Lab # 10

An Alarm Clock – Phase 4

Objectives

1. To implement the alarm behavior.
2. To finalize the alarm clock project.

Overview

In this lab, you will finalize any incomplete portion of the ongoing project. You will also implement the alarm behavior by using a comparator.

Design Specifications

The alarm should be on for 60 seconds once the alarm time equals the current time. For illustration purpose, we will use an LED instead of a Buzzer. Checking the equality of the current time and the alarm time requires checking the equality of every bit in the current time with its corresponding bit in the alarm time. A 16-bit magnitude comparator is used for this purpose.

In Spartan Library, COMPM16 is a 16-bit magnitude comparator. This component takes two 16-bit buses as inputs and outputs two signals: a Less Than (LT) signal, and a Greater Than (GT) signal. Refer to www.xilinx.com software manuals to find out how this component is used.

COMPM16 has no output that tells whether its two inputs are equal or not. However, two numbers A and B are equal if and only if A is not greater than B and A is not less than B. Thus, feeding these two outputs to a NOR gate produces the EQ (Equality) output signal.

Pre-Lab

- Bring the schematic of the previous lab with you.
- Review magnitude comparators.

In-Lab

Note: In the following steps, the purpose of the labeling is to combine X0–X15 and Y0–Y15 into buses X [15:0] and Y [15:0], respectively. These two buses will be the inputs of the COMPM16 component.

1. Open the schematic of the previous lab.
2. Zoom in around the hour's counter of the current time. Label the outputs of the hours counter as X0, X1, … X7.

3. Now zoom in around the minute's counter of the current time. Label the outputs as X8, X9, … X15.
4. In the same way and order, do the same thing with the alarm time, but with labels starting with Y. i.e., Label the outputs of the hours counter of the alarm time as Y0, Y1, … Y7. Label the outputs of the minutes counter in the alarm time as Y8, Y9, … Y15.
5. Instantiate a COMPM16 component.
6. Connect a bus to the A input of the COMPM16 and label it as **X**.
7. Connect a bus to the B input of the COMPM16 and label it as **Y**.
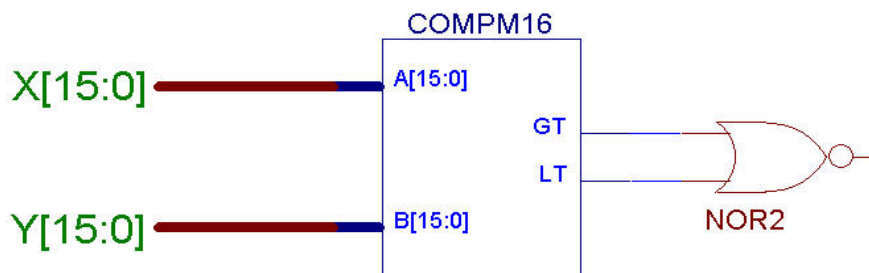8. Connect the outputs of the COMPM16 to a NOR gate. See Figure 10.1.

Figure 10.1

9. Constraint the output of the NOR gate to one of the LEDs.
10. Download & test your circuit. Demonstrate it to your instructor.

Post-Lab

In case you have not completed the project, you have to document all the problems you faced, what are possible causes, and possible solutions.