

Homework 0 Due: Beginning of Class, Sept 11/12

Name: _____

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.

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:

<code>this.cond1()</code>	<code>this.cond2()</code>	Behavior
false	false	Neither <code>this.method1()</code> nor <code>this.method2()</code> executes.
false	true	<code>this.method1()</code> executes, but <code>this.method2()</code> does not.
true	false	<code>this.method2()</code> executes, but <code>this.method1()</code> does not.
true	true	<code>this.method1()</code> executes, and then <code>this.method2()</code> 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 );
}
```