	T3	T4	T5	T6	T7	T8	F1	F2
0	0	0	0	0	0	0	0	0	1	0	0	0
0	0	1	0	1	0	0	0	0	1	1	1	0
0	1	0	0	1	0	0	0	0	1	1	1	0
0	1	1	0	1	0	0	1	1	0	0	0	1
1	0	0	0	1	0	0	0	0	1	1	1	0
1	0	1	0	1	0	1	0	1	0	0	0	1
1	1	0	0	1	1	0	0	1	0	0	0	1
1	1	1	1	1	1	1	1	1	0	0	1	1