

CSI 140 Introduction to Programming

1. What is the output of the following code?

a	<pre>int i = 5, j = 90; do{ j = j / i - 5; if (j > i){ j = i + 30; } }while (j < 0); cout << "i = " << i << " j = " << j << endl;</pre>	
b	<pre>int i; for (i = -5; i <= 5; i++){ if (i % 3 == 0){ cout << "i = " << i << endl; } }</pre>	
c	<pre>for (int i = 1; i <= 10; i++) { cout << i << endl; if (i % 2 == 0){ i--; } }</pre>	
d	<pre>int i = 10; while (i < 5){ cout << "i = " << i << endl; }</pre>	
e	<pre>int i = 0; do{ if (i % 2 == 0){ cout << "Hello\n"; } else if (i % 3 == 0){ cout << "Hi\n"; } else{ cout<<i<<endl; } i += 3; } while (i <= 20);</pre>	

f	<pre> int a = 0; int b = 0; int i; for (i = 1; i <= 20; i++) { a++; if (i % 5 == 0) { b += i; } if (i == 12) { break; } } </pre>	<p>a) What are the values of a, b, and i after iteration 7?</p> <p>b) What are the values of a, b, and i after the loop completes?</p>
g	<pre> int n = 5; int factorial = 1; int counter = 1; while (counter <= n) { factorial *= counter; counter++; } </pre>	<p>a) What are the values of factorial and counter after iteration 3?</p> <p>b) What are the values of factorial and counter after the loop completes?</p>
h	<pre> int x = 0, y = 0, z = 0, i = 0; for (i = 1; i <= 10; i++) { x++; if (i % 2 == 0) { y++; continue; } if (i % 3 == 0) { z++; } } </pre>	<p>a) What are the values of x, y, and z after iteration 6?</p> <p>b) What are the values of x, y, and z after the loop completes?</p> <p>c) What is the final value of i?</p>

Nested Loops - Theoretical Explanation

What is a Nested Loop? A nested loop is a loop inside another loop. The **outer loop** controls the first level of iteration, and the **inner loop** runs completely for each iteration of the outer loop.

Basic Structure

```
for (outer_initialization; outer_condition; outer_update) {  
    // Outer loop body  
    for (inner_initialization; inner_condition; inner_update) {  
        // Inner loop body - executes multiple times per outer iteration  
    }  
}
```

The Golden Rule: For EACH iteration of the outer loop, the inner loop runs COMPLETELY from start to finish.

Execution Flow:

1. Outer loop starts (iteration 1)
2. Inner loop runs ALL its iterations
3. Inner loop finishes
4. Outer loop moves to iteration 2
5. Inner loop runs ALL its iterations again
6. This repeats until outer loop finishes

Example Walkthrough: Simple 2x3 Grid

```
for (int i = 1; i <= 2; i++) { //Outer loop: 2 iterations  
    for (int j = 1; j <= 3; j++) { //Inner loop: 3 iterations  
        cout << i << "," << j << " ";  
    }  
    cout << endl;  
}
```

Output:

1,1 1,2 1,3
2,1 2,2 2,3

Tracing:

Outer loop i = 1:

Inner loop j = 1: print "1,1 "
Inner loop j = 2: print "1,2 "
Inner loop j = 3: print "1,3 "
Print newline

Outer loop i = 2:

Inner loop j = 1: print "2,1 "
Inner loop j = 2: print "2,2 "
Inner loop j = 3: print "2,3 "
Print newline

Counting Total Iterations

Formula: Total iterations = (outer loop iterations) × (inner loop iterations) = 2 * 3 = 6 iterations

What is the output of the following code?

<pre>for (int i = 1; i <= 3; i++) { for (int j = 1; j <= 2; j++) { cout << i + j << " "; } cout << endl; }</pre>	Output:
<pre>for (int i = 1; i <= 4; i++) { for (int j = 1; j <= i; j++) { cout << j; } cout << endl; }</pre>	Output:
<pre>for (int i = 1; i <= 3; i++) { for (int j = 1; j <= 4; j++) { if (i == j) { cout << "X "; } else { cout << "O "; } } cout << endl; }</pre>	Output: