CSE 1530

Introduction to Computer Use II: Programming

Winter 2005 (Section M)

Topic B: Variables, Data Types and Expressions

Monday, January 16 2006

Bill Kapralos

COSC 1530, Winter 2006, Bill Kapralos

Overview (1):

- **Before We Begin**
  - Some administrative details
  - Some questions to consider
- **Introduction To Topic B**
  - Topic overview
  - Main concepts we will look at
- **Data - Variables and Constants**
  - Variables and constants
  - Data types
  - Variable scope

Before We Begin

Administrative Details (1):

- **Lab Exercise 3-3**
  - This week, you should be working on Ex. 3-3 from your textbook
  - Follow instructions given on the course website
  - Due Monday, January 23 2005 before noon
    - Place in the assignment drop-box located on the 1st floor of the CSE building just by the elevator and CSE undergraduate offices
  - I will drop by the Glade lab either Wednesday or Friday (or perhaps both days) after the lecture

---

Administrative Details (2):

- **Review Questions**
  - Available at the end of each chapter on the online (web) version of the textbook
  - You should make an attempt to work on these questions just for your own practice (you do not need to submit them)
  - Answers are available by dragging mouse over the potential responses
    - Try answering the questions before looking at the answers!

Some Questions to Consider (1):

- What is a method ?
- Describe the structure of a method
- How are events handled ?
- What is the assignment operator ?
- How do we "split" one long line of VB code into multiple lines ?
- What are reserved words ?

Introduction to Topic B

Topic Overview (1):

- **Topic B Topics**
  - Topic A was concerned with some of the tools of the VB graphical development environment along with the idea of objects and their properties
  - Now we will begin focusing on programming language features that are necessary to start developing more complex programs
    - We will "add" what we learn now to our previous knowledge of VB (e.g., Topic A) and develop more meaningful and useful VB applications

Topic Overview (2):

- **Topic B Topics (cont.)**
  - We will build an understanding of programming language capabilities and concepts in general
    - Applicable to any programming language and not solely to VB although it will be geared towards VB
  - Main topics
    - Variable declarations and data types
    - Conversion between data types
    - Local variables versus global variables
    - Arithmetic operators

Data: Variables and Constants

Variables (1):

- **Introduction**
  - So far, all data we have worked with have been properties of objects
    - The Caption property of a Label and Textbox can be assigned String data for example
  - Will all the data we look at be restricted to property values of objects ?
    - No! → this would restrict the potential use of any programming language!
    - We can work with data (values) that are not properties of objects

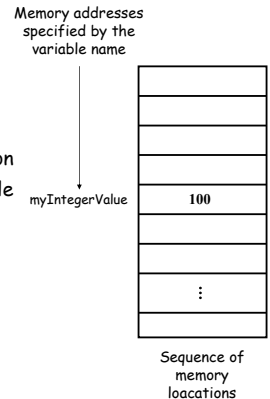## Variables (2):

- **Introduction (cont.)**
  - Every object contains properties that can be assigned specific values → these values can be accessed, assigned different values etc. either in design or run mode
    - As a result, these values must be "placed" (stored) somewhere in the computer's memory to be accessed as needed → they don't just magically appear!
    - Think of the computer memory as a sequence of memory locations, each with a unique "address" that stores a value of some type

Variables (3):

- **Introduction (cont.)**
  - We do not have to be concerned with memory addresses of course when using Visual Basic
    - We basically associate a name with each address and VB takes care of locating it etc.
  - Example → myintegerValue = 100
    - Sets aside a memory location within the computer's memory that is called "myIntegerValue" and the stores the value 100 there
    - We can refer to the memory location and therefore the value by "myIntegerValue"

Variables (4):

- **Introduction (cont.)**
  - We can now also change the value stored within a particular memory location during run-time (e.g., while the program is executing

Memory addresses specified by the variable name

myIntegerValue | 100

Sequence of memory loacations

Variables (5):

- **Introduction (cont.)**
  - We can now define the term variable
    - Variable → A memory location that holds data of a particular type that can be changed during the execution of the project (application)
  - With this definition, we can now define a constant
    - Constant → A memory location that holds data of a particular type that cannot be changed during the execution of the project (application)
    - Once its value is set, it cannot be changed!

Variables (6):

- **Introduction (cont.)**
  - Recall from last lecture → values must be of a specific type
    - Integer, String, Boolean etc.
    - Therefore, variables must be of a particular type as well → when we ask VB to set aside a variable (e.g., memory location with a stored value) we must specify a type as well

Variables (7):

- **Declarations**
  - Statements that establish your project's variables and constants → give the variables and constants names and specify the type of data they will hold
  - Some examples
    - Dim strName As String (Declares a string variable)
    - Dim intCounter As Integer (Declares an integer variable)

Data Types and Visual Basic (1):

- **Variable Data Types**
  - Specifies the type of the information that the variable will hold (e.g., the information that will be stored in the allocated memory space)
    - For example, Integer, String, Boolean
  - Basically, when you declare a variable, you typically provide a type for the variable
    - If you do not provide a variable type, a default type is provided → known as a variant type that adapts as needed throughout the program (these are actually less efficient than regular types)

Data Types and Visual Basic (2):

Visual Basic Variable Data Types

Data Type	Use For
Boolean	True or False values.
Byte	A single ANSI character (code 0 to 255).
Currency	Decimal fractions, such as dollars and cents.
Date	An eight-character date.
Double	Double-precision floating-point numbers with 14 digits of accuracy.
Integer	Whole numbers in the range −32,768 to 32,767.
Long	Larger whole numbers.
Single	Single-precision floating point numbers with six digits of accuracy.
String	Alphanumeric data: letters, digits, and other characters.
Variant	Converts from one type to another, as needed.

Data Types and Visual Basic (3):

Visual Basic Variable Data Types

- Size required for each of the variable types

Data Type	Number of Bytes of Memory Allocated
Boolean	2
Byte	1
Currency	8
Date	8
Double	8
Integer	2
Long	4
Single	4
String (variable length)	10 bytes plus 1 byte for each character in the string.
Variant	Holding numbers—16 bytes. Holding characters—22 bytes plus 1 byte for each character in the string.

Data Types and Visual Basic (4):

Visual Basic Variable Data Types (cont.)

- Most common type of variables and constants (at least in this course)
  - String, Integer, Boolean, Double
- Of course, it is up to you as a programmer to determine the variable type but some common guidelines are as follows
  - If data is used in a calculation → numeric type
  - If not used in a calculation → String
  - Scientific calculations → Single or Double