Computer Programming

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Lectures 20, 21, 22

A Generic Iteration Construct

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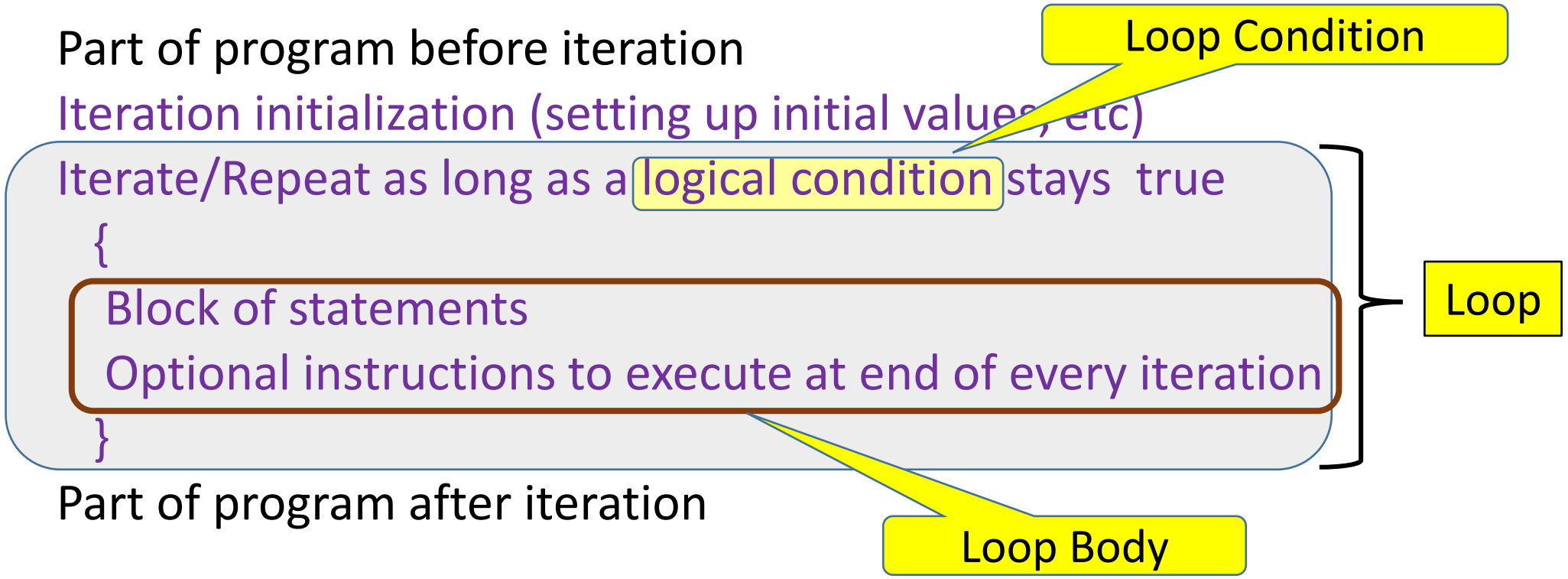
- General structure of program with iteration



"while" Statement in C++

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Part of program before execution

```
while (loop condition)
  {
     Block of statements  (Body of "while" loop)
  }
```

Part of program after iteration

“do … while …” Statement in C++

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Part of program before execution

```
do
  {
     Block of statements  (Body of “do-while” loop)
  } while (loop condition)
```

Part of program after iteration

"for …" Statement in C++

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Semi-colons not to denote end of executable statements
But to separate three parts inside for (…..)

Part of program before iteration

```
for (iteration initialization ; loop condition ;
        instructions to execute at end of every iteration)
{
    Block of statements  ("for" loop body )
}
```

Note absence of semi-colon

Part of program after iteration

Recap Quiz on Lectures 20, 21, 22

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Q1. Why do we need iteration/looping constructs? Why not simply repeat code as many times as we need?

A. Possible source of errors

B. Sometimes number of iterations is not known

C. Simply wasteful, code cannot be reused

D. All of the above

Recap Quiz on Lectures 20, 21, 22

Q2. In which of the following looping constructs in C++, the loop must iterate at least once?

A. do-while loop

B. while loop

C. for loop

D. None

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Q3. In a simple conversion of a *do-while loop* to a *while* loop, which of the following are true (more than one may be true)?

A. The loop body must be replicated twice

B. The loop condition must be replicated twice

C. Both A and B

D. Either A or B, but not both

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Q4. What is the sequence of execution for the following *for loop*:

```
for(assignment X;  condition Y; assignment Z)
  {loop body W;}
```

A. X -> Y -> Z -> W -> …

B. X -> Y -> W -> Z -> …

C. X -> Z -> Y -> W -> …

D. X -> Z -> W -> Y -> …

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Q5. Consider the for loop

```
for (x = y;  x >= 10 ; x = x+1) { y = y – 2; }
```

Suppose we start executing this loop with the values of x and y as 10 and 10, respectively. How many times is (x = y) executed, and how many times is y = y – 2 executed?

A. 1 and 1, B. 1 and ∞, C. ∞ and ∞,

D. 1 and 0

Practice Problem on Lectures 20, 21, 22

- **We want to compute the factorial of a non-negative integer using a looping construct in C++. Fill in the missing part of the code below:**

Program Skeleton

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```
int n; int i;
 ????  factorialN = 1;
 cout << "Give n: ";  cin >> n;
 for (i = ???; i < n; i = i+1) {factorialN = ?????; }
 cout << "Factorial of " << n << "is: ";
 cout << factorialN << endl;
```

Practice Problem on Lectures 20, 21, 22

- **We want to calculate the n^{th} power ($n \geq 0$) of an integer m by a looping program. Complete the missing part of the following code:**

Program Skeleton

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```
int m, n, i;
unsigned long result = ????;
cout << "Give m and n: ";  cin >> m >> n;
i = ????;
do { ????  } while (i < n);
cout << m << "raised to " << n << "is " <<
result;
```

Practice Problem for Lectures 20, 21, 22

Suppose n is a power of 2, e.g. n = 16. We want to compute the n^{th} power of an integer m by the method of repeated squaring, i.e.

$$n^2 = n \times n$$

$$n^4 = n^2 \times n^2$$

$$n^8 = n^4 \times n^4, \ldots$$

Practice Problem for Lectures 20, 21, 22

Write an iterative program that takes n and m, checks whether n is a power of 2, and if so, computes m^n using repeated squaring. Otherwise, the program exits with return code -1.

Program Skeleton


```
cout << “Give m and n: “; cin >> m
// Check if n is a power of 2 using a loop
// If so, get c such that n = 2^c , otherwise
// return -1
// Use repeated squaring c times in a loop to
// to get m^n
```

Practice Problem on Lectures 23, 24, 25

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Q7. Evaluate the output:

```
int num=0, i;
for(i = 0; i < 10; i++)
{ if(i%2 == 0) {continue;}
  else {cout<< num += i << “,” ;}
}
```

Options:

A. 1,4,9,16,25
B. 2,4,6,8,10
C. 1,3,5,7,9
D. 1,5,11,15,19

Quiz on Lectures 23, 24, 25

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Q5. Identify all the incorrect statement(s) from the following:

A. Break statement can be used in all looping constructs
B. Missing loop condition of *for loop necessarily* makes the loop iterate infinitely many times
C. for(i=0,j=0; i<10; i++,j--) is a valid form of the *for header*
D. In C++, *assignment* can never serve as an expression

Quiz on Lectures 23, 24, 25

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Q6. What will be printed on the screen on executing the following statements if the value of x is 10 and that of y is 2?

```
cout << x++ << "," << --y << ",";
cout << x+y;
```

A. 11,1,12
B. 10,1,12
C. 10,2,13
D. 11,2,11