Fall 2016

CSc 256 Chapter 6 Short assignment

(4% of your grade)
(due on iLearn by 4pm, Thursday 11/10/2016)
(no late submissions will be accepted)

This is an individual project. *Work on your own!*

Problem 1 (25 points):

a) Create a truth table according to these specifications:

There are 4 input bits, x3, x2, x1, x0, and 3 output bits, s2, s1, s0. The 3-bit output is the largest number of consecutive 1's in the 4 input bits. (x3 is the most significant bit of the input, and s2 is the most significant bit of the output.)

For example, input 0000 gives output 000 (no 1's), inputs 0001 and 0101 give output 001, inputs 0011 and 0110 give output 010, input 1110 gives output 011, etc.

Show all 16 rows of the table clearly. (You can write this out neatly in plain text; don't worry about using tables in a word processor.)

b) Refer to Chapter 6 Slide 9, where we filled out the truth table for the 2-bit adder. We also wrote out a logical expression for the s0 bit, following a *sum of products* approach. For the s0 bit of the new circuit, follow the same procedure and write out the logical expression.

Problem 2 (25 points):

Type the truth table from Problem 1 into Logisim. Use Logisim's *Analyze Circuit* feature to construct logical expressions for the s0 bit. What is this logical expression? (It may be a little different from the one you had in Problem 1, because it may be optimized to use fewer gates.)

Problem 3 (25 points):

Use Logisim's *Analyze Circuit* feature to construct a logic circuit for all 3 digits of the circuit in Problems 1 and 2. Be sure to select the option *Use Two-input gates only*. Show a printout of the circuit. (You can do a screenshot, or go to the File menu and try Export Image, or print directly.)

Problem 4 (25 points):

Download the Logisim circuit

http://unixlab.sfsu.edu/~whsu/csc256/LABS/DOCS/LogisimExamples/F16Lab6.circ

This is very similar to the mini PC with +4 circuit that you saw in Lab 6.2; in this case, a register is incremented by 1 every time. The output of the register provides the address for a memory block.

Some locations in the memory block have been initialized. The output data of the memory block is sent to a Logisim TTY device, which basically prints an ASCII character per clock tick.

Set *enable* to 1. Start ticking the clock, and watch each ASCII character print on the TTY device, as the address is incremented. Stop when you reach a null or zero byte. What message is printed on the TTY device?