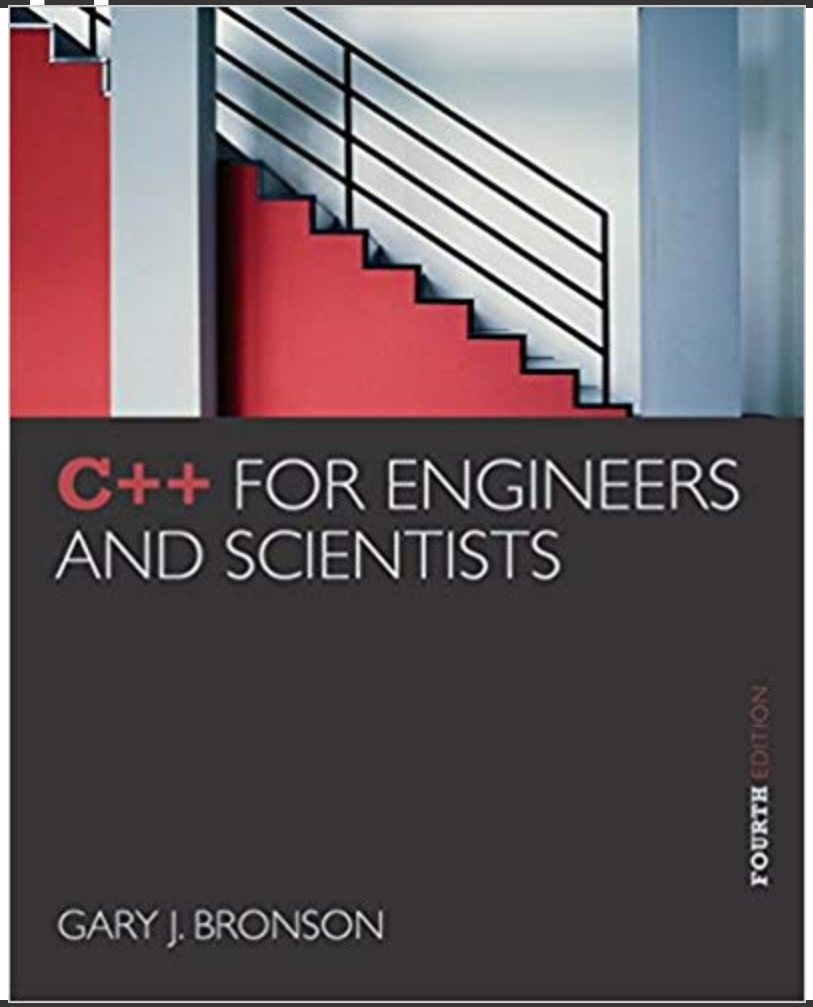
ELEG 1043
Computer Applications in Engineering



Chapter 5:
Repetition Statements

C++ FOR ENGINEERS
AND SCIENTISTS

Acknowledgement

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Objectives

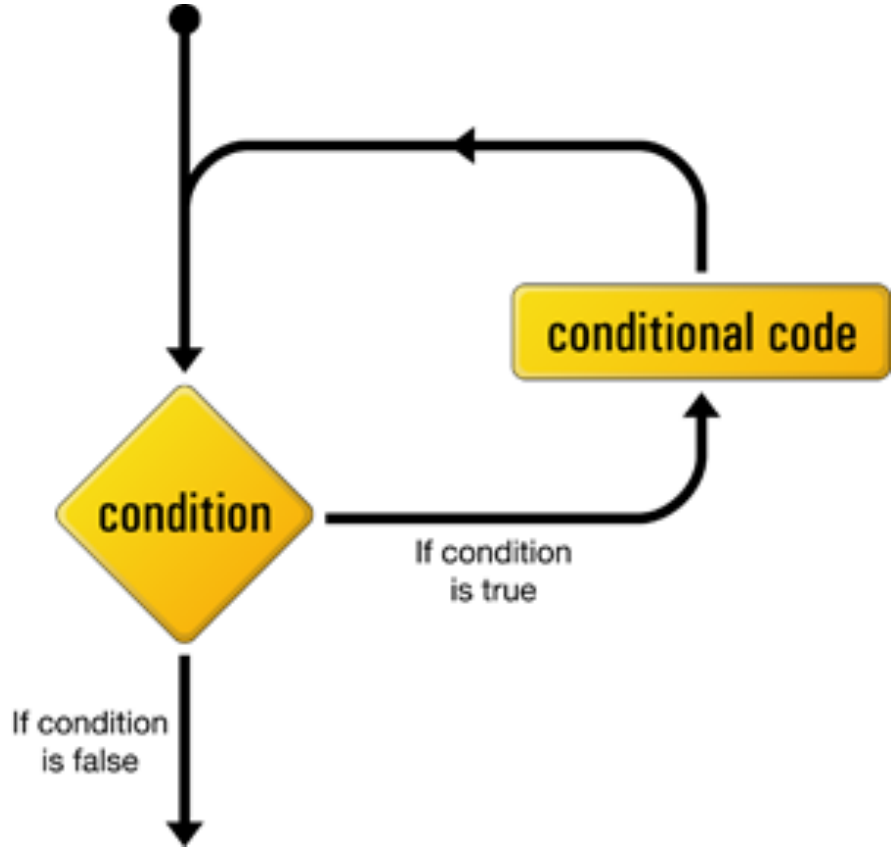
In this chapter, you will learn about:

- Basic loop structures
- **`while`** loops
- Interactive **`while`** loops
- **`for`** loops
- Loop programming techniques

Objectives (continued)

- Nested loops
- **`do while`** loops
- Common programming errors

LOOP


conditional code
condition
If condition
is true
If condition
is false

Basic Loop Structures

- Repetition structure has four required elements:
  - Repetition statement
  - Condition to be evaluated
  - Initial value for the condition
  - Loop termination
- Repetition statements include:
  - **`while`**
  - **`for`**
  - **`do while`**

Basic Loop Structures (continued)

- The condition can be tested
  - At the beginning: **Pretest** or **entrance-controlled** loop
  - At the end: **Posttest** or **exit-controlled** loop
- Something in the loop body must cause the condition to change, to avoid an **infinite loop**, which never terminates

Pretest and Posttest Loops

- Pretest loop: Condition is tested first; if false, statements in the loop body are never executed
- **`while`** and **`for`** loops are pretest loops

  do while?

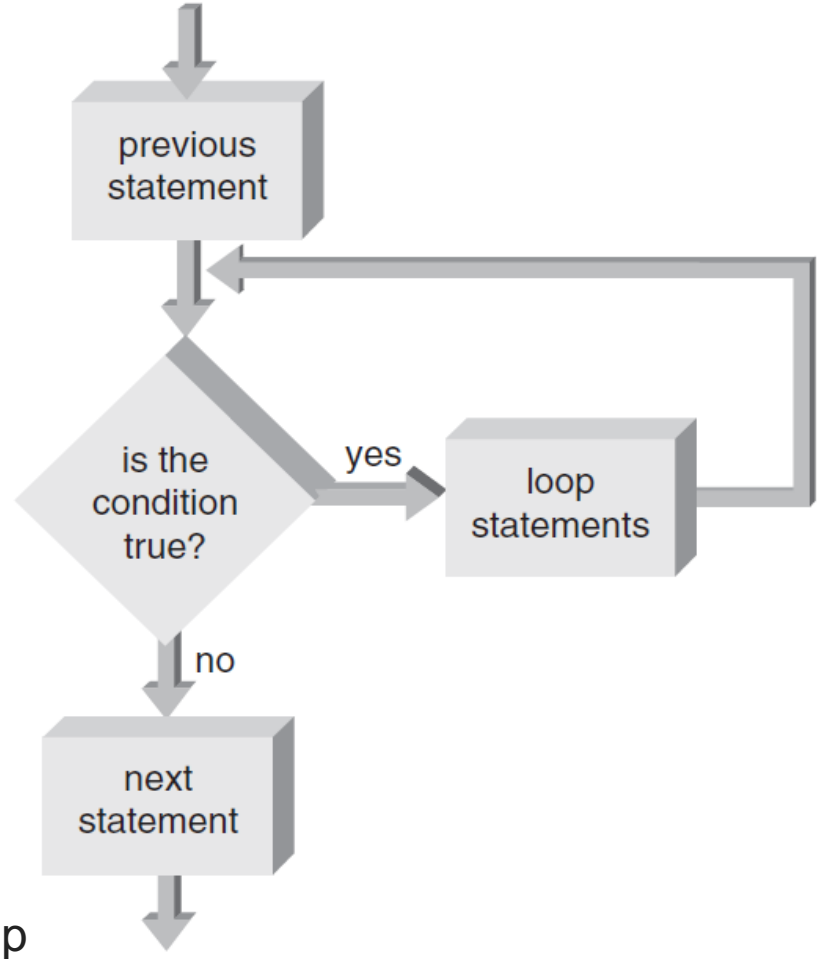


Figure 5.1 A pretest loop

Pretest and Posttest Loops (continued)

- Posttest loop: Condition is tested after the loop body statements are executed; loop body always executes at least once
- `do while` is a posttest loop

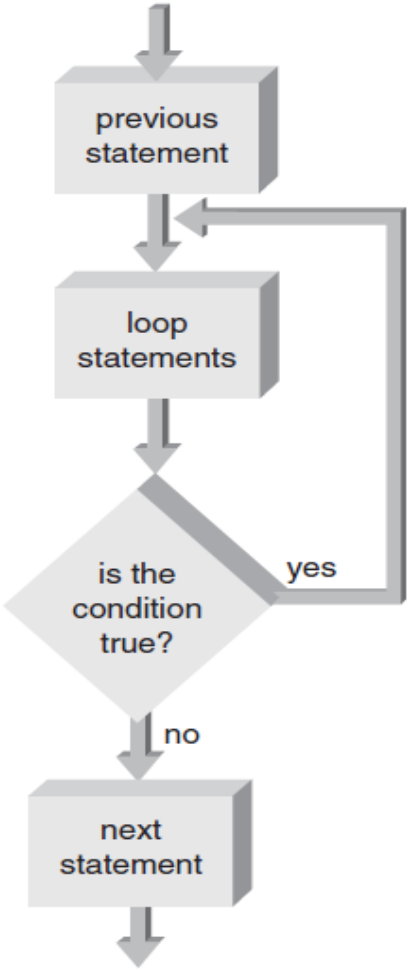


Figure 5.2 A posttest loop

Fixed-Count Versus Variable-Condition Loops

- **Fixed-count loop:** Loop is processed for a fixed number of repetitions
- **Variable-condition loop:** Number of repetitions depends on the value of a variable

while Loops

`while` Loops

- **`while` statement** is used to create a `while` loop
  - Syntax:

while (expression)

statement;

- Statements following the expressions are executed as long as the expression condition remains true (evaluates to a non-zero value)

while Loops (continued)

Program 5.1

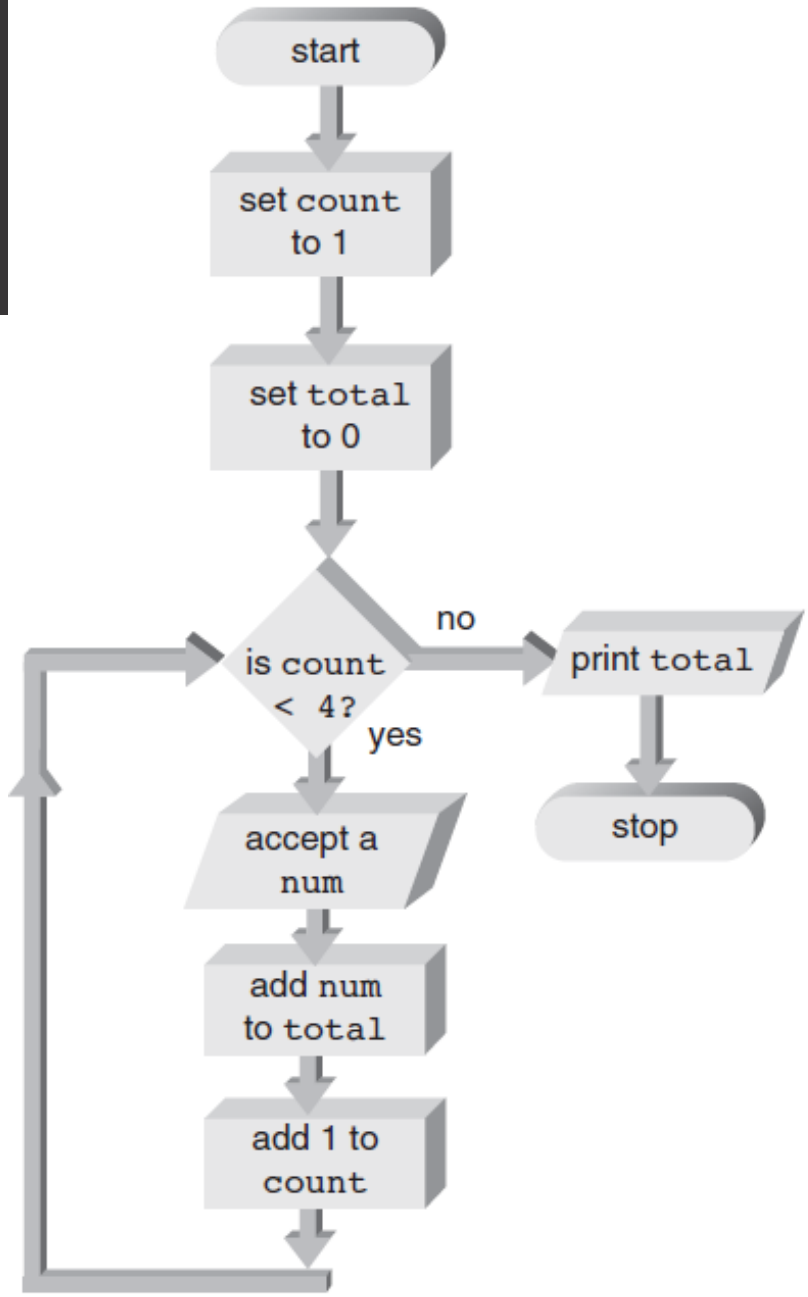
```
#include <iostream>
using namespace std;

int main()
{
  int count;

  count = 1;                // initialize count
  while (count <= 10)
  {
    cout << count << "   ";
    count++;                // increment count
  }

  return 0;
}
```

Interactive `while` Loops

- Combining interactive data entry with the **`while`** statement provides for repetitive entry and accumulation of totals

Interactive `while` Loops (cont'd)

Figure 5.7 Accumulation flow of control



Interactive `while` Loops (cont'd)

```
#include <iostream>
using namespace std;

int main()
{
    int count = 0, total = 0;

    while(count < 4)
    {
        int num;
        cout<<"Enter a num \n";
        cin>>num;
        total = total + num;
    }

    cout<<"The total is "<<total;
    return 0;
}
```

Interactive `while` Loops (cont'd)

```
#include <iostream>
using namespace std;

int main()
{
    int count = 0, total = 0;

    while(count < 4)
    {
        int num;
        cout<<"Enter a num \n";
        cin>>num;
        total = total + num;
        count = count + 1
    }

    cout<<"The total is "<<total;
    return 0;
}
```

`break` and `continue` Statements

- **`break`** statement
  - Forces an immediate break, or exit, from **`switch`**, **`while`**, **`for`**, and **`do-while`** statements
  - Useful for breaking out of loops when an unusual condition is detected

`break` and `continue` Statements (cont'd)

- Example of a `break` statement:

```
while (count <= 10)
{
  cout << "Enter a number: ";
  cin  >> num;
  if (num > 76)
  {
    cout << "You lose!\n";
    break;        // break out of the loop
  }
  else
    cout << "Keep on trucking!\n";
  count++;
}
// break jumps to here
```

`break` and `continue` Statements (cont'd)

- **`continue`** statement
  - Applies to **`while`**, **`do-while`**, and **`for`** statements; causes the next iteration of the loop to begin immediately
  - Useful for skipping over data that should not be processed in this iteration, while staying within the loop

`break` and `continue` Statements (cont'd)

- A `continue` statement where invalid grades are ignored, and only valid grades are added to the total:

```
while (count < 30)
{
   cout << "Enter a grade: ";
   cin  >> grade
   if(grade < 0 || grade > 100)
     continue;
   total = total + grade;
   count++;
}
```