Middle East Technical University | Department of Computer Engineering

CENG 232

Logic Design

Spring 2015-2016

Lab Assignment 1

Due date: Friday, March 11, 2016, 23:55hrs

1 Introduction

This laboratory aims to get you familiar with basic logic gates and logical circuit design. You will simplify the circuit that is explained below and draw the circuit using Logisim tool with the given gates.

2 IC Pool

- 74LS08 (AND)
- 74LS32 (OR)
- 74LS04 (Inverter)

3 Lab Work

In this lab, you are expected to design a circuit that performs the following operations :

The circuit should take 4-bit input and generate 3-bit output. The input consists of two 2-bit binary numbers X(X1X0) and Y(Y1Y0), respectively. The output is represented as O(O2O1O0). The circuit is supposed to perform two basic operations based on the values of the X and Y :

- If X and Y are both odd numbers then the circuit should add X and Y and set the output O as the result of the addition operation.
- Otherwise, the system should multiply X and Y and set the output as the result of the multiplication.

Suppose the input is given as 1011. The left most two bits represents X in the form of X1X0 and the rightmost two bits represent Y as Y1Y0. Therefore, X = 10 and Y = 11. Since X is even and Y is an odd number, the numbers will be multiplied and the value of output, O, should be set to 110 (10*11 = 110).

You have to use "pins" for your inputs and outputs. Set their labels correctly using the following names. **Only set "label" property of the "pin" objects, do not add a "label" object in Logisim part.**

Input pins: X1, X0, Y1, Y0
Output pins: O2, O1, O1

Each pin corresponds to a digit in a binary number. If it is set, then the value of the digit is 1 if reset, then the value of the digit is 0. The input pins represent 4 bit binary number where the bits are ordered as X1, X0, Y1, Y0. X1X0 represents the first 2-bit binary number and Y1Y0 represent the other binary number. X1 and Y1 are the most significant bit of the corresponding binary number. The output is a 3-digit binary number, O2,O1,O0 that represent the result of the operation. O2 is the most significant and O0 is the least significant bit of the output.

4 Free Session

There will be a free session week after your homework is announced. You will have 2 hours in your free session slot. During the free session, you will try to build your circuit on a breadboard by using IC components, and you will practice how to handle possible problems related to physical circuit.

5 Demo Session

There will be a 2-hour-long demo session week following the free session week. In demo session:

- You will take a short quiz about the logic concepts that involve the coverage of this lab.
- You will reconstruct your circuit on your breadboard.
- You will show that the circuit drawn in Logisim works as specified.

6 Deliverables

1. Submit the circuit named **lab1.circ** prepared in Logisim, which is your preliminary work, via COW until the specified deadline. The evaluation of the submission will be a black-box test.
2. In demo session, you will reconstruct and show that the circuit drawn in Logisim works. This part will be graded in lab.
   Submission of a working circuit is a must to attend DEMO lab sessions. **You should use CENG version of Logisim which is available on COW. Circuits designed with other tools or not named properly will not be graded!**

7 What to Bring in the Lab

- Print-out of submitted file of the circuit.
- Chips and their data-sheets. www.alldatasheet.com
- Pencil, as you will have a quiz at the very beginning of the DEMO lab.

8 Cheating Policy

All the lab work should be individual and there is zero tolerance policy for cheating. See the course website for further information about cheating policy.

9 References

CENG Logisim Version