

Introduction to Visual Basic and Visual C++

Lesson 10

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Relational and Logical Operators

Logical Data and Operators

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Relational Operators

- Relational operators are binary – they require an operand on both sides of the operator
- Result of a relational expression will always be Boolean
- They are evaluated from left to right with no order of operations

Operator	Meaning	Precedence
<	less than	10
<=	less than or equal	
>	greater than	
>=	greater than or equal	
==	equal	9
!=	not equal	

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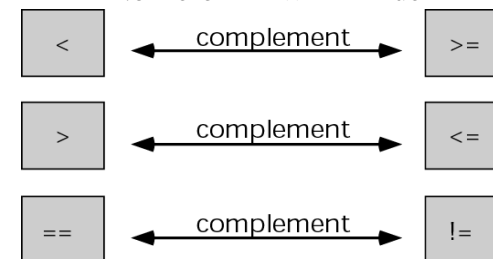
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Logical Operator Complements

- In C++, if a value is zero, it can be used as the logical value false.
- If a value is not zero, it can be used as the logical value true.

■ Zero <> False

■ Nonzero <> True



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Logical Operators Truth Table

not (!)

x	!x
false	true
true	false

!

x	!x
zero	1
nonzero	0

logical
and (&&)

x	y	x && y
false	false	false
false	true	false
true	false	false
true	true	true

C++ Language
&&

x	y	x && y
zero	zero	0
zero	nonzero	0
nonzero	zero	0
nonzero	nonzero	1

or (||)

x	y	x y
false	false	false
false	true	true
true	false	true
true	true	true

||

x	y	x y
zero	zero	0
zero	nonzero	1
nonzero	zero	1
nonzero	nonzero	1

logical

C++ Language

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Short-circuit Methods for AND/OR

- False AND anything (True/False) → False
- True OR anything (True/False) → True

false && (anything)



false

true || (anything)



true

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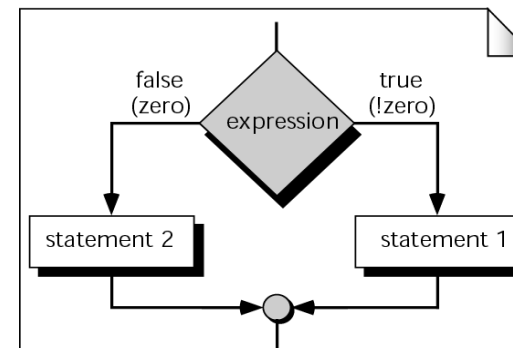
Decision Making

Multiple Selection

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Two-way Decision Logic



(a) Logical Flow

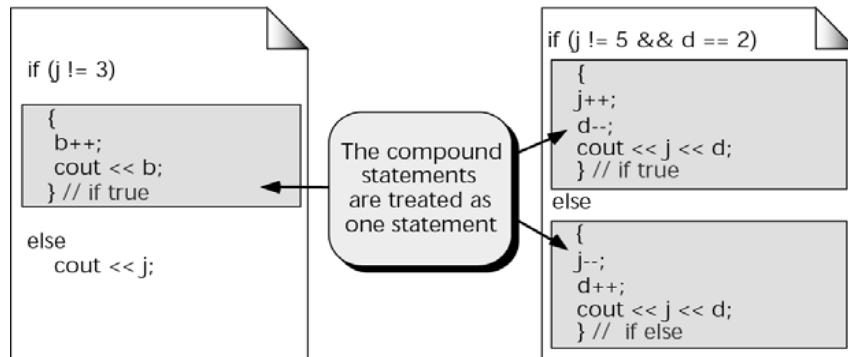
```
if ( expression )
    statement 1
else
    statement 2
```

(b) Code

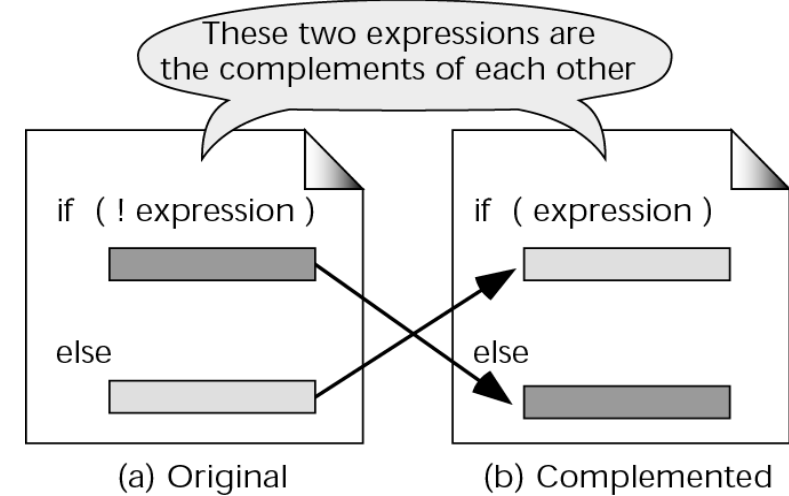
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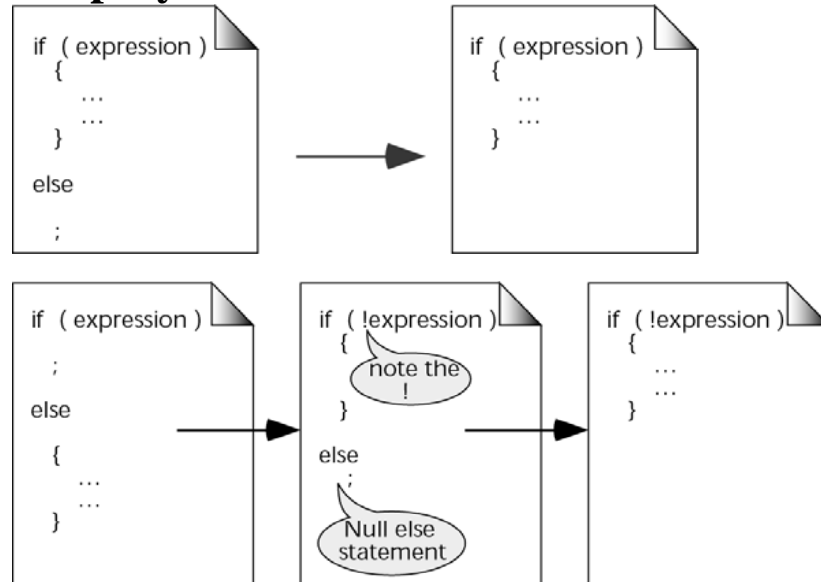
Compound statements in an if...else



Complemented if...then Statements

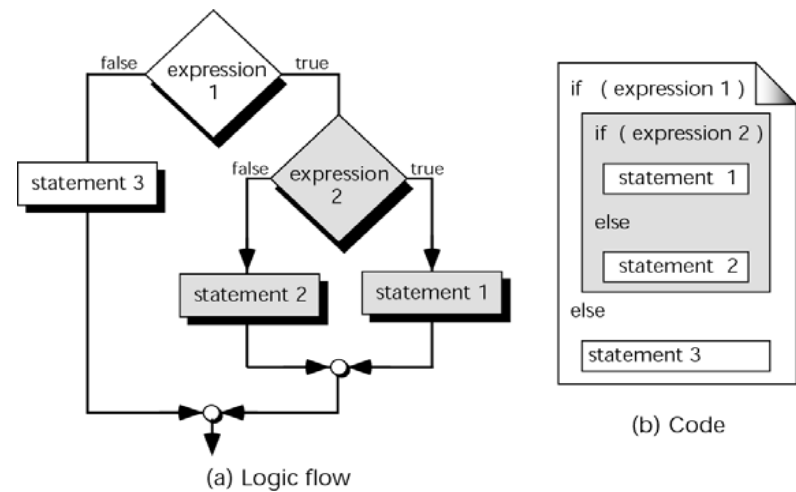


Simplify Null if...else Statement

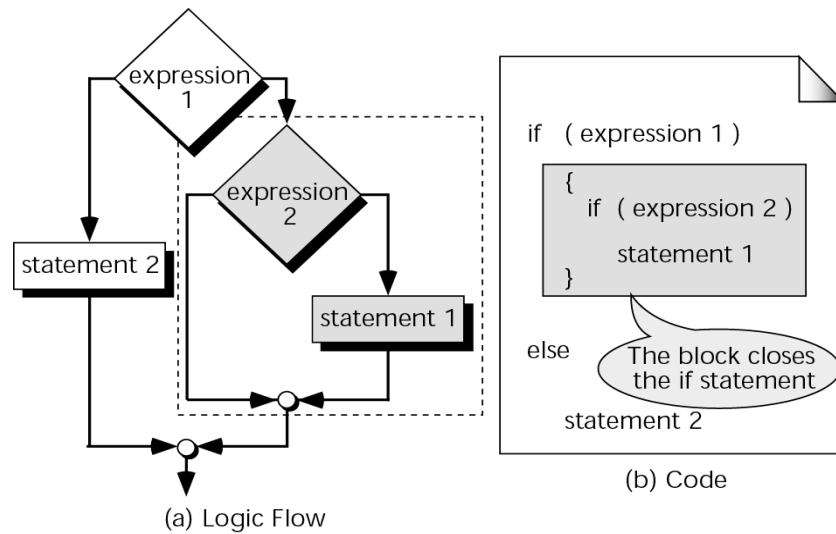


Nested if Statements

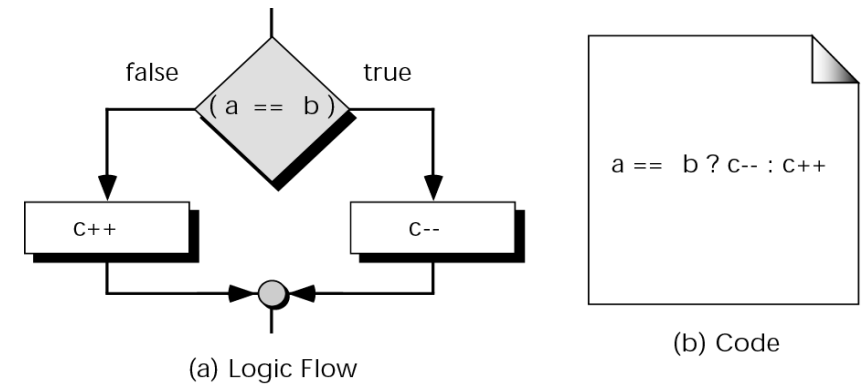
- else is always paired with the most recent, unpaired if



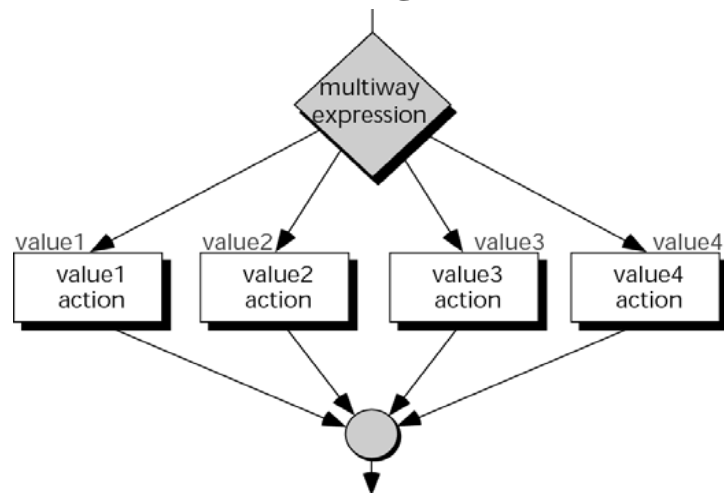
Dangling else solution



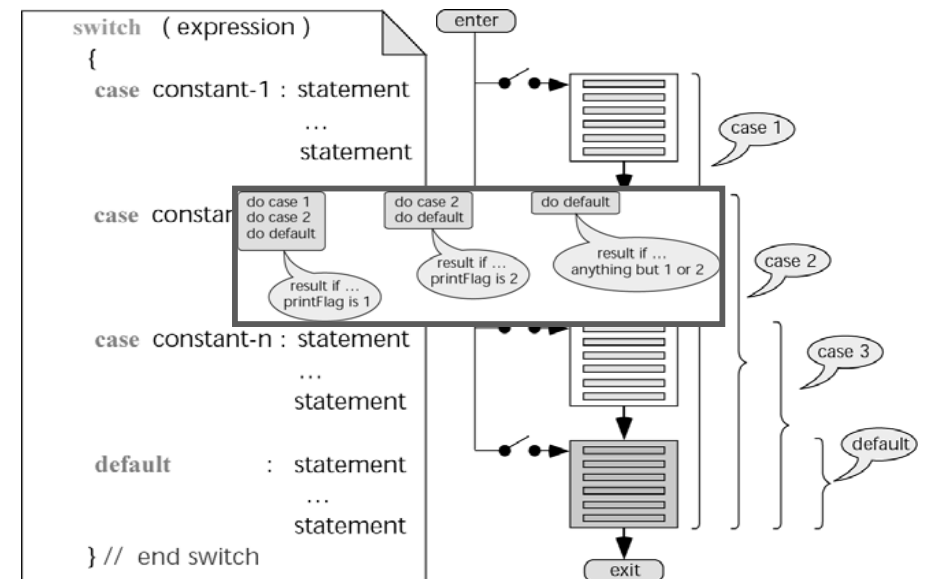
Conditional Expression



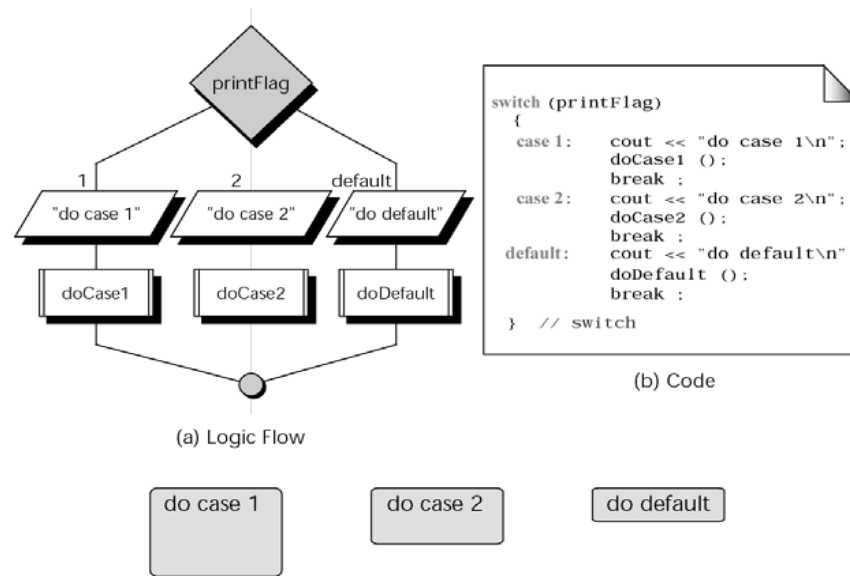
Switch Decision Logic



switch Statement



A switch with Break Statements

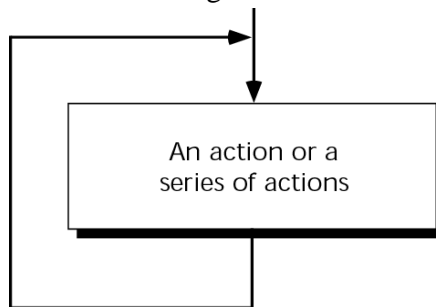


Iterations

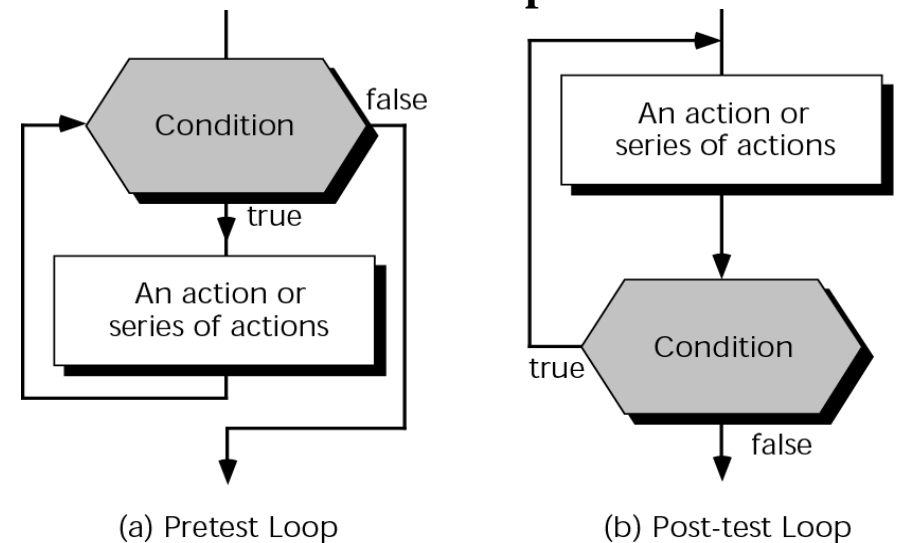
Looping

The Concept of a Loop

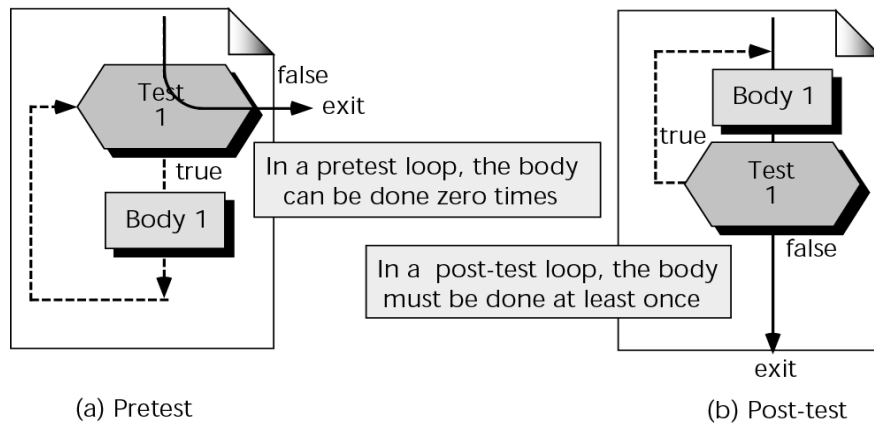
- A loop is a series of commands that will continue to repeat over and over again until a condition is met.



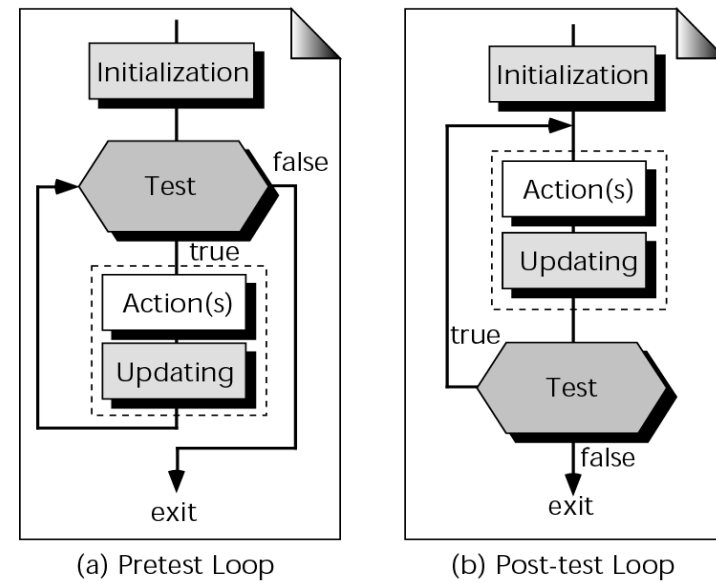
Pretest and Post-test Loops



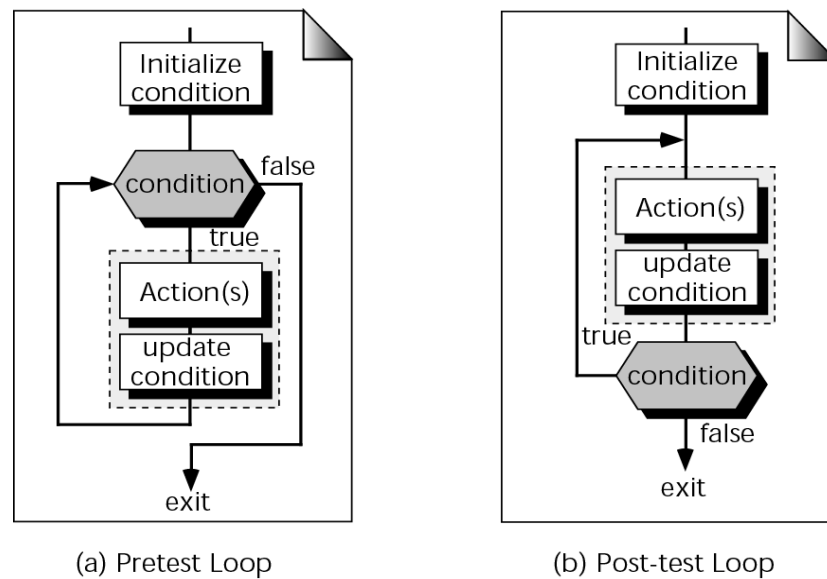
Minimum Number of Iterations in Two Loops



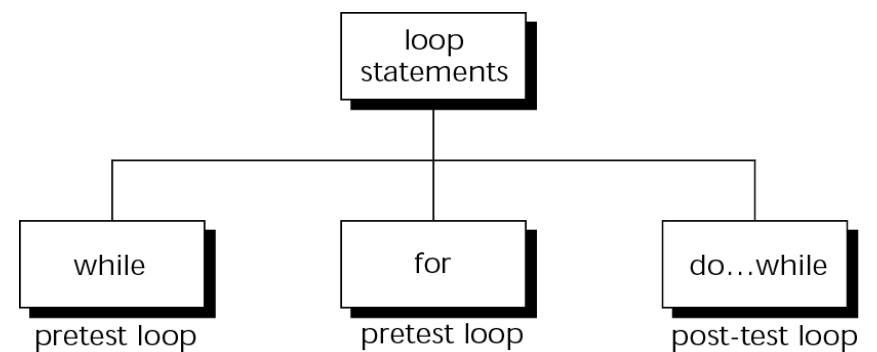
Loop Initialization and Updating



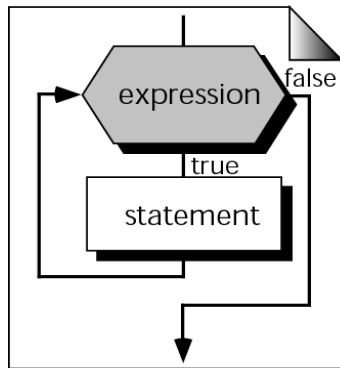
Event-controlled Loop Concept



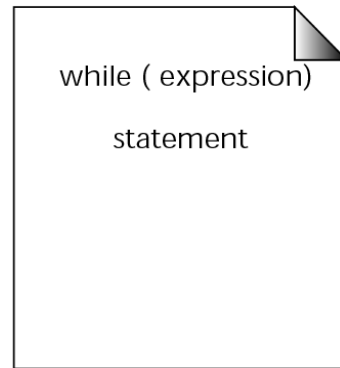
C++ Loop Constructs



The while Statement

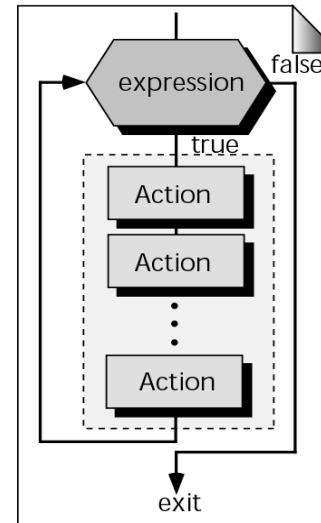


(a) Flowchart

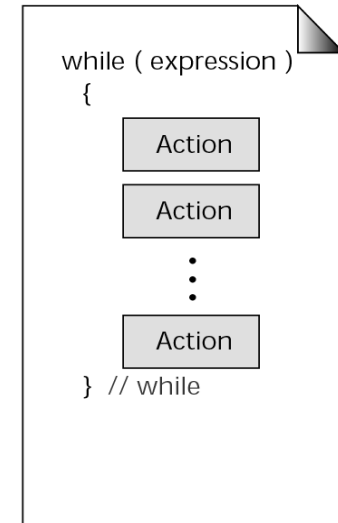


(b) Sample Code

Compound while Statement



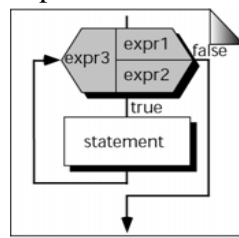
(a) Flowchart



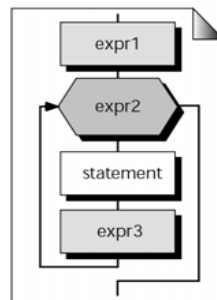
(b) C++ Language

The for Statement

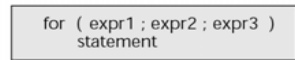
- A **for** loop is used when your loop is to be executed a known number of times. You can do the same thing with a **while** loop, but the for loop is easier to read and more natural for counting loops.



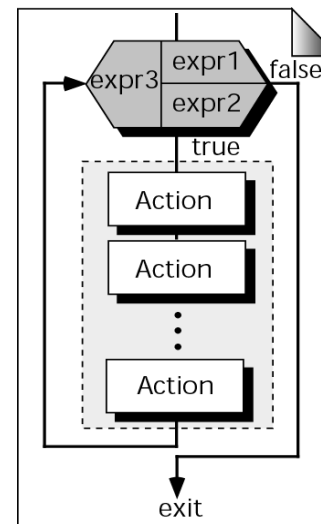
(a) Flowchart



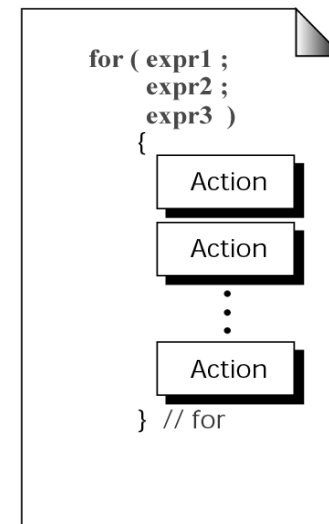
(b) Expanded Flowchart



Compound for Statement

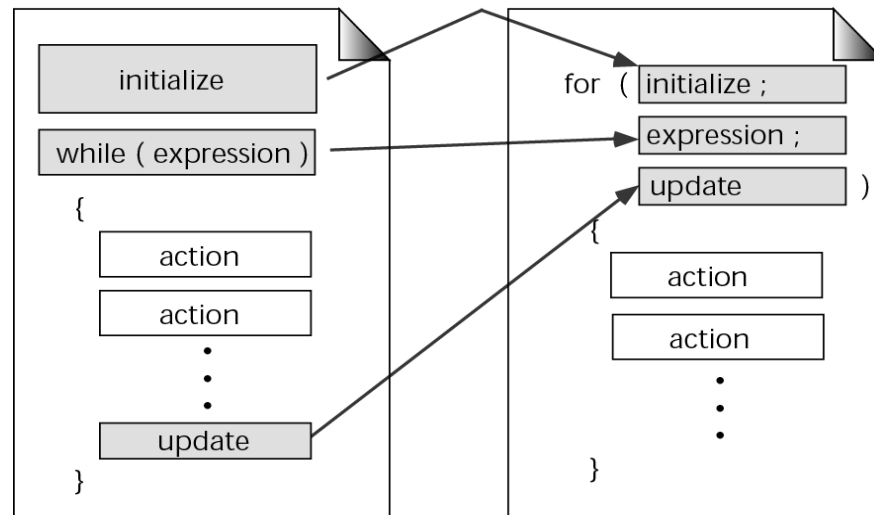


(a) Flowchart

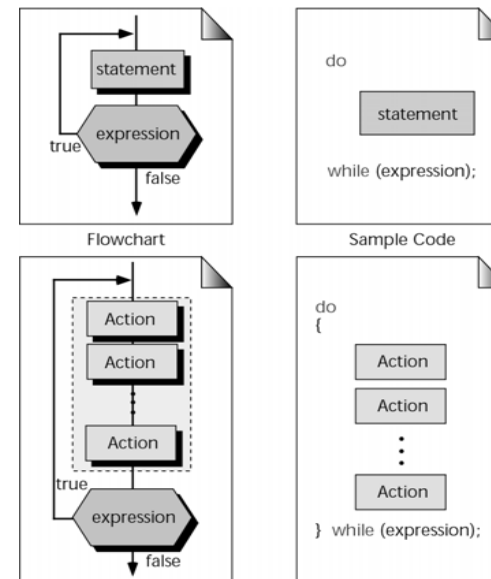


(b) C++ Language

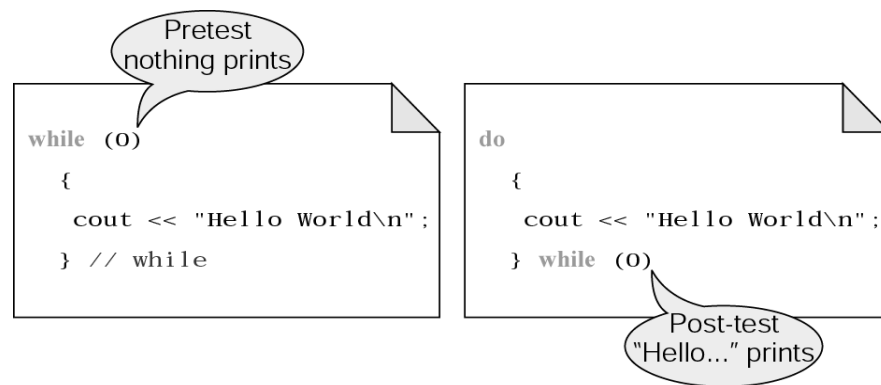
Comparing for and while Loops



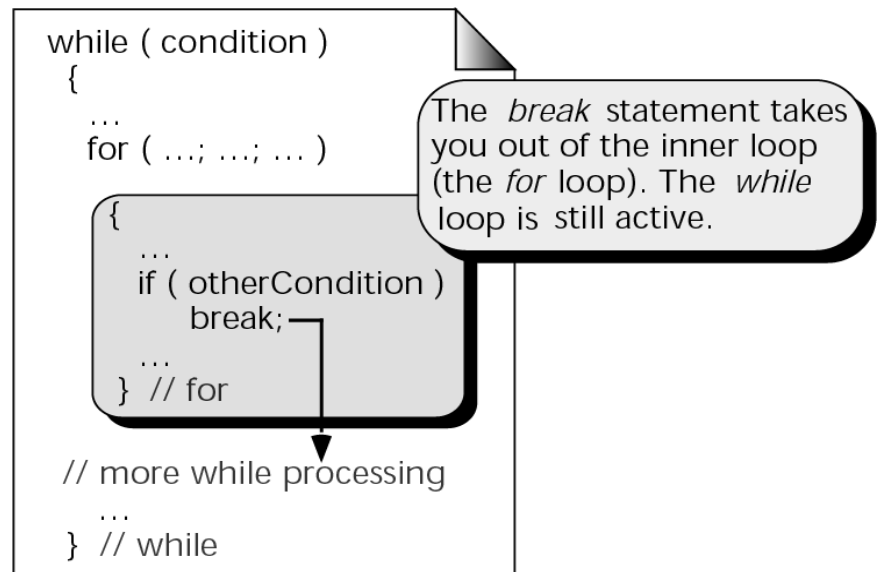
Format of the do...while Statement



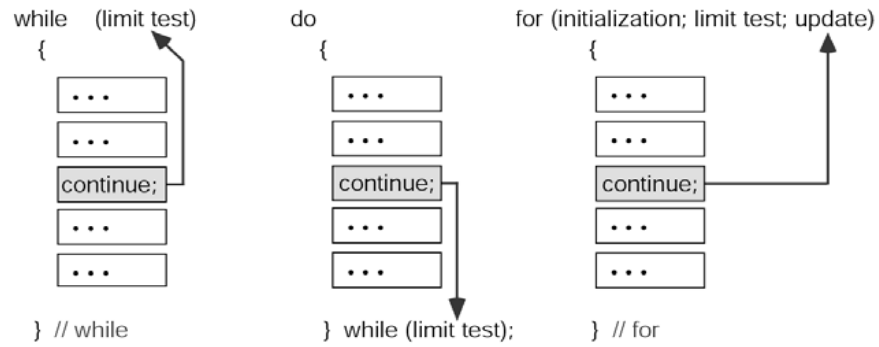
Comparison between Pre- and Post-Test Loops



break and Inner Loops



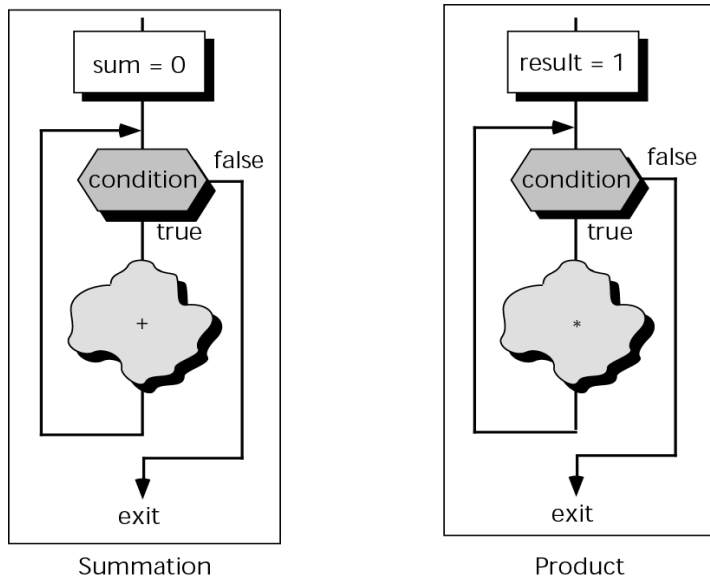
The continue Statement



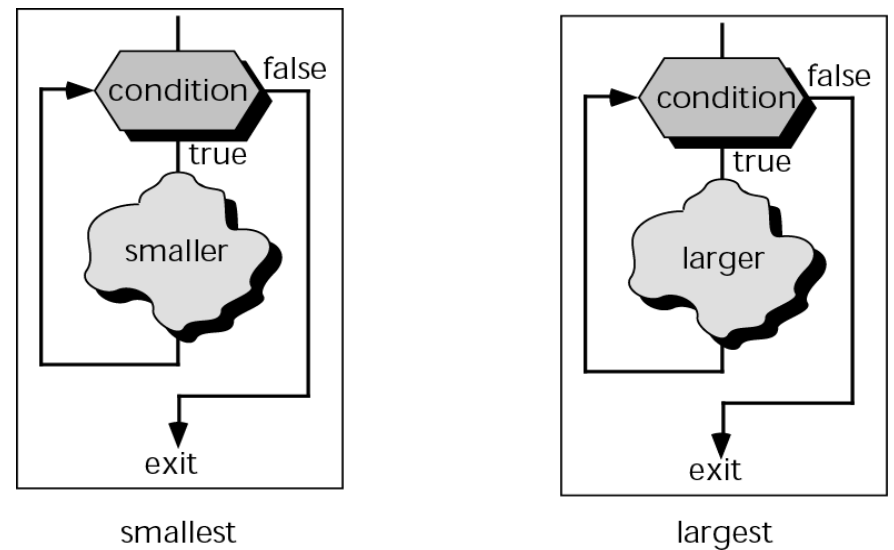
Looping Application

Application of Iteration

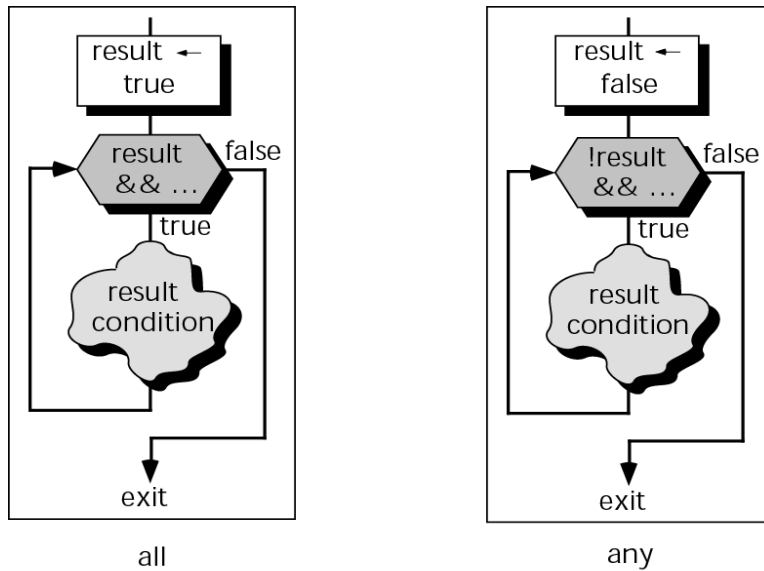
Summation and Product Loops



Smallest and Largest Loops



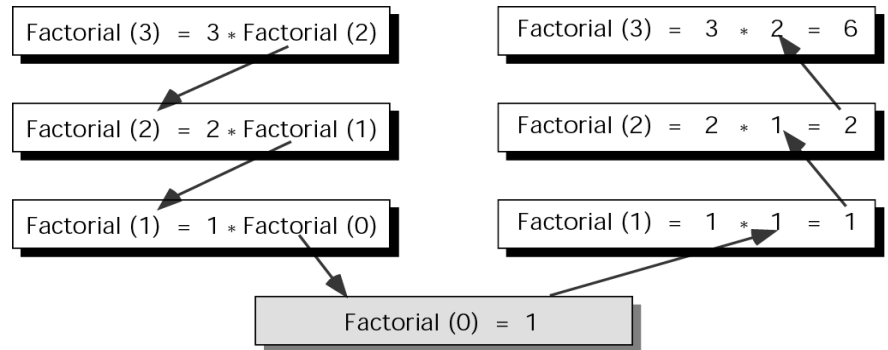
Any and All Inquiries



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Factorial Recursively

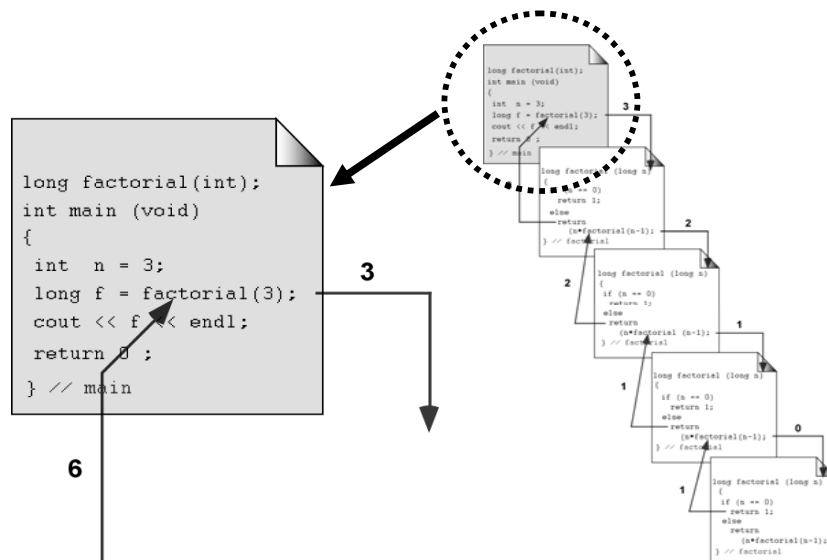
- Every recursive call must either solve part of the problem or reduce the size of the problem



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Calling a Recursive Function



Array

Introduction to Array

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Declaring and Defining Arrays

int scores [9];

[0] [1] [2] [3] [4] [5] [6] [7] [8]
scores

type of each element

char name [10];

[0] [1] [2] [3] [4] [5] [6] [7] [8] [9]
name

name of the array

float gpa [40];

[0] [1] [2] ... [37] [38] [39]
gpa

number of elements

41

Initializing Arrays

int numbers [5] = { 3,7,12,24,45 }; int numbers [] = { 3,7,12,24,45 };

int numbers [5] = { 3,7 }; int lotsOfNumbers [1000] = { 0 };

The rest are filled with 0s

All filled with 0s

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Exchanging Scores with Temporary Variable

numbers []

Before

temp = numbers [3];

During

numbers [3] = numbers [1];

During

numbers [1] = temp;

After

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Passing Individual Elements to Function

```
void print_square ( int );

int main ()
{
    int base[5] = { 3, 7, 2, 4, 5 };
    for ( int i = 0; i < 5; i++ )
        print_square ( base [ i ] );

    return 0;
} // main
```

base

3 base [0]

7 base [1]

2 base [2]

4 base [3]

5 base [4]

x

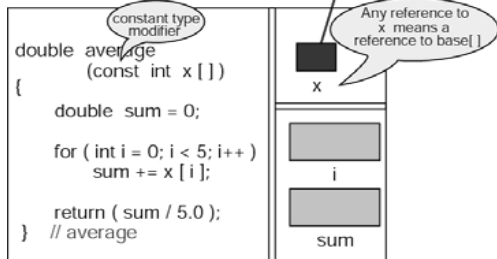
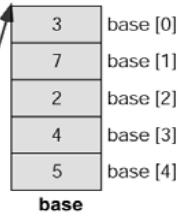
```
void print_square ( int x )
{
    cout << " " << x * x;
    return ;
} // print_square
```

Passing Arrays to Function

```
double average (const int x []);

int main ()
{
    double ave;

    int base[5] = { 3, 7, 2, 4, 5 };
    ...
    ave = average (base);
    ...
    return 0;
} // main
```



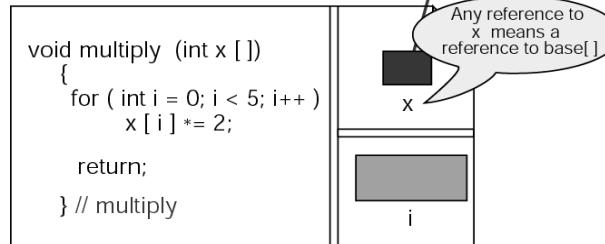
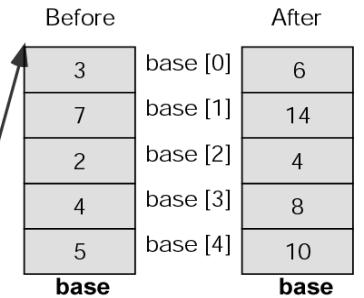
Changing Arrays Value in Function

```
void multiply (int x []);

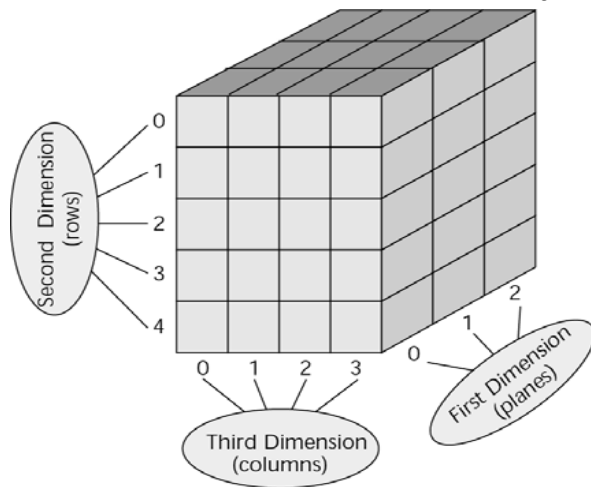
int main ()
{
    int base[5] = { 3, 7, 2, 4, 5 };

    multiply (base);

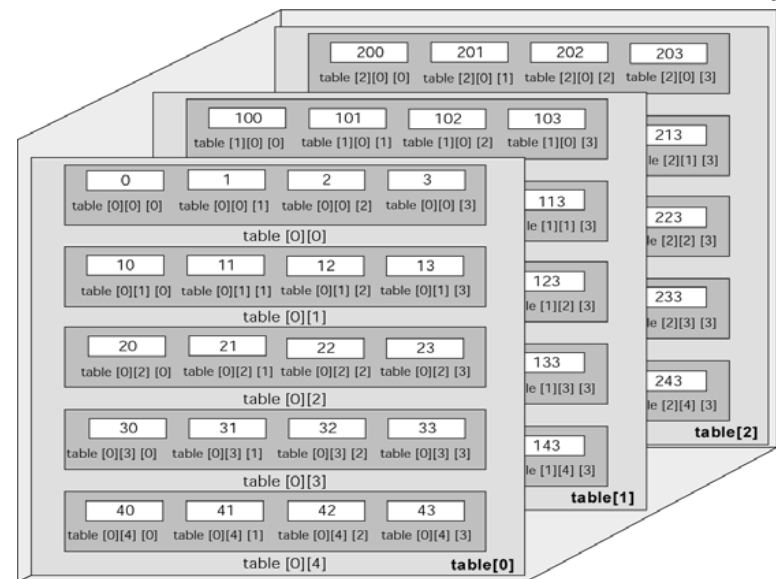
    return 0;
} // main
```



A Three-Dimensional Array



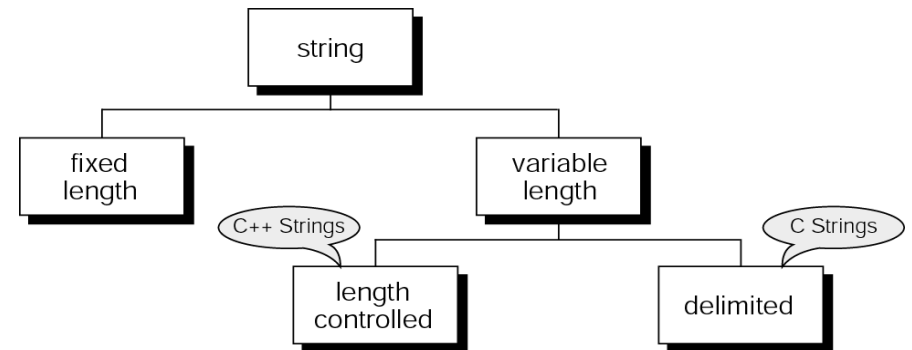
C++ View of Three-Dimensional Array



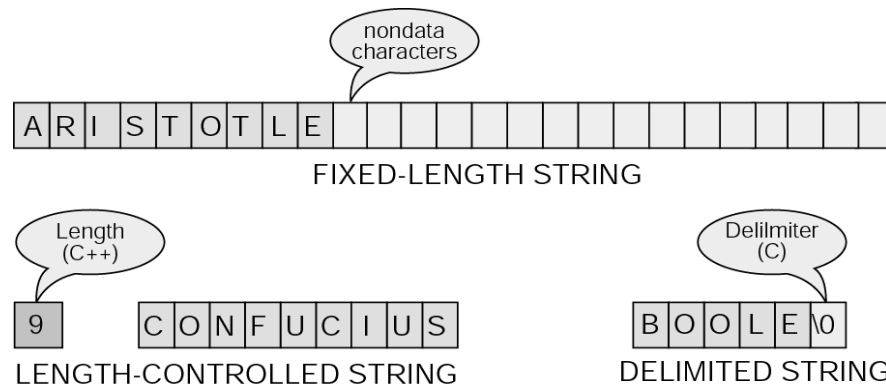
String

String Handling

String Taxonomy

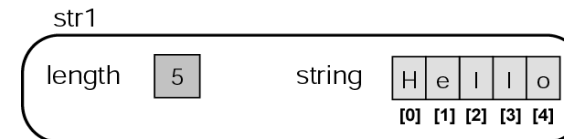


String Format

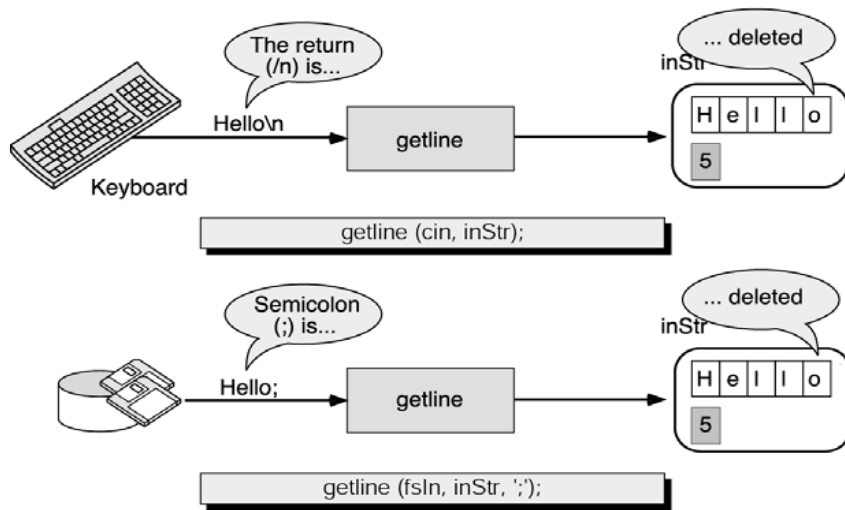


C++ String

- The extraction operator stops at whitespace.
- To read a string with spaces, we must use **getline**
- The string input /output operators and functions are defined in the string header file, not the I/O stream header file.

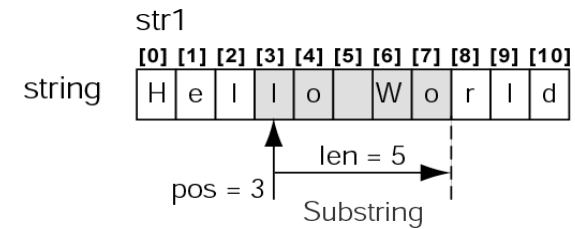


getline Function

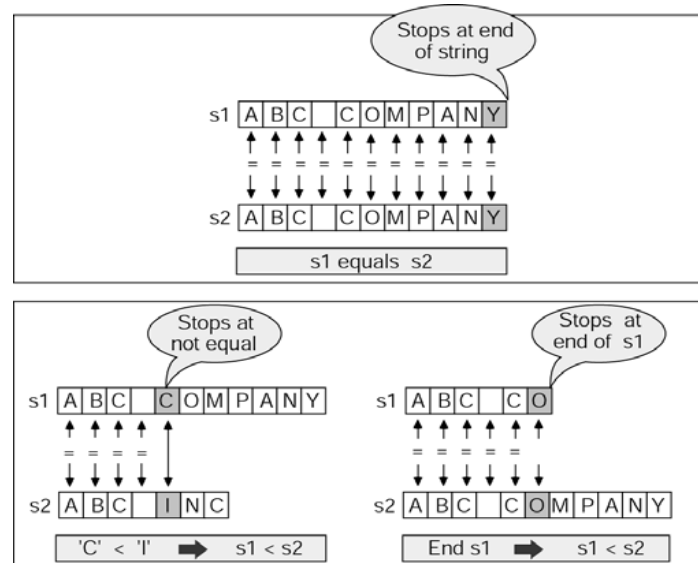


Substring Concept

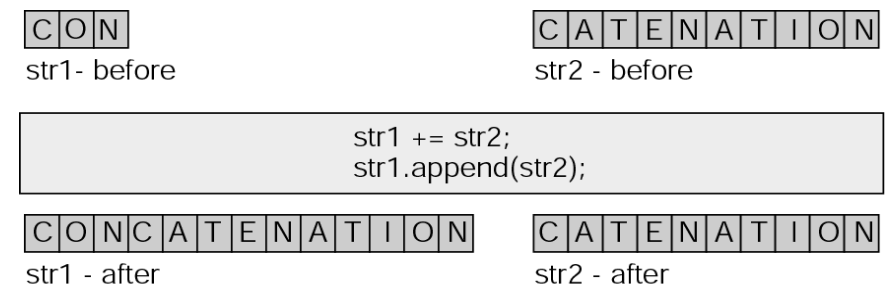
- A subsequence, substring, prefix or suffix of a string is a subset of the symbols in a string, where the order of the elements is preserved. In this context, the terms string and sequence have the same meaning.



String Comparison



String Append



Find First and Last

