PROG0101 FUNDAMENTALS OF PROGRAMMING

Chapter 7
Loops
Topics

• Loops
• Condition Tested Loops
• Counted Loops
• Endless Loops
• FOR Loop
• WHILE Loop
• DO-WHILE Loop
Loops

• A loop is a sequence of instructions that is continually repeated until a certain condition is reached.
• Loops allow for the same statement to be executed a number of times in succession.
Loops

Pseudocode:

Loop
   Do Something
Until Condition
Loops

• There are three types which are common to most programming languages:
  – Condition Tested Loops
  – Counted Loops
  – Endless Loops
Condition Tested Loops

- A condition tested loop is one which repeats a set of instructions until a certain condition is reached.
- The test can be performed at the start of the loop (before any of the instructions are executed), during the loop, or at the end of the loop.
- Usually, the condition will be testing the result of executing the statements that are inside the loop.
Counted Loops

• A counted loop is one which allows the programmer to instruct the computer to perform a set of instructions \( x \) times, where \( x \) is usually an integer value, but some programming languages offer other data types.

• One could argue that the counted loop is just a condition tested loop which updates a counter and exits once a given value is reached.
Counted Loops

- The only time to use a count loop is when the program can determine ahead of time how many times the loop will repeat.

- There are generally two ways that the number of repetitions of a loop will be known ahead of time:
  - The loop always repeats the same number of times.
  - The program calculates the number of repetitions based upon user input.
Endless Loops

• An endless loop goes round and round until one of three things happens:
  – The computer is turned off (or the application stopped, forcefully)
  – The computer encounters an EXIT (or similar) statement
  – An error forces the application to 'crash'

• Some endless loops serve a purpose, in message loops, for example, where it is necessary to continually monitor for incoming messages from the operating system.
Example of Loop Statement

• These are examples loop statement in programming language
  – FOR Loop
  – WHILE Loop
  – DO … WHILE Loop
FOR Loop

- A FOR loop is a loop that repeats a specified number of times.
- The loop uses a counter to tell it how many times to run the same sequence of activities.
Loops

FOR Loop

• The counter has the following three numeric values:
  – Initial counter value
  – Increment (the amount to add to the counter each time the loop runs)
  – Final counter value
• The loop ends when the counter reaches the final counter value, or, if there is an associated test condition, when the test condition is true.
FOR Loop

Pseudocode:

FOR $x$ times
    Do Something
    Increment

Flowchart:
Loops

FOR Loop

FOR loop syntax:

FOR (initial counter value, final counter, increment)
Statement (Do Something)
Loops

FOR Loop

Example 1:

FOR (x=1, x<5, x++)
PRINT “Hello World”

Output:
Hello World
Hello World
Hello World
Hello World
FOR Loop

Example 2:

FOR (x=1, x<=4, x++)
    PRINT x

Output:
1
2
3
4
FOR Loop

Example 3:

FOR (x=5, x>0, x--)
PRINT x

Output:
5
4
3
2
1
WHILE Loop

- A WHILE loop is a loop that repeats while some condition is satisfied.
- The WHILE loop tests its condition at the beginning of every loop.
- If the condition is false from the start, the sequence of activities contained in the loop never runs at all.
WHILE Loop

Pseudocode:

WHILE condition
Do Something
Loops

WHILE Loop

WHILE loop syntax:

WHILE (Condition)
    Statement (Do Something)
WHILE Loop

Example 1:

WHILE (\(x < 5\))
   PRINT “Hello World”
   x++

Output:
Hello World
Hello World
Hello World
Hello World
WHILE Loop

Example 2:

WHILE (key != Esc)
   PRINT “Hello World”

Output:
Hello world
Hello world
Hello world
Hello world
...

PROG0101 Fundamentals of Programming
Loops
DO-WHILE Loop

• Like a while loop, a do-while loop is a loop that repeats while some condition is satisfied.
• Unlike a while loop, a do-while loop tests its condition at the end of the loop.
• This means that its sequence of activities always runs at least once.
DO-WHILE Loop

Pseudocode:

Do

something

WHILE condition

Flowchart:
DO-WHILE Loop

DO-WHILE Loop Syntax

DO
  Statement
  WHILE (Condition)
DO-WHILE Loop

Example 1:

\[
x = 1 \\
\text{DO} \\
\quad \text{PRINT} \text{ "Hello World"} \\
\quad x++ \\
\text{WHILE} \ (x < 5)
\]

Output:

Hello World
Hello World
Hello World
Hello World
DO-WHILE Loop

Example 2:

\[
x = 1 \\
DO \\
\quad \text{PRINT “Hello World”} \\
\quad x++ \\
\ WHILE (x > 5)
\]

Output:

Hello World
DO-WHILE Loop

Example 3:

```
DO
  PRINT "Hello World"
WHILE (Key != Esc)
```

Output:
Hello World
Hello World
Hello World
...

Exercise

Draw flowchart diagram for the following programs using loop:

1. A program that display number 1 to 20
2. A program that display a person name x times.