Lecture 5

Simplification using Boolean Algebra:

Using Boolean Algebra techniques, simplify the following expressions:

i. AB + A(B+C) + B(B+C)

Solution:
AB+ A(B+C) + B(B+C)
= AB+AB+AC+ BB+BC [applying distributive law]
= AB+AB+AC+B+BC [∵ BB=B]
= AB+AC+B+BC [∵ AB+AB=AB]
= AB+AC+B [∵B+BC=B]
=B+AC [∵AB+B=B]

Ans: B+AC

ii. $[A\overline{B}(C+BD)+\overline{A}\overline{B}]C$

Solution:
$[A\overline{B}(C+BD)+\overline{A}\overline{B}]C$
$= (A\overline{B}C+A\overline{B}BD+\overline{A}\overline{B})C$ [applying distributive law]
$= (A\overline{B}C+A.0.D+\overline{A}\overline{B})C$ [$\because B\overline{B}=0$]
$= (A\overline{B}C+0+\overline{A}\overline{B})C$
$= (A\overline{B}C+\overline{A}\overline{B})C$
$= A\overline{B}CC+\overline{A}\overline{B}C$ [applying distributive law]
$= A\overline{B}C+\overline{A}\overline{B}C$ [$\because CC=C$]
$= \overline{B}C(A+\overline{A})$
$= \overline{B}C.1$ [$\because A+\overline{A}=1$]
$=\overline{B}C$

Ans: $\overline{B}C$

*See this type of examples from book.

Boolean Functions:

A Boolean function is an expression formed with binary variables, the two binary operators OR and AND, the unary operator NOT, parentheses, and equal sign.

For a given value of the variables, the function can be either 0 or 1.

Example: ***i. Implement $F_2 = x + y'z$ with basic gates.***

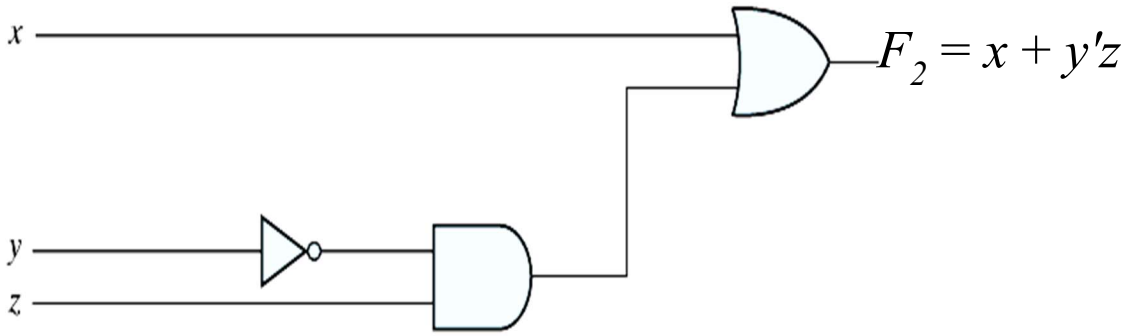

Figure: Implementation of Boolean function $F_2 = x + y'z$ with basic gates

ii. ***Implement $F_3 = x'y'z + x'yz + xy'$***

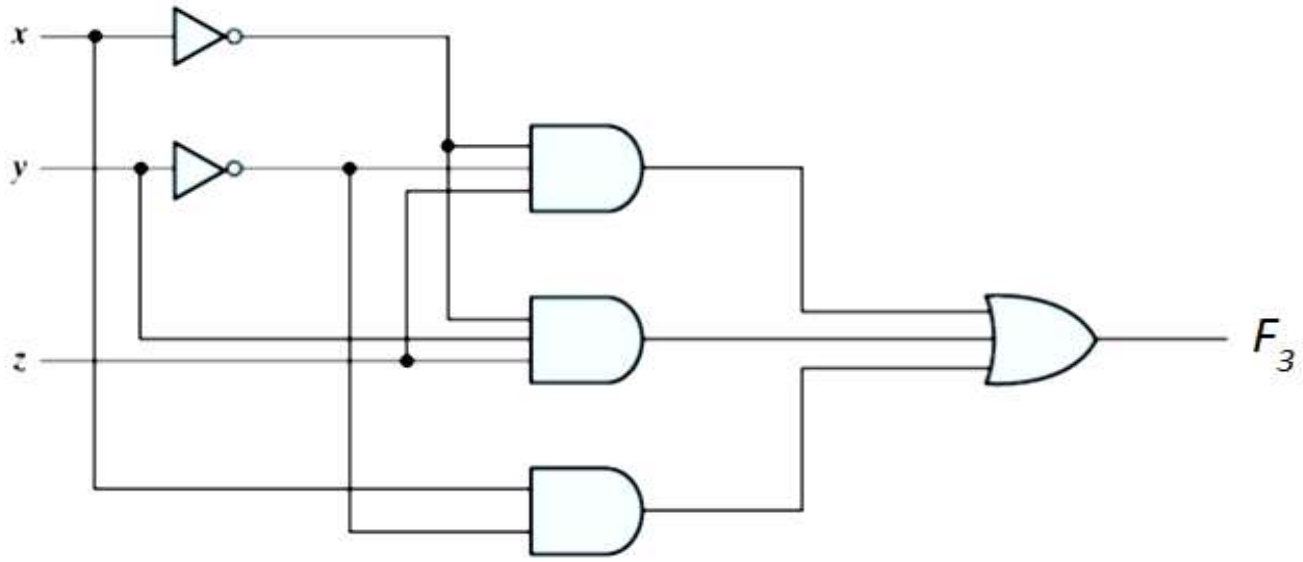

Figure: Implementation of Boolean function $F_3 = x'y'z + x'yz + xy'$

iii. ***Implement $F_4 = x\,y' + x'\,z$***

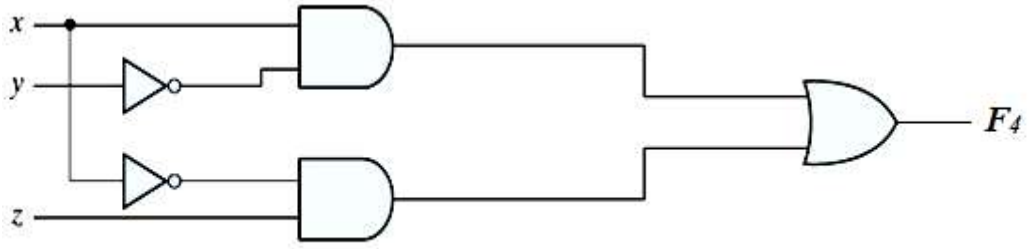

Figure: Implementation of Boolean function $F_4 = x\,y' + x'\,z$

Truth table:

Input			Output		
x	y	z	F_2	F_3	F_4
0	0	0	0	0	0
0	0	1	1	1	1
0	1	0	0	0	0
0	1	1	0	1	1
1	0	0	1	1	1
1	0	1	1	1	1
1	1	0	1	0	0
1	1	1	1	0	0