

UNIVERSITY OF GAZIANTEP

ELECTRICAL-ELECTRONIC ENGINEERING DEPARTMENT

EEE 340 DIGITAL DESIGN-I

LABORATORY EXPERIMENT -2

SIMPLIFICATION OF LOGIC CIRCUITS

1.OBJECT

In this experiment you will study and apply logic simplification rules and De Morgan's theorem. You will also examine and design the EX-OR function.

2.PRELIMINARY WORK

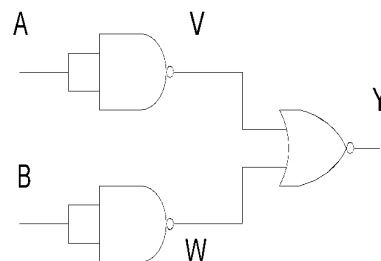
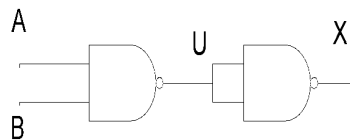
P1-Two relations between logic expressions may be desired by De Morgan's laws.

1. $(X+Y)'=X'Y'$

2. $(XY)'=X'+Y'$

Prove that these equations hold, i.e determine the truth table for each side of the equation and compare them. They should be identical in both cases.

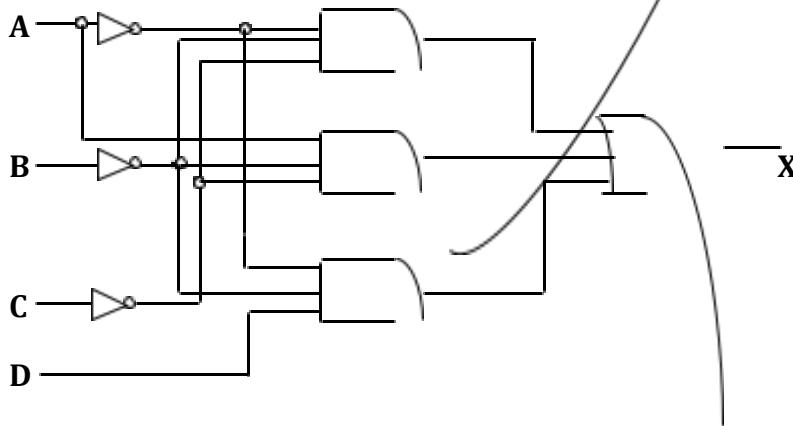
P2-Suppose you are given the following circuit. Find the logic expressions for U,V,W,X and Y in terms of A and B.



P3-Design an EX-OR circuit using only 2-input NAND gates. Use the minimum number of gates. Assume that primed variables are not available.

P4-a) Write the Boolean expression for the output X in the figure given below. Derive the truth table.

b-) Convert the circuit to one using only NAND gates. Then write the output expression for the new circuit, simplify it using De Morgan's theorems and compare it with the expression for the original circuit.



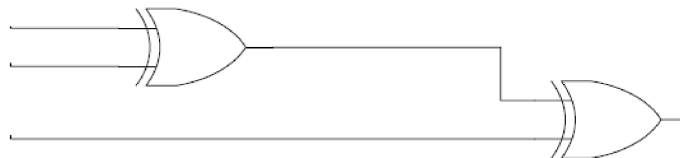
3. EXPERIMENTAL PROCEDURE

E1- Set up logic circuits to prove that De Morgan's laws hold, i.e. derive the truth table for each side of the equations given in P1 experimentally.

E2- Construct the circuit given in P2. Obtain the truth table for U,V,W,X,Y.

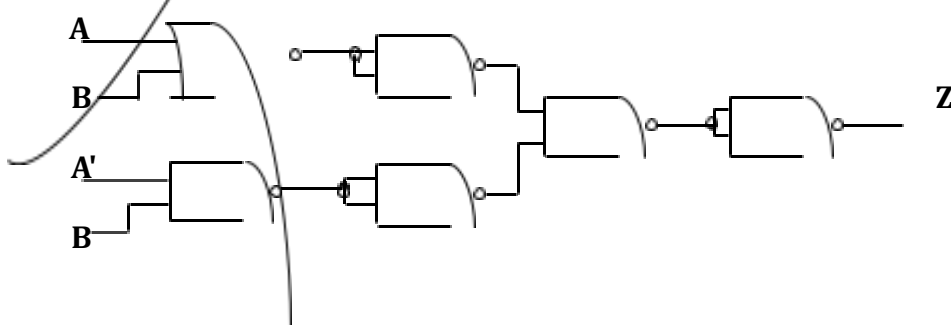
E3-a) Construct the 2-bit EX-OR circuit you designed in P3. Derive the truth table.

b-) Construct the circuit given below. Obtain the truth table and write the logic expressions for X and Y. Can this circuit be used as a three input EX-OR gate?



4. QUESTIONS

Q1- For the following circuit, derive the truth table and find the logic expression for Z. Can this circuit be simplified? Show the simplified circuit realizing the same output. Construct the simplified version of the circuit and derive the truth table.



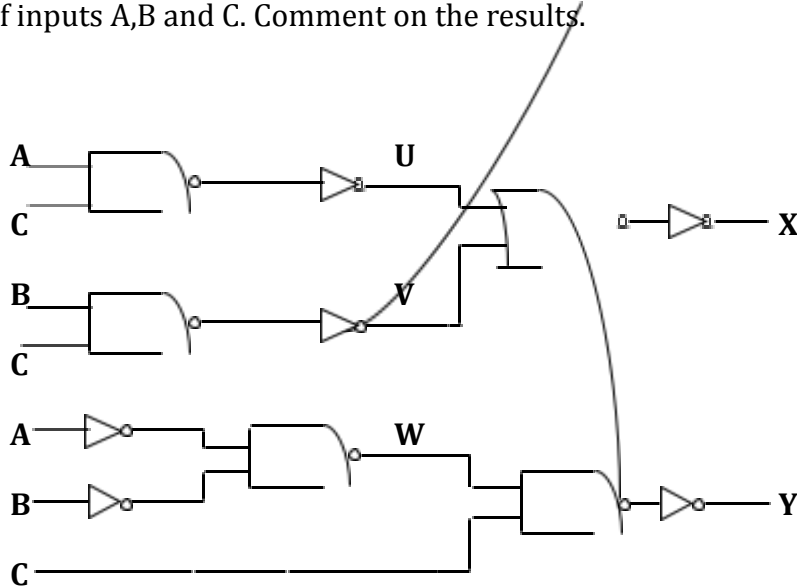
Q2-Realize the following functions with 2-input gates. Hint: you may use EX-OR gates.

$$Z=X'YZ+XY'Z+XYZ'+X'Y'Z'$$

Q3-Realize the following function with a minimum number of 2-input EX-OR and NAND gates only.

$$Z=X'YZ+XY'Z+X'Y'Z'$$

Q4-For the circuit given below, derive the truth table and find the logic expressions for U,V,W,X and Y in terms of inputs A,B and C. Comment on the results.



5. EQUIPMENT LIST

7400 quad 2-input NAND gate

7402 quad 2-input NOR gate

7432 quad 2-input OR gate

7408 quad 2-input AND gate

7404 hex inverter

7486 quad 2-input EX-OR gate