LAB #1 Introduction to CpE64 Lab Equipment

LAB OBJECTIVES

1. Familiarization with the CpE64 PLD XILINX_Spartan-3E board
2. Use of switches as inputs and light emitting diodes (LEDs) or LCD (liquid crystal display) as outputs
3. Acquiring design experience in using a truth table to implement a logic circuit
4. Experience in designing a circuit using the 7400 series logic gates
5. Using Boolean algebra to reduce a logic equation (and hardware)
6. Using K-maps as a reduction method for logic equations
7. Learning to create schematics and logic diagrams

LAB PROCEDURE

Lab 1 Part 1 Examine the Spartan-3E circuit board. Your instructor will describe it to you, but you may not understand it until you use it.   The Spartan-3E has both switches (for inputs) and liquid crystal display (for outputs). This board is used when you download a XILINX file from the PC. The program should be one of your logic designs that you created prior to coming to lab. Your instructor will go over topics about the Spartan-3E circuit board.
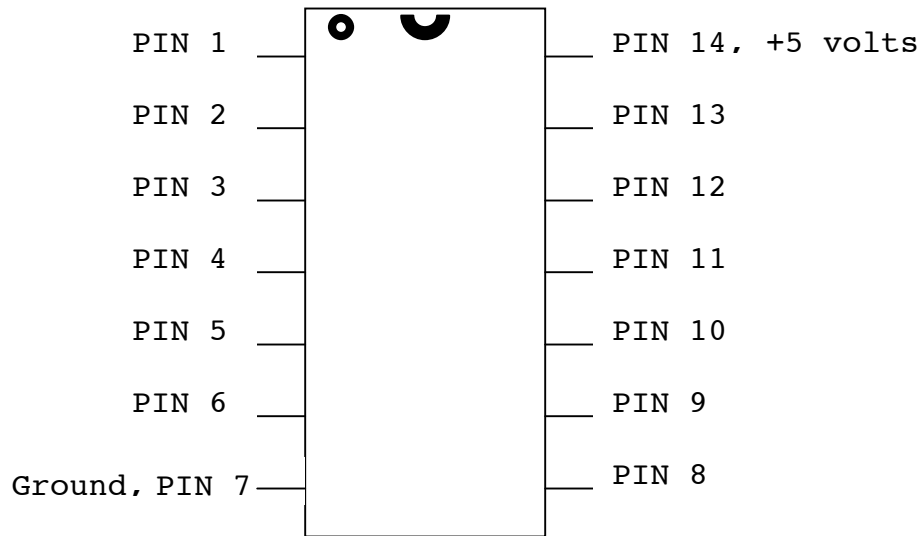
Lab 1 Part 2 Identify the 7400 Series TTL gates, 7400, 7404, 7408 and 7432. Describe in your lab report each of their functions. Also show their logic symbol, use the function in an equation and show the Truth Table for one gate in each of the integrated circuits. This needs to be done for each of the four integrated circuits (ICs) (chips).

Lab 1 Part 3 Use the components from the lab kit. Select the 7404 (a package of six INVERTERs – usually called a hex INVERTER package). Place the 7404 across the center line (horizontal line) of your white breadboard and seat the device firmly (push down) on the breadboard. Find the dot that marks Pin 1 (most device have a notch at one end – if so, Pin 1 is to the left of the notch and on the corner of the device.) Viewed from the top, pin numbers always go counter-clockwise. Using RED wire, connect Pin 14 to +5 volts. Using BLACK wire, connect Pin 7 to GROUND. One of the six INVERTERS has its input pin on Pin 1, and its corresponding output on Pin 2. Connect the INVERTER's input to a switch and the output to an LED. Test to see if the function works properly. Compare this output data to the truth table for this device. Go on and test to the other five "gates" as we call them. When you complete the 7404 IC, continue testing the other three Integrated Circuits (ICs). The 7400 is a quad NAND gate, the 7408 is a quad AND gate, and the 7432 is a quad OR gate. Test each gate of each Integrated Circuit (IC). Record your results for your lab report. Since each gate had two inputs, you must use two switches for each gate. You still only need one LED for the one output of each gate.
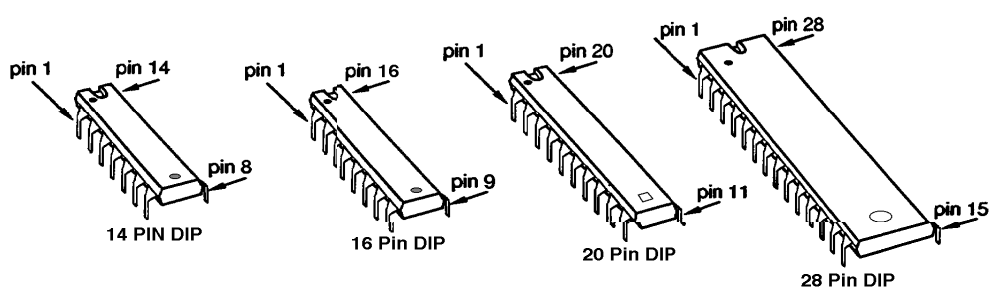
Lab1 Part 4 There is an output for each function or gate. Wire up one LED to each of the gate function's output. ALL the LEDs are connected at the same time. There should be 4 LEDs used: one for the NAND (7400), one for the NOT or Inverter (7404), one for the AND (7408), and one for the OR (7432). That takes care of the outputs. For the inputs you only need two switches that will connect to each gate. {note: the 7404 (inverter) only needs one switch connected to the input}. Your complete the circuit; it will have a total of 4 LEDS, and 2 switches (along with 4 ICs). Test and record the functions by observing the 4 outputs when you place the 4 possible input patterns – 00, 01, 10, 11 on the switches. Create a schematic for this Part and put it in your lab report.

Here is some information about the 7400 Series TTL Integrated Circuits:

Dot near pin 1 or Notch at top center

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PIN 1  ___                    ___ PIN 14, +5 volts

PIN 2  ___                    ___ PIN 13

PIN 3  ___                    ___ PIN 12

PIN 4  ___                    ___ PIN 11

PIN 5  ___                    ___ PIN 10

PIN 6  ___                    ___ PIN 9

Ground, PIN 7 ___             ___ PIN 8
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Top View of a 14 pin 74xx device
Dual In-Line Package (DIP)

pin 1   pin 14   pin 1   pin 16   pin 1   pin 20   pin 1   pin 28   **32**

pin 8   pin 9   pin 11   pin 15

14 PIN DIP   16 Pin DIP   20 Pin DIP   28 Pin DIP