

Problem Set #2

Date Assigned: Monday, February 9, 2015
Date Due: Monday, February 16, 2015
Points: 50

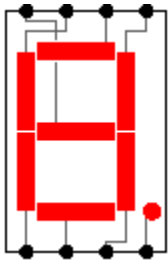
1) (15 pts) Consider the Boolean function: $F(x,y,z) = x'y + xyz'$

a) Derive a simplified algebraic expression for F' . Express your simplified expression in sum-of-products form. However you do your derivation, I want to see one step at a time. If I cannot easily follow your logic, your solution is incorrect.

b) Show that $FF' = 0$, one step at a time.

c) Show that $F + F' = 1$, one step at a time.

2) (20 pts) Using Logisim v2.7.1, you are to create a logic circuit that accepts two bits of information and displays the representation of the two bits using a 7-segment display; therefore, the 7-segment display will only display the values 0, 1, 2, and 3. The 7-segment display is as follows:



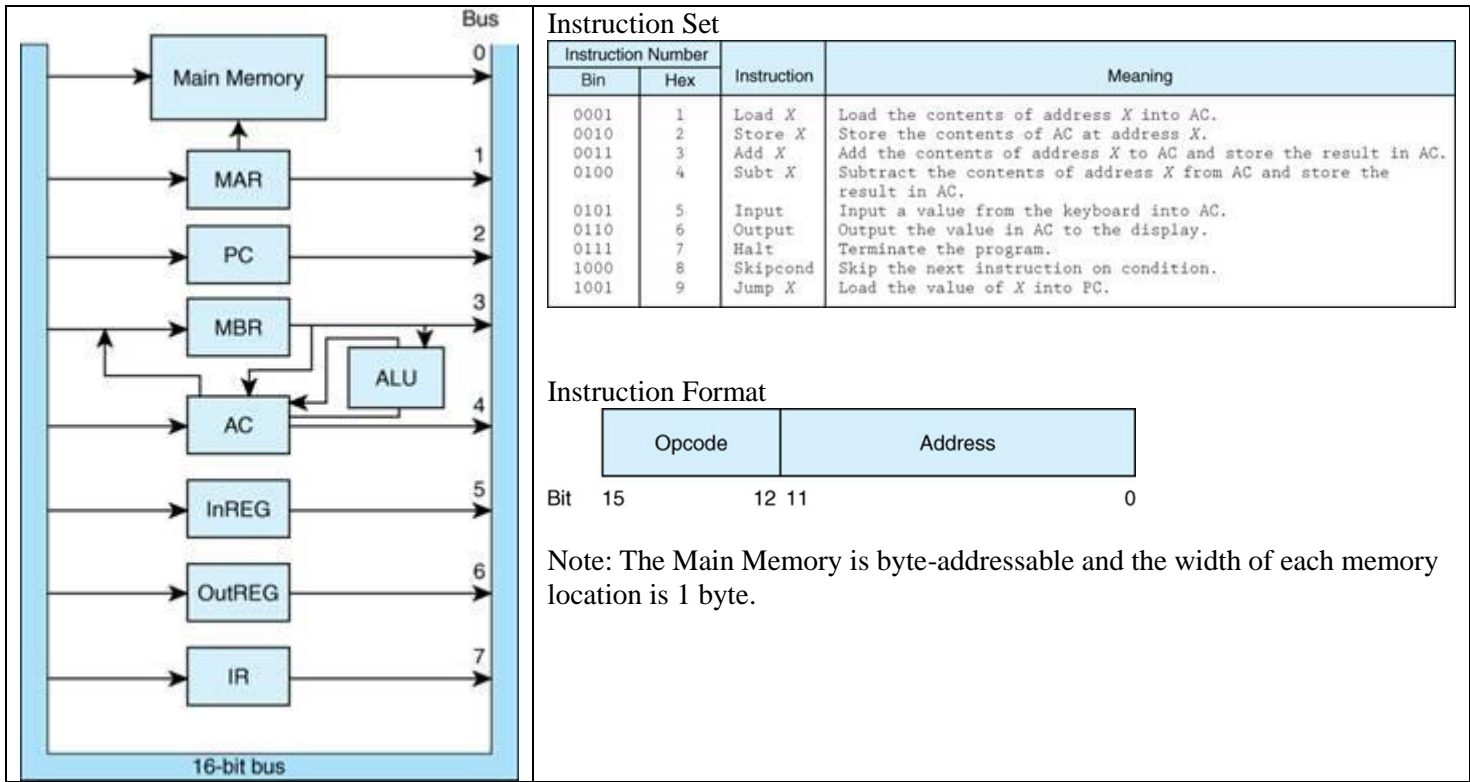
a) Develop the truth table for this circuit.

b) Express each output for the 7-segment display in simplified POS form.

c) Build the circuit out of:

1. A single clock
2. A single counter that counts from 0 to 3
3. A single splitter that takes the output from your counter and feeds the output into your circuit that converts the two-bit inputs into the correct inputs into the LED. Note: Your circuit must be built using only NOR gates.
4. Save your circuit as led.circ

3) (15 pts) Consider the following non-IAS architecture:



a) What is the maximum directly addressable memory capacity (in bytes)? Explain.

b) What is the minimum number of bits needed for each of the following registers?

Explain your answer. (1) IR (2) MAR (3) MBR

c) Consider the following program:

Load 100
 Add 101
 Store 102
 Halt

(1) What is the machine language in HEX of this assembly language program?

(2) If the program starts at location 0 in Main Memory, exactly how many main memory accesses are needed to complete the program execution? Explain your answer.

(3) The manufacturer has a computer with a 16-bit bus and a computer with an 8-bit bus. What are the ramifications of this decision? Number each ramification.

Note1: Please make sure your problem sets are typed, answered in order, and stapled together. This word document will be placed in CS430-01Public on grace.

Note2: A hard copy of your Problem Set Solution is due on the instructor's desk by 11:45am on the day the assignment is due.

Note3: Create a folder punetid and place: a) the word document with all of your solutions typed up and b) the file led.circ. Then drop the punetid folder onto grace.