

Homework 0 (Skills Review)
Maximum points : 20

This homework is due on Tuesday, 7th December.

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.

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 in 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:

<code>this.cond1()</code>	<code>this.cond2()</code>	Behavior
false	false	<code>this.method1()</code> executes, and then <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	Neither <code>this.method1()</code> nor <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 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 );
}
```