Loop Structures

WHEN A GAME PLAYER has five chances to guess a randomly generated number, it is appropriate to use a "for" loop. A "for" loop is a counting loop and can be programmed easily to execute five times. The "for" loop is only one of three common looping structures in C++.

Objective:

Describe the purpose of a program loop, and compare and contrast three common looping structures in C++.

Key Terms:

do-while loop
expression
for loop
game loop
loop body
post-test loop
pre-test loop
program loop
while loop

Looping Structures

The instructions read, "Pour one ounce of milk into a cup. Repeat until full." Therefore, you pour one ounce of milk into a cup and repeat this step until the condition of the cup being full is met. The process of pouring would then cease. Basically, program loops work the same way.

PURPOSE OF A PROGRAM LOOP

A **program loop** is blocks of code that instruct the computer to repeat a process until a certain condition is met. A program loop is composed of a loop body and an expression. The **loop body** is information enclosed in curly braces and consists of the instructions to be repeated. An **expression** is a mathematical statement tested by the computer to determine if the instructions in the loop should be processed. The loop body will repeat as long as the expression evaluates to true.

Examples

In a game in which the player must choose a level of difficulty between 1 and 5, an invalid selection (e.g., 6) must result in the program prompting the player to choose a difficulty level between 1 and 5. Until the player chooses a valid difficulty level, the program will repeat the menu instructions to prompt the user to make a valid selection.

Almost every game contains a game loop. A **game loop** is content that consists of most, if not all, events that occur during a game. When most games end, the player is asked to play again. If the player chooses to play again, the game events are repeated. Therefore, all instructions in the game are repeated until the player chooses not to play again.

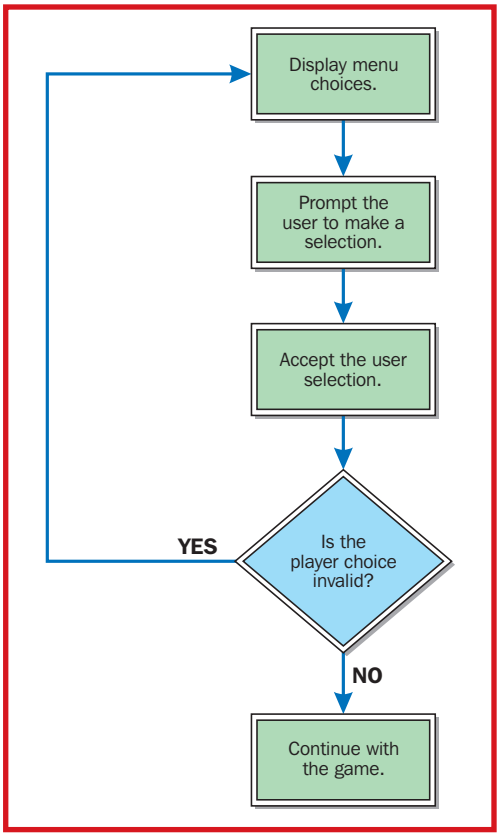

FIGURE 1. A program loop is blocks of code that instruct the computer to repeat a process until a certain condition is met.

LOOPING STRUCTURES IN C++

Three common looping structures in C++ are the do-while loop, the post-test loop, and the while loop. A **do-while loop** (do loop) is a loop that causes a program to execute a block of code, test an expression, and repeat that block of code as long as the tested expression remains true. It is considered a **post-test loop**, which is a looping structure that executes before the expression is tested. Therefore, a do-while loop always executes at least once. The do-while loop is appropriate to use when the loop body must execute one time before a condition is tested.

A **while loop** is a loop that tests an expression and then executes a block of code if the tested expression evaluates to true. It is considered a **pre-test loop**, which is a looping structure in which an expression is tested before the loop body executes. If the expression is false,

UNDER INVESTIGATION...

LAB CONNECTION: Appropriate Looping Structures

Create three separate program scenarios in which the three looping structures covered in class are the appropriate loops for the developed program. Create different scenarios from those used in class or already used in other homework assignments. You should carefully demonstrate program requirements for the do-while loop, the while loop, and the for loop. After you create your scenarios, explain why your chosen looping structure is the right fit for the program requirement.

the loop will not execute. The while loop is appropriate to use when the loop body executes only if a particular condition is met.

A **for loop** is a loop that causes a block of code to repeat execution based on a counter. The for loop is often considered a counting loop because the number of times the loop body is repeated is based on a counter updated after each iteration of the loop. The for loop is appropriate to use when the loop body must execute a specific number of times.

```
while (expression)
{
statement 1;
statement 2;
statement…n;
}
```

FIGURE 2. The while loop structure is considered a pre-test loop because the expression is evaluated before the instructions in the loop body are executed.

Summary:

A program loop is blocks of code that instruct the computer to repeat a process until a certain condition is met. A program loop consists of a loop body and an expression. The loop body is enclosed in curly braces and consists of the instructions to be repeated. An expression is a mathematical statement tested by the computer to determine if the instructions in the loop should be processed. The loop body will repeat as long as the expression evaluates to true. Almost every game contains a game loop.

Three common looping structures in C++ are the do-while, while, and for loop. A do-while loop (do loop) causes a program to execute a block of code, test an expression, and repeat that block of code as long as the tested expression remains true. It is considered a post-test loop. A while loop tests an expression and then executes a block of code if the tested expression evaluates to true. It is considered a pre-test loop, which is a looping structure in which an expression is tested before the loop body executes. A for loop causes a block of code to repeat execution based on a counter. It is often considered a counting loop because the number of times the loop body is repeated is based on a counter updated after each iteration of the loop. The for loop is appropriate to use when the loop body must execute a specific number of times.

Checking Your Knowledge:

1. Define the term do-while loop. Then give an example of a program requirement that fits the definition.
2. Define the term while loop. Then give an example of a program requirement that fits the definition.
3. Define the term for loop. Then give an example of a program requirement that fits the definition.
4. Which loop is considered a post-test loop?
5. Which loop is considered a pre-test loop?

Expanding Your Knowledge:

On paper, explain why program loops are used in a computer program. Then do some additional research online to make sure you have not overlooked or omitted anything from your explanation.

Web Links:

Loops in C++
http://www.dreamincode.net/forums/topic/13919-understanding-loops-in-c/

The For Loop, C++ Tutorial
http://www.hitmill.com/programming/cpp/forLoop.htm

Programming Loops
http://www.cprogramming.com/tutorial/lesson3.html

C++ For Loops, While Loops
http://www.codingunit.com/cplusplus-tutorial-for-loops-while-loops