1 Introduction

This pre-lab is divided into two parts. In part one you will build a circuit for providing inputs to your CPLD board on your breadboard. Bring the completed pre-lab to your lab session and get it verified with your lab instructor. In part two you have to derive a boolean expression for the output given a truth table.

CAUTION:

Do not supply power to the input circuit and the CPLD board without getting permission from the instructor. If the connections are wrong your CPLD board will get damaged (you may have to buy a new board again!!).

Part 1

2 Input circuit

In this part of the pre-lab you are going to build an input circuit to supply inputs to your CPLD board. Figure 1 shows how the completed circuit might look like. Please note that Figure 1 shows only three switches connected to the CPLD board. The remaining switches can be connected in the same fashion. The input circuit is shown on the breadboard (on the lower part of the Figure 1) which is connected to the CPLD board.

Figure 1: Completed Circuit Board


2.1 Input Circuit

Your Cool runner-2 CPLD board has four input switches. Two are sliding switches and the other two are push button switches. In the next labs you are going to have experiments which require more than 4 inputs and hence you are going to build an input circuit.

Dual Inline Package (DIP) switches are commonly used for this purpose. The DIP switch used for the 332-lab comprises eight single switches. These switches can be either "On" or "Off". In order to make a single switch switch between a logic "1" and a logic "0" a pull-up resistor is needed. The resistor is connected to Vcc and to one side of the switch, the output. The other side of the switch is connected to ground. When the switch is open, the output gets pulled high by the resistor. When the switch is closed, the output is low. Figure 2 shows the schematic of the input circuit with four switches and four pull up resistors.

![Schematic of the Input Circuit](image)

Figure 2: Schematic of the Input Circuit

The input circuit uses four resistors of the same value, all connected with one pin to Vcc. A resistor network can do this much more elegantly. Figure 3 shows the resistors in the resistor network are connected. Pin 1 is the pin that is connected to all resistors. It is marked on the plastic casing by either an indentation or a dot.

![Resistor Network](image)

Figure 3: Resistor Network

Now build the input circuit on the left most part of your bread board. Connect all inputs of the DIP switch to ground and each of the outputs to Pins 2 through 9 of the resistor network. Connect Pin 1 of the resistor network to Vcc. Figure 4 shows the actual input circuit.
Figure 4: Input Circuit on the Bread Board

Figure 5. shows the two jumpers which you are going to use for this lab. They are marked with a red box and are termed as J1 and J4. Both of the jumpers are 12-pin female connectors.

You should have two 6-pin male connectors in your 332-lab kit. You are going to connect one 6-pin male connector to the front 6-pins of J4 and the other to the back 6-pins of J1 as shown in Fig 6.

The pins J4-6 should be connected to Vcc and J1-11 to ground on the bread board (shown in Fig 7). You are going to connect pins J1-7,8,9,10 and J4-1,2,3,4 to the DIP switches. The pin configuration for the two jumpers is also shown in the Figure 7
After connecting the CPLD board to the input circuit on the breadboard, make sure that the two boards are firmly attached. The board and the DIP switches will be powered via the USB port when connected to the computer.

Note (again): Please do not power the CPLD board without getting permission from your lab instructor.
Part 2

3 Derive the Boolean Expression

In this part of the pre-lab you are going to derive a Boolean expression for each of the outputs (F and G) in the Truth Table given in Table 1 below. Both outputs are functions of the inputs A, B, and C.

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<th>C</th>
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Table 1: Truth Table for the Circuit

The Boolean expressions for

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F : \quad \text{-----------------------------}
\]

\[
G : \quad \text{-----------------------------}
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Lab #3 requires that you write the VHDL code that implements the Boolean expressions described by the Truth Table shown above.