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 2006 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).

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**

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

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**Data Types and Visual Basic (3):**

- **Visual Basic Variable Data Types**

  - **Size required for each of the variable types**

<table>
<thead>
<tr>
<th>Data Type</th>
<th>Number of Bytes of Memory Allocated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boolean</td>
<td>1 byte</td>
</tr>
<tr>
<td>Byte</td>
<td>1 byte</td>
</tr>
<tr>
<td>Currency</td>
<td>4 bytes</td>
</tr>
<tr>
<td>Date</td>
<td>8 bytes</td>
</tr>
<tr>
<td>Double</td>
<td>8 bytes</td>
</tr>
<tr>
<td>Integer</td>
<td>2 bytes</td>
</tr>
<tr>
<td>Long</td>
<td>4 bytes</td>
</tr>
<tr>
<td>Single</td>
<td>4 bytes</td>
</tr>
<tr>
<td>String</td>
<td>Size (variable length) + 1 byte for each character in the string</td>
</tr>
<tr>
<td>Variant</td>
<td>Holding numbers—16 bytes.</td>
</tr>
<tr>
<td></td>
<td>Holding characters—20 bytes plus 1 byte for each character in the string</td>
</tr>
</tbody>
</table>

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**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