EECS 270: Introduction to Digital Logic **Fall 2000**
Homework Assignment No. 2 **Instructors: Jenkins/Mazumder**
Due Date: September 25, 2000

Problem 1.

Using Boolean Algebra, show that (Proofs by Truth Table are not acceptable):

(a) $(X \quad Y)' = X \quad \overline{Y} = \overline{X} \quad Y = XY + \overline{X} \ \overline{Y}$

(b) $(X \quad Y) \quad Z = X \quad (Y \quad Z) = X \quad Y \quad Z.$

(c) $AB + BC + CA = (A+B)(B+C)(C+A)$

(d) $X\overline{Y} + XYZ + \overline{X}Z = (\overline{X}\,\overline{Z} + Y\overline{Z})'$

Problem 2.

Simplify the following expressions as possible by using Boolean algegra:

(a) $XY + \overline{X}Y\overline{Z} + YZ$

(b) $X\overline{Y} + Z + (\overline{X} + Y)\overline{Z}$

(c) $\overline{X}Y \quad YZ \quad XY \quad \overline{Y}\,\overline{Z}$

(d) $\overline{X}\,\overline{Y} + YZ + XZ + XY$

Problem 3.

(a) A combinational network has 4 inputs (A,B,C,D) and three outputs (X,Y,Z). XYZ represents a binary number whose value equals the number of 1's at the input. For example, if ABCD = 1011, XYZ = 011.

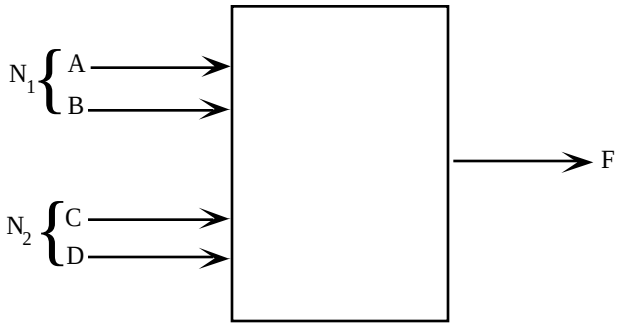
a. Find the minterm expansions for X, Y and Z.

b. Find the maxterm expansions for Y and Z.

(b) A switching network has 4 inputs as shown below. A and B represent the first and second bits of a binary number N_1. C and D represent the first and second bits of a binary number N_2. The output of the network is to be 1 only if the product $N_1 \times N_2$ is greater than two. A and C are the most significant bits of N_1 and N_2, respectively.

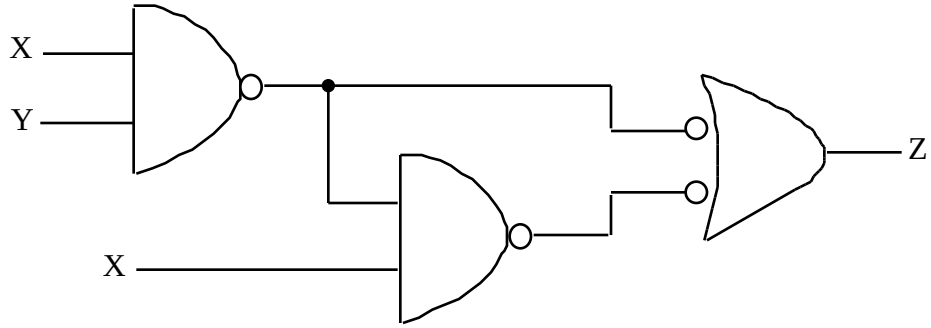
a. Find the minterm expansion for F.

b. Find the maxterm expansion for F.

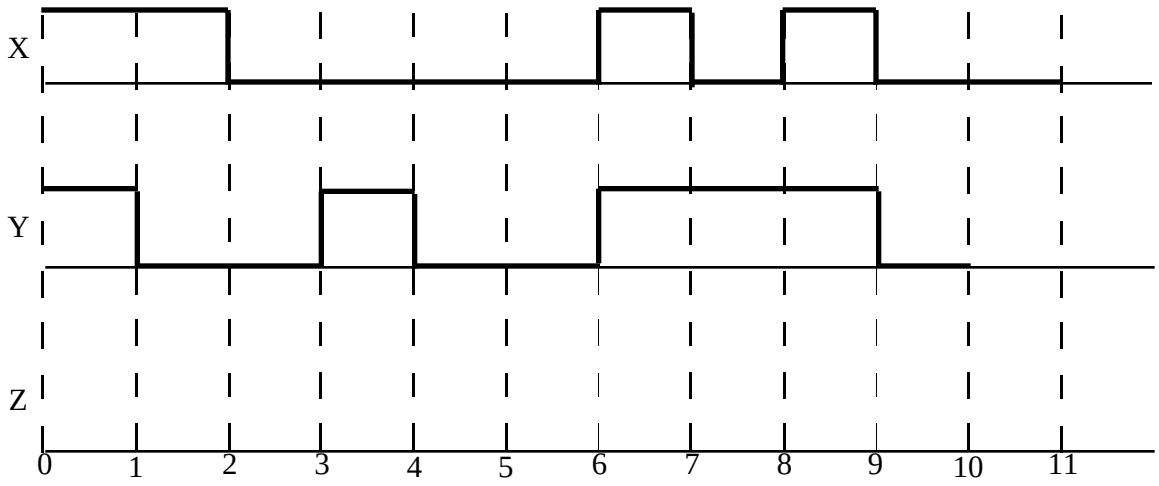


Problem 4.

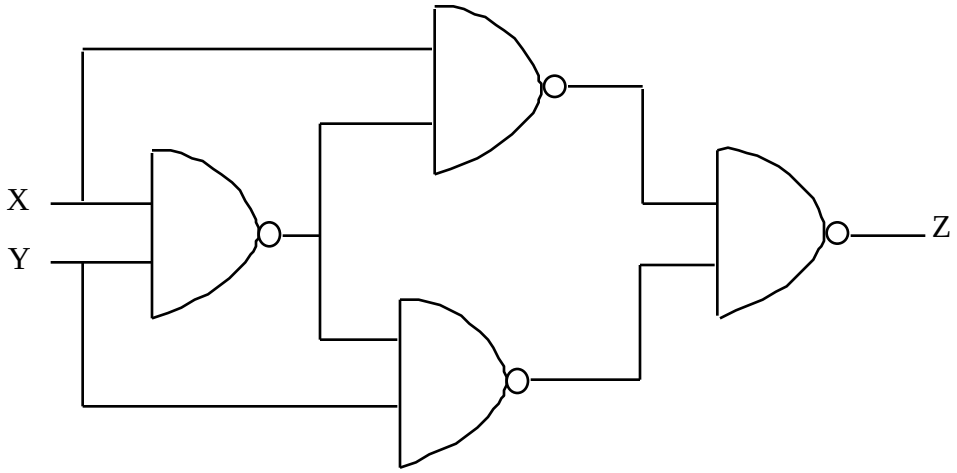
(a) Given the following network, write an expression for Z and simplify.

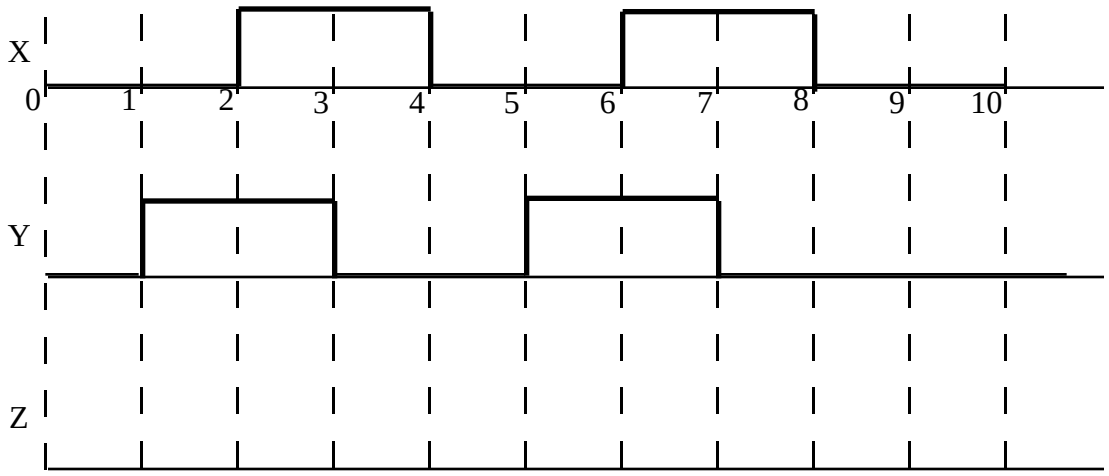


Assume that each gate has 1 unit of delay. (Delay time = 1 on timing diagram.)
Draw the output waveform (Z) for the given input values of X & Y.



(b) Obtain an SOP (sum of products) expression for Z. Draw the output waveform (Z) for the given values of X and Y. Assume each gate has zero delay.





Problem 5. Textbook problem 4.46

Problem 6. Textbook problem 4.49

Problem 7. Textbook problem 4.55

ALL HOMEWORK MUST BE TURNED IN DURING LECTURE TIME, OTHERWISE IT WILL NOT BE GRADED.