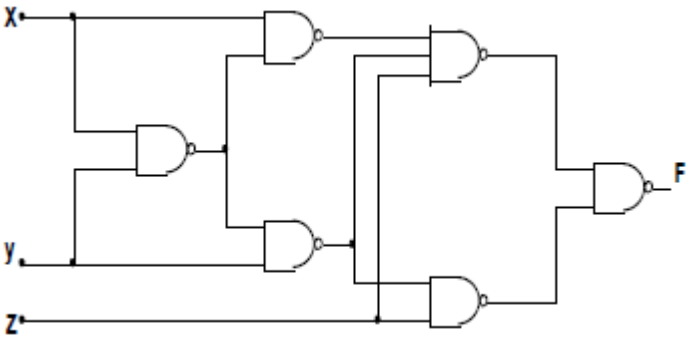
# *Sheet #2*

## *Combinational Circuits*

1. Obtain the truth table for the circuit shown in the figure. Draw an equivalent circuit for F with fewer NAND gates.




2. A majority function is generated in a combinational circuit in which the output is equal to 1 if the input variables have more 1's than 0's. The output is 0 otherwise. Design a 3-input majority function.

3. Design a comparator circuit that compares two numbers. Each number consists of two digits.

i.e. $N_1=A_1A_0$ and $N_2=B_1B_0$

to determine if $N_1$ is *greater*, *equal*, or *less* than $N_2$.

4. Design a combinational circuit whose input is a 4-bit number and whose output is the two's complement of the input number.

5. Design a combinational logic circuit that converts a decimal digital from the 8421 code to BCD.

6. Design a combinational logic circuit that converts a decimal digital from the 8421 code to Gray code.

7. Design a combinational circuit that forms the binary sum of two 2-bit numbers $A_1A_0$ and $B_1B_0$. Do not use half adders or full adders. Design the circuit starting with a truth table.

8. Design a BCD to Excess-3 code converter with 4-bit adder.what must be done to change the circuit to an Excess-3 to BCD code converter?

9. Design a binary multiplier that multiplies two 4-bit numbers. Use AND gates and binary adders.

10. Develop a 3-to-8 decoder using NOR gates only, and draw its logic diagram.

11. Construct a 5-to-32 decoder using the following decoders:

- 2-to-4 line decoder, active low outputs and a single active low enable.
- 3-to-8 line decoder, active low outputs with 2 active low and one active high enable.

12. Construct an 8-to-1 line multiplexer with enable input.

13. A combinational circuit is defined by the following three Boolean functions. Design the circuit with a decoder and external gates.

$$F_1 = \overline{xy} + xy\overline{z}$$

$$F_2 = \overline{x} + y$$

$$F_3 = xy + \overline{xy}$$

14. Repeat problem 13 using a 4-to-1 multiplexer.

15. Design an octal –to- binary priority encoder.

***Best Wishes of Success***