Rose-Hulman Institute of Technology
Computer Science and Software Engineering
Profs. Archana Chidanandan and J.P. Mellor

Homework 0

Due Date: 9th September, at the beginning of class.

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 four 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	0
0	0	0	1	1
0	0	1	0	0
0	0	1	1	0
0	1	0	0	1
0	1	0	1	1
0	1	1	0	1
0	1	1	1	1
1	0	0	0	0
1	0	0	1	0
1	0	1	0	0
1	0	1	1	0
1	1	0	0	0
1	1	0	1	0
1	1	1	0	1
1	1	1	1	0

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. Draw the state transition diagram for a circuit with one input (other than the clock). The only output line must be 0 unless the input has been 1 for four consecutive clock pulses or 0 for four consecutive clock pulses. The output must be 1 at the time of the fourth consecutive identical input.

2's Complement Representation

4. Find the 8-bit 2's complement representation of -88.

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Hexadecimal Representation

5. Find the hexadecimal form of the 8-bit 2's complement representation of -88.

Data Types

6. Find the range of integers that can be expressed in 32-bit 2's complement representation.

7. Write a Java code fragment that declares an array of integers, allocates 5 elements to it, and initializes it such that the element with index *i* holds the value *2i*.

Control Structures

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

`this.cond1()`	`this.cond2()`	Behavior
`false`	`false`	Neither `this.method1()` nor `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`	`this.method1()` executes, and then `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 `for` 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 );
}
```