

CSC 211: Object Oriented Programming

Introducing loops (for)

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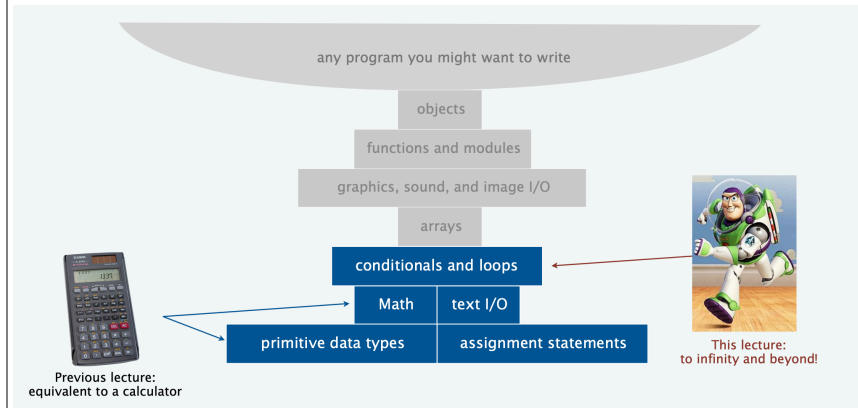
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Original design and development by Dr. Marco Alvarez

Basic building blocks



<https://introcs.cs.princeton.edu/java/lectures/>

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Flowchart of if statements

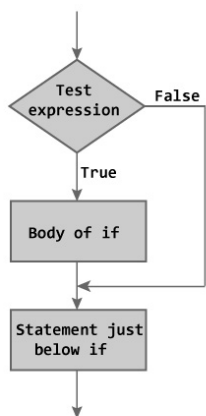


Figure: Flowchart of if Statement

```
// ...  
// statements above  
// ...  
  
if (test_expression) {  
    // body of if  
}  
  
// ...  
// statements below  
// ...
```

<https://www.programiz.com/cpp-programming/if-else>

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Flowchart of if statements

```
// ...  
// statements above  
// ...  
  
if (test_expression) {  
    // body of if  
} else {  
    // body of else  
}  
  
// ...  
// statements below  
// ...
```

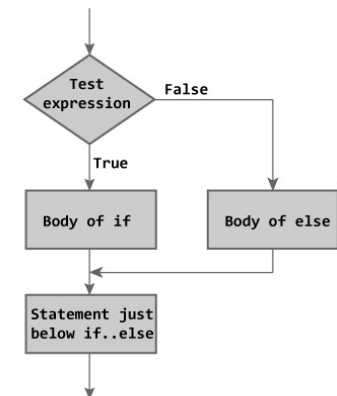


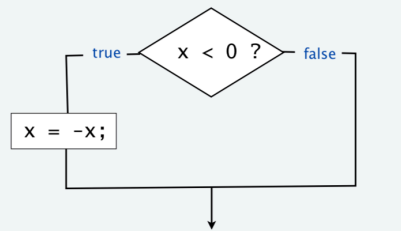
Figure: Flowchart of if...else Statement

<https://www.programiz.com/cpp-programming/if-else>

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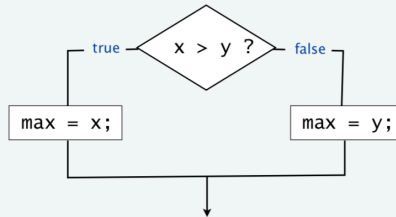
if statement examples

Example: `if (x < 0) x = -x;`



Replaces x with the absolute value of x

Example: `if (x > y) max = x;`
`else max = y;`



Computes the maximum of x and y

<https://introcs.cs.princeton.edu/java/lectures/>

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The increment/decrement operators

- Increment (`++`) and decrement (`--`) are **unary** operators that add or subtract one, to or from their operand, respectively
 - pre-increment** and **pre-decrement** operators increment (or decrement) their operand by 1, and the value of the expression is the resulting incremented (or decremented) value
 - post-increment** and **post-decrement** operators increase (or decrease) the value of their operand by 1, but the value of the expression is the operand's original value prior to the increment (or decrement) operation

Example:

`5 + ++a`

`5 + a++`

from: wikipedia

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Trace the code

```
int x;
int y;

// increment operators
x = 1;
y = ++x;
y = x++;

// decrement operators
x = 3;
y = x--;
y = --x;
```

from: wikipedia

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the for loop

Flowchart of for statement

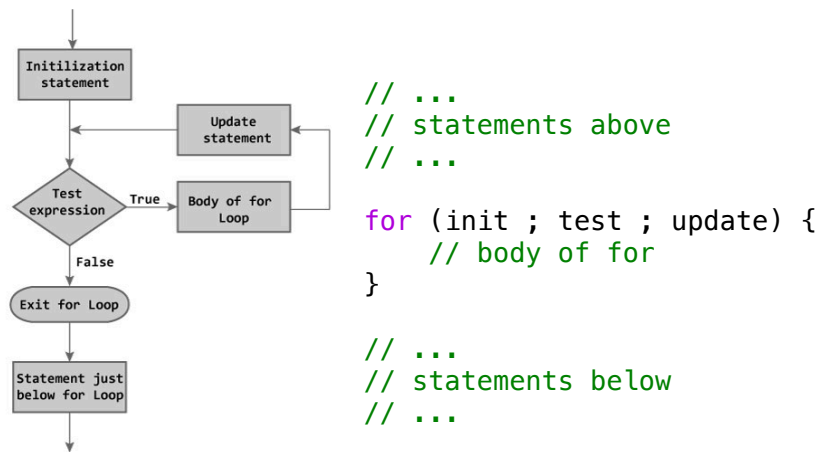


Figure: Flowchart of for Loop

<https://www.programiz.com/cpp-programming/for-loop>

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1. initialization

4. update

2. boolean

```
for (int i = 0 ; i < 3 ; i++) {
    std::cout << i << ' ' ;
}
```

3. statement

then go back to step 2

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A for Statement

```
//Illustrates a for loop.
#include <iostream>
using namespace std;

int main()
{
    int sum = 0;
    for (int n = 1; n <= 10; n++) {
        sum = sum + n;
    }

    cout << "The sum of the numbers 1 to 10 is "
         << sum << endl;
    return 0;
}
```

Initializing action (points to `int n = 1`)
Repeat the loop as long as this is true. (points to `n <= 10`)
Done after each loop body iteration (points to `n++`)
//Note that the variable n is a local variable of the body of the for loop! (points to `n` in `sum = sum + n`)

Output

The sum of the numbers 1 to 10 is 55

from: Problem Solving with C++, 10th Edition, Walter Savitch

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What is the output?

```
int value = 0;
```

```
for (int i = 0 ; i < 5 ; i++) {
    value += (i * 10);
}
```

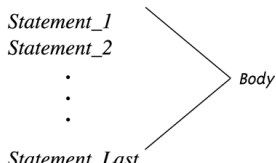
```
std::cout << value << std::endl;
```

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for Loop with a Multistatement Body

Syntax

```
for (Initialization_Action; Boolean_Expression; Update_Action)
{
    Statement_1
    Statement_2
    .
    .
    Statement_Last
}
```



Example

```
for (int number = 100; number >= 0; number--)
{
    cout << number
        << " bottles of beer on the shelf.\n";
    if (number > 0)
        cout << "Take one down and pass it around.\n";
}
```

from: Problem Solving with C++, 10th Edition, Walter Savitch

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Examples

```
int n = 1;
```

```
for ( ; n <= 10 ; n = n + 2)
    std::cout << n << std::endl;
```

```
for (n = 10 ; n > 0 ; n -= 2) std::cout << n << std::endl;
```

```
for (n = 0 ; n > -30 ; n = n - 7) {
    std::cout << n << std::endl;
}
```

```
for (double x = 16.0 ; x >= 2.0 ; x = sqrt(x)) {
    std::cout << x;
    std::cout << std::endl;
}
```

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Careful with the semi-colon

- Semi-colon is used to end statements
- Placing it after the parenthesis of a **for** loop creates an **empty statement**

```
for (int count = 1 ; count <= -4 ; count++);
    std::cout << "Hello\n";
```

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Question

- Write a single for loop to print the first 50 even numbers

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Question

- Write a single for loop to print the average of the first 25 multiples of 3