UNIVERSITY OF GAZIANTEP

ELECTRICAL AND ELECTRONICS ENGINEERING DEPARTMENT

EEE 340 DIGITAL DESIGN I

LABORATORY EXPERIMENT-1

BASIC LOGIC FUNCTIONS

1. OBJECT

In this experiment you will study;

- the basic logic functions AND,OR,INVERT,NAND and NOR.
- the representation of these functions by truth tables,logic diagrams and Boolean Algebra.You will gain familiarity with logic gates.

2. INTRODUCTORY THEORY

In electronic logic circuits input and outputs occur as voltage levels. These input and outputs are dual-valued or dual-leveled. To provide a common basis for comparison it has become usual to represent the two levels symbollically as 1 or 0. In one circuit the 1 might be +20 volts and the 0 might be -10 volts. In some other circuit the 1 might be +15 volts and the 0 might be +1 volt.Despite the difference in voltage levels,a basic operation will be the same using either pair of voltages.

All logic circuits can be constructed out of the basic AND, OR and NOT logic gates. In practice,however,NAND and NOR gates are normally used to construct logic curcuits.This means that each of the AND,OR and NOT gates can be replaced by either an equivalent NAND or an equivalent NOR construction.

3.IC PIN CONNECTIONS

Each of the IC's in this experiment are in 14-pin dual in-lin case.The base pins progress in a counter-clockwise directions as can be seen in figure.Pin 1 is located by an identifying symbol,or the location of pins 1 and 14 are identitied by an index notch at the end of the case where the pins 1 and 14 are located.

Vcc=14, Ground=7

4.PRELIMINARY WORK

P1-a) If the H represents the more positive voltage level and L the more negative voltage level, fill in the following truth tables for NAND gates with positive logic.

2-input gate

A	B	Z
L	L	H
L	H	H
H	L	H
H	H	L

3-input gate

A	B	C	D	Z
L	L	L	L	H
L	L	L	H	H
L	L	H	L	H
L	L	H	H	H
L	H	L	L	H
L	H	L	H	H
L	H	H	L	H
L	H	H	H	H
H	L	L	L	H
H	L	L	H	H
H	L	H	L	H
H	L	H	H	H
H	H	L	L	H
H	H	L	H	H
H	H	H	L	H
H	H	H	H	L

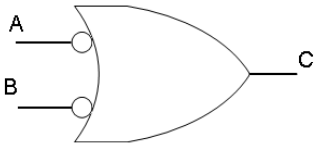
b-) What logical function do each of these gates implement?Does it matter whether positive or negative logic is assumed?

c-) If three inputs of the 4-input gate are connected together write a H-L truth table fort he resulting 2-input gate.

P2-Propagation delay of a gate is the time delay between the input voltage and output change. Propose a method to measure the propagation delay og a gate. Keep in mind that propagation delay is very small.

P3-Give the truth table of the gate whose logic symbol is given below. Use positive logic.The small circles at the inputs represent inversion.Is there another logic symbol for the gate gicen below?If so,explain.

A	B	C
0	0	1
0	1	1
1	0	1
1	1	0



P4-a) Show that logic OR, AND and NOT functions can be performed with NAND gates. Assume each gate has 2 inputs.

b-) Give a logic diagram for the following Boolean expression utilizing 2-input NAND gates. Assume only true values are avaliable.

F= A'B'+AC'

5. EXPERIMENTAL PROCEDURE

E1-Connect the inputs of a 2-input AND gate to switches and its output to a lamp. Make a truth table using H-L as in preliminary work. Use CRO to measure the voltage level at the ouput. Repeat the same procedure 2-input OR, NOT, 2-input NOR and 2-input NAND gates.

E2- **a)** Connect the inputs of a 4-input NAND gate to switches and its output to a lamp and derive a truth table using H-L. Measure voltage level at the output by using CRO.

b) Leave one input unconnected. Make a 3-input truth table using H-L.

c) Drive three inputs from the same switch. Drive the forth input from another switch. Make a 2-input truth table.

E3-Individuals Gates may be connected to build up more complex circuits. Using three 2-input AND gates determine a method of combining them to represent a 4-input AND gate. Wire up the circuit and verify your design.

E4-a) Construct the 2-input NAND circuit equivalents of OR, AND and NOT functions found in **P4-a)**and derive the truth tables.

b)Wire up the circuit diagram that you derived in **P4-b)**using 2-input NAND gates. Produce the truth table.

6. QUESTIONS

Q1-Using 1 and 0 consruct a truth table for the 2-input gates used in the experiment assuming positive logic. What logical functions does the gate perform with positive logic?

Q2-Write a 1 and 0 truth table for the same 2-input gates assuming negative logic. What function does it perform?

Q3-Write a 1 and 0 truth table for the 4-input gate assuming negative logic. What function does it perform?

Q4-What function does the 4-input gate perform when all inputs are tied togeher? What will happen if only one input is used?

Q5-Suppose you need to use 4 input gate as a 3-input gate.List 3 alternatives that show unused input such that it does not control the output. What are the advantages and disadvantages of each connection?

7 EQUIPMENT LIST

7400 quad 2-input NAND gate

7402 quad 2-input NOR gate

7404 hex inverter

7420 dual 4-input NAND gate

7432 quad 2-input OR gate

7408 quad 2-input AND gate