Rose-Hulman Institute of Technology
Computer Science and Software Engineering
Profs. Archana Chidanandan and Larry Merkle

Homework 0 (Skills Review)
Maximum points : 20

This homework is due at the beginning of class on Thursday, 8th September for sections 1 and 3 and Friday, 9th September for section 2.

Combinational Logic

1. Design a digital logic circuit that implements the 4-input Boolean function described by the truth table below. You may use three inverters to complement the inputs, and up to five other gates. *Hint*: Consider using a Karnaugh map.

x_0	x_1	x_2	x_3	$f(x_0x_1x_2x_3)$
0	0	0	0	1
0	0	0	1	0
0	0	1	0	1
0	0	1	1	1
0	1	0	0	0
0	1	0	1	0
0	1	1	0	0
0	1	1	1	0
1	0	0	0	1
1	0	0	1	1
1	0	1	0	1
1	0	1	1	1
1	1	0	0	1
1	1	0	1	1
1	1	1	0	0
1	1	1	1	1

2. Explain why each of the following statements about full adders is false (assume that the inputs are A, B, and CI, and that the outputs are D and CO).

    a. D is true if and only if exactly one of the inputs is 1.
    b. CO is true if and only if exactly two of the inputs are 1.

Sequential Logic

3. Obtain the state diagram for a 3-bit up-down counter. The inputs are:
    UP = 1 (count up)
    = 0 (count down)

    RESET = 1 (set the counter to 000)
    = 0 (continue counting)

2's Complement Representation

4. Find the 8-bit 2's complement representation of -55.

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Hexadecimal Representation

5. Find the hexadecimal form of the 8-bit 2's complement representation of -55.

Data Types

6. Find the range of integers that can be expressed in 16-bit 2's complement representation.

7. Write a Java code fragment that determines the largest number is an array of 10 integers. It should also determine the index of the largest value in the array.

Control Structures

8. Write a Java code fragment that implements the behavior shown in the following table:

`this.cond1()`	`this.cond2()`	Behavior
`false`	`false`	`this.method1()` executes, and then `this.method2()` executes.
`false`	`true`	`this.method1()` executes, but `this.method2()` does not.
`true`	`false`	`this.method2()` executes, but `this.method1()` does not.
`true`	`true`	Neither `this.method1()` nor `this.method2()` executes.

9. Write a Java code fragment such that `this.method1()` executes exactly *N* times, where *N* is a non-negative integer. You may **not** use a `while` loop.

10. Given the following Java code fragment, what output would result from evaluating the expression `this.myMethodB()`?

```
private int myInField = 1;
private int myOutField = 2;

public int myMethodA( int myParameter ) {
   this.myInField = myParameter;
   return this.myOutField;
}

public void myMethodB() {
   int myLocal = 3;
   myLocal = this.myMethodA( 4 );
   System.out.print( this.myInField + ", ");
   System.out.print( myLocal );
}
```