14:332:231-Digital Logic Design
Assignment 4

1. A majority function is a function that has an output value of "**1**" if the number of **1**s on its inputs is more than the number of **0**s. Otherwise, its output value will be "**0**". Find a Boolean expression for a 3-input majority function.

2. Design a 4-bit input combinational circuit that gives 3-bit binary output that is approximating the square root of the input number. For example, if the square root≥3.5 it generates 4, and if the 2.5 ≤square root <3.5, it generates 3.

3. Design a BCD to 7-Segment decoder (construct the truth table, plot the K-Maps for each output, and find the simplified sum-of-product function for each output).

4. Using five 2-to-4 decoders which also have "Enable" input, design a 4-to-16 decoder which also has an "Enable" input.

5. Build the following logic functions using ***a)*** one or more 74x138 decoder and AND/OR gates, and ***b)*** one or more 74x138 decoder and NAND/NOR gates.

i) $F(X, Y, Z) = \sum_{X,Y,Z}(2,5,7)$
ii) $F(X, Y, Z) = \prod_{X,Y,Z}(2,4,5,6,7)$

6. Design a 4-bit input priority encoder that follows the truth table below using basic logic gates (AND, OR, NAND, NOR, NOT).

D_3	D_2	D_1	D_0	A_1	A_0	IDLE
0	0	0	0	X	X	1
X	X	X	1	0	0	0
X	X	1	0	0	1	0
X	1	0	0	1	0	0
1	0	0	0	1	1	0

7. Build the Boolean function $F(W, X, Y, Z) = \sum_{W,X,Y,Z}(1,3,4,11,12,13,14,15)$ using

a) a 8x1 multiplexer and external gates.

b) a 4x1 multiplexer and external gates.

c) two 3-to-8 decoders with enables and external gates with a maximum of 4 inputs.