CSE 1530

Introduction to Computer Use II: Programming

Winter 2006 (Section M)

Topic E: Subprograms – Functions and Procedures

Monday, March 6 2006

Bill Kapralos

Overview (1):

- **Before We Begin**
  - Some administrative details
  - Some questions to consider
- **Topic Overview**
  - Introduction
- **Subprograms**
  - Introduction
  - Function subprograms
  - Function example

Before We Begin

Administrative Details (1):

- **Lab Exercise**
  - You should be working on Ex 6-3 this week
    - Due Monday, March 13
- **Test 2 Reminder**
  - Wednesday, March 15 2006
- **Course Drop-Deadline**
  - Last day to withdraw from course is Friday, March 10 2006

Some Questions to Consider (1):

- Describe the Replace function
- Describe the InStr function
- Describe the Len function
- Describe the "Mid" function

Topic Overview

Introduction (1):

- **So Far, Two Alternatives to Sequential Programming → If Statements and Loops**
  - These are however not the only alternatives!
  - Another departure from sequential programming is a sub-program (function, method or procedure)
  - While executing a set of statements, and call to a subprogram is encountered, execution of those statements is interrupted
    - Execution of subprogram statements occurs and when subprogram statements have been executed, return back to original set of statements and continue at point after call to subprogram

Introduction (2):

- **We Have Already Encountered Subprograms**
  - We have made use of many subprograms up until this point, including the following
    - All the string-related functions → "Mid", "Len", "InStr", "Replace" etc…
    - AddItem from the ListBox
    - Date-related functions
    - Format function
  - But up until this point, the subprograms (functions) have been given to us
    - We simply use them without worrying about them!

Introduction (3):

- **Overview of Topic E**
  - We will examine subprograms (functions) in detail
    - We will learn how to write our own subprograms
  - Main concepts of the this topic
    - Abstraction and modularization
    - Function subprograms
    - Procedure (or Sub) subprograms
    - Transferring values via an argument list
    - The scope of variables

Subprograms

Introduction (1):

- **What is a Subprogram ?**
  - A convenient way to encapsulate some computation that can be then used many times over without worrying about its implementation
    - Allows us to ignore *how* a job is done
    - All we need to know is *what* is done (e.g., the outcome)
    - Can be used by many other programs as well

Introduction (2):

- **Why Use Subprograms ?**
  - Separate the performance of some task from the rest of the program
    - In designing a large program, its usually best to "divide and conquer" → break the task down into a number of pieces, each of which can be programmed separately
    - Imagine having to compute some computation many times → you can replicate the code many times or you can write the code once within a function and simply call the function

Introduction (3):

- **Why Use Subprograms ? (cont.)**
  - Break large sections of code into smaller units that perform a specific task
  - By breaking your calculations into smaller tasks
    - Simplify maintenance that needs to be done to the program in the future
    - Make the code easier to read/follow and troubleshoot

Introduction (4):

- **Subprograms are "Connected" to the Program That Calls Them**
  - They must usually use data from the calling program
  - Two ways that data from the calling program can be made available in the subprogram
    - Transferred to the subprogram via an argument list (arguments)
    - Global variables are also accessible within subprogram

Introduction (5):

- **Specific Types of Subprograms**
  - We have already encountered various subprograms
    - Event handlers → called in response to a user interaction via the GUI (e.g. command1_Click())
    - Functions → Called whenever it is encountered during program execution (e.g. Mid(inputTxt, position, 1))
    - Methods → a subprogram that is associated with a particular class/object and in fact the method can only be called via the object (e.g., listBox.AddItem(myString))

Introduction (6):

- **We Will Divide Subprograms Into Two Categories**
  - Function Subprograms
    - Restricted to computing and returning a single result only
    - Restricted
  - Procedure subprogram
    - More "freedom" to perform "greater" operations
  - For the remainder of the lecture, we will focus on function subprograms

Function Subprograms (1):

- **Purpose**
  - Calculates a some specific single result
  - Separate that calculation from the rest of the program code
    - Can perform this specific calculation many times by simply calling function within program
    - Depending on how the function is defined, it may also be called within different programs → the built in functions of VB are an example
  - Function should do nothing else except calculate a single result → shouldn't change object properties or modify global variables for example

Function Subprograms (2):

- **Promote Modularization**
  - Functions allow you to separate a well defined piece of some calculation
    - That piece of calculation becomes represented by the name of the function
    - Think of the larger problem independently of the piece represented by the function
  - This is known as modularization
    - Divide and conquer → dividing the task into smaller, well defined pieces or modules such that you can focus your thinking on smaller, more manageable tasks

Function Subprograms (3):

- **The Result of a Function**
  - A function (subprogram) can only calculate a single value
    - The value may be an integer, real number, string, boolean etc.
  - A function is essentially an expression and can therefore be used in the same places that a variable or expression might be used
    - For example, a function may be used on the right hand side of an assignment statement → myValue= Round()

Function Subprograms (4):

- **Defining a Function**
  - Syntax

```
Private Function functionName(argument list) As resultDataType
   function body (statements)
End Function
```

  - Private, Function, As and End Function
    - Key words
  - functionName
    - The name of the function that you provide
    - The name should be meaningful and represent the calculation performed by the function

Function Subprograms (5):

- **Defining a Function (cont.)**
  - (Argument list)
    - The argument list is optional however the parenthesis are not → they must be used even if there are no arguments
  - resultDataType
    - Specifies the data type of the result returned by the function (e.g., Integer, Single, Double…)

Function Subprograms (6):

- **Defining a Function (cont.)**
  - Function body
    - Statements that ultimately calculate the result
    - Must assign the result to the function name → therefore, within the function body itself, the following statement must appear

      functionName = …
    - The function name is treated as if it were a normal variable name
    - Function body may contain local variable declarations and may use any global variables

Function Example (1):

- **Compute a Sum**
  - Consider a function that will compute (and return) the sum of the numbers in the range 1-100
    - Function name → computeSum
    - Arguments → none
    - Return data type → Integer
  - Function definition

    Private Function computeSum() As Integer

    …

    End Function

Function Example (2):

- **Compute a Sum (cont.)**
  - Here is the Visual Basic code for the function

```
Private Function computeSum() As Integer
  Dim loopIndex As Integer
  Dim sum As Integer
  sum = 0

  For loopIndex = 1 To 100
    sum = sum + loopIndex
  Next
  computeSum = sum
End Function
```

Function Example (3):

- **Compute a Sum (cont.)**
  - Here is another (equivalent) version of the function
    - What is the difference ?

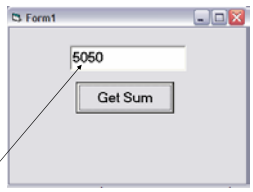
```
Private Function computeSum() As Integer
  Dim loopIndex As Integer
  computeSum = 0

  For loopIndex = 1 To 100
    computeSum = computeSum + loopIndex
  Next
End Function
```

Function Example (4):

- **Compute a Sum (cont.)**
  - Lets use the function now
    - Call it in the button Click event handler

```
Private Sub btnSum_Click()
  Dim sum As Integer
  sum = computeSum()
  txtSum.Text = sum
End Sub
```



Output after pressing button