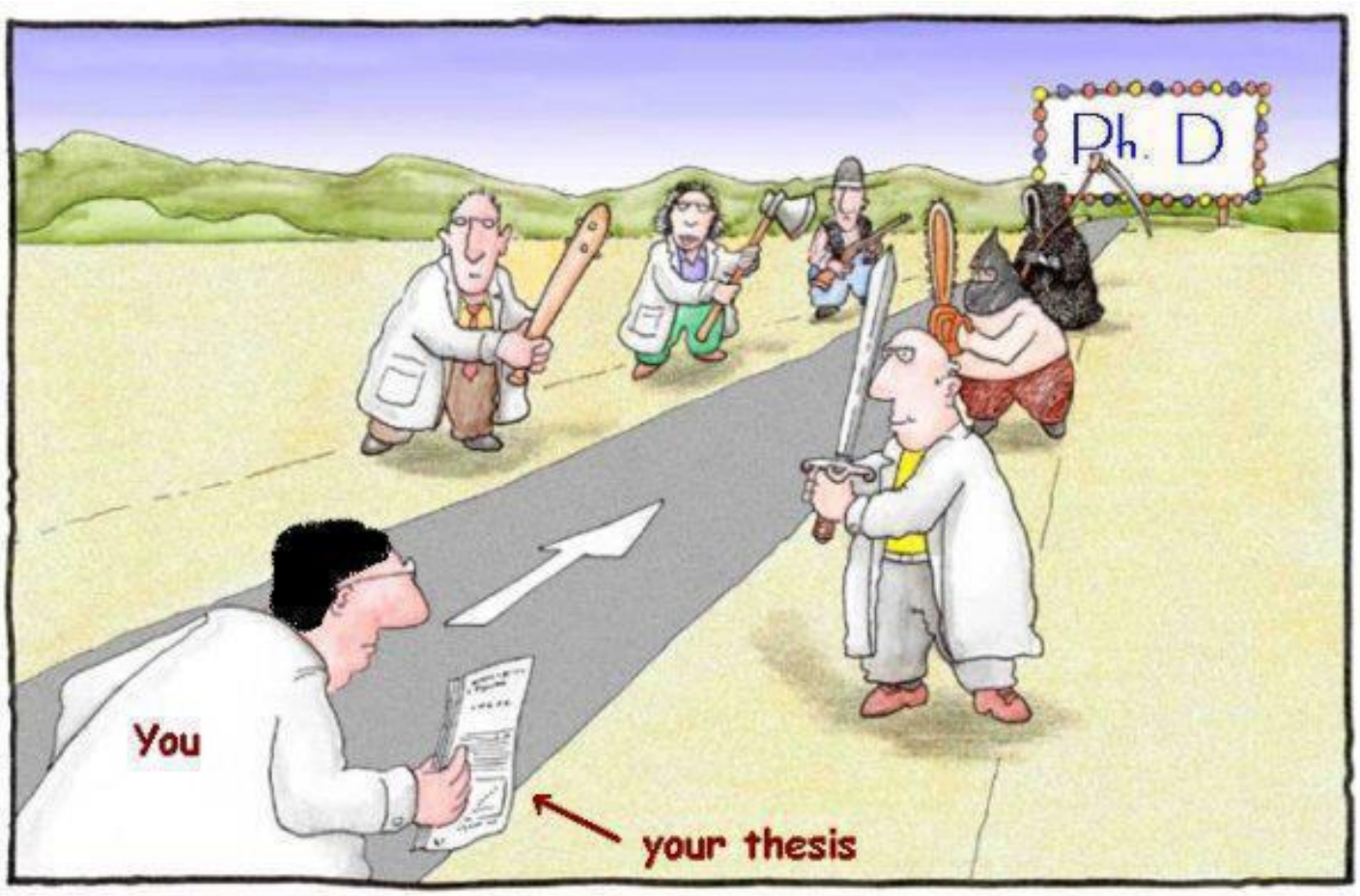
Visual Basic - Chapter 3



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* Adopted from An Introduction to Programming Using Visual Basic 2010, Schneider

Chapter 3 – Variables, Input, and Output

3.1 Numbers

3.2 Strings

3.3 Input and Output

3.1 Numbers

- Arithmetic Operations
- Variables
- Incrementing the Value of a Variable
- Built-In Functions:
  - Math.Sqrt
  - Int
  - Math.Round

Numbers (continued)

- The Integer Data Type
- Multiple Declarations
- Two Integer-Valued Operators
- Parentheses
- Three Types of Errors
- The Error List Window

Arithmetic Operations

- Numbers are called **numeric literals**
- Five arithmetic operations in Visual Basic

  \+ addition

  \- subtraction

  * multiplication

  / division

  ^ exponentiation

Numeric Expressions

2 + 3

3 * (4 + 5)

2 ^ 3

Displaying Numbers

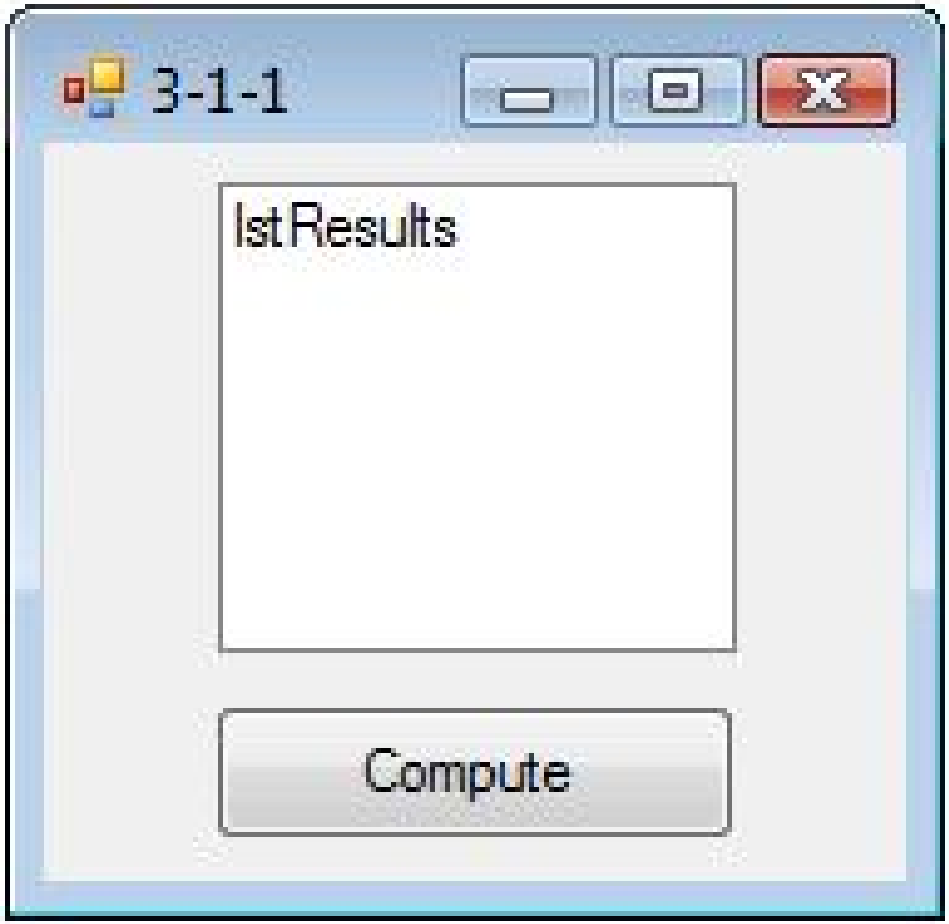
Let *n* be a number or a numeric expression.

The statement

```
lstBox.Items.Add(n)
```

displays the value of *n* in the list box.

Example 1: Form



Example 1: Code and Output

```
Private Sub btnCompute_Click (...)
                          Handles btnCompute.Click
  lstResults.Items.Add(5)
  lstResults.Items.Add(2 * 3)
  lstResults.Items.Add((2 ^ 3) – 1)
End Sub
```

Output in list box

5
6
7

Numeric Variable

A **numeric variable** is a name to which a number can be assigned.

Examples:

speed
distance
interestRate
balance

Variables

- Declaration:

```
Dim speed As Double
```

variable name **data type**

- Assignment:

```
speed = 50
```

Initialization

- Numeric variables are automatically initialized to 0:

```
Dim varName As Double
```

- To specify a nonzero initial value

```
Dim varName As Double = 50
```

Numeric Expressions

Numeric variables can be used in numeric expressions.

```
Dim balance As Double = 1000
lstBox.Items.Add(1.05 * balance)
```

Output: **1050**

Assignment Statement

```
Dim numVar1 As Double = 5
Dim numVar2 As Double = 4
numVar1 = 3 * numVar2
lstBox.Items.Add(numVar1)
```

Output: **12**

Incrementing

- To add 1 to the numeric variable *var*

```
var = var + 1
```

- Or as a shortcut

```
var += 1
```

- Or as a generalization

```
var += numeric expression
```

Built-in Functions

Functions *return* a value

- Math.Sqrt(9) returns 3
- Int(9.7) returns 9
- Math.Round(2.7) returns 3

Integer Data Type

- Variables of type Double can be assigned both whole numbers and numbers with decimals.
- The statement

```
Dim varName As Integer
```

declares a numeric variable that can only be assigned whole number values between about -2 billion and 2 billion.

Multiple Declarations

```
Dim a, b As Double
```

Two other types of multiple-declaration statements are

```
Dim a As Double, b As Integer
Dim c As Double = 2, b As Integer = 5
```

Two Integer-Valued Operators

- Integer division (denoted by \) is similar to ordinary long division except that the remainder is discarded.
- The Mod operator returns only the integer remainder.

  23 \ 7 = 3 23 Mod 7 = 2

  8 \ 2 = 4 8 Mod 2 = 0

Parentheses

- Parentheses should be used liberally in numeric expressions.
- In the absence of parentheses, the operations are carried out in the following order: ^, * and /, \, Mod, + and -.

Three Types of Errors

- Syntax error
- Runtime error
- Logic error

Some Types of Syntax Errors

- Misspellings

```
lstBox.Itms.Add(3)
```

- Omissions

```
lstBox.Items.Add(2 + )
```

- Incorrect punctuation

```
Dim m; n As Integer
```

A Type of Runtime Error

Overflow error

```
Dim numVar As Integer = 1000000
numVar = numVar * numVar
```

A Logical Error

```
Dim average As Double
Dim m As Double = 5
Dim n As Double = 10
average = m + n / 2
```

Value of *average* will be 10. Should be 7.5.

Error List Window

```
Dim m; n As Double
lstResults.Items.Add(5
lstResults.Items.Add(a)
```

Error List

3 Errors | 0 Warnings | 0 Messages

	Description	File	Line	Column	Project
1	Character is not valid.	frmShowErrors.vb	4	10	3-1-6
2	')' expected.	frmShowErrors.vb	5	26	3-1-6
3	Name 'a' is not declared.	frmShowErrors.vb	6	26	3-1-6

3.2 Strings

- Variables and Strings
- Option Explicit and Option Strict
- Using Text Boxes for Input and Output
- Auto Correction
- String Properties and Methods:

Length	ToUpper
Trim	ToLower
IndexOf	Substring

Strings (continued)

- Concatenation
- The Empty String
- Initial Value of a String
- Widening and Narrowing
- Internal Documentation
- Line Continuation
- Scope of a Variable

String Literal

A **string literal** is a sequence of characters surrounded by quotation marks.

Examples:

```
"hello"
"123-45-6789"
"#ab cde?"
```

String Variable

A **string variable** is a name to which a string value can be assigned.

Examples:

```
country
ssn
word
firstName
```

String Variable (continued)

- Declaration:

```
Dim firstName As String
```

variable name

data type

- Assignment:

```
firstName = "Fred"
```

String Variable (continued)

You can declare a string variable and assign it a value at the same time.

```
Dim firstName As String = "Fred"
```

Add Method

Let *str* be a string literal or variable. Then,

```
lstBox.Items.Add(str)
```

displays the value of *str* in the list box.

String Variable

You can assign the value of one string variable to another.

```
Dim strVar1 As String = "Hello"
Dim strVar2 As String = "Goodbye"
strVar2 = strVar1
lstOutput.Items.Add(strVar2)
```

Output: **Hello**

Variables and Strings

```
Private Sub btnDisplay_Click(...) Handles
                                    btnDisplay.Click
  Dim president As String
  president = "George Washington"
  lstOutput.Items.Add("president")
  lstOutput.Items.Add(president)
End Sub
```

Output:

```
president
George Washington
```

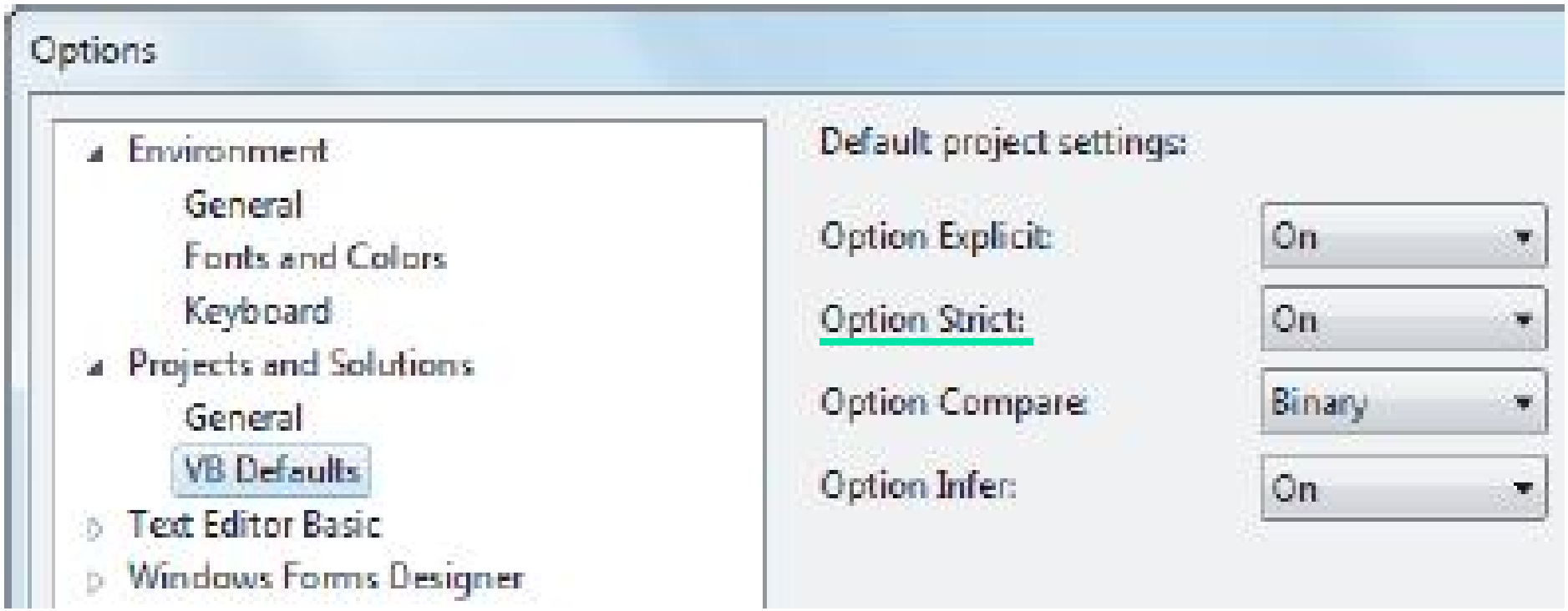
Option Strict

- Visual Basic allows numeric variables to be assigned strings and vice versa, a poor programming practice.
- To prevent such assignments, set Option Strict to On in the Options dialog box.

Option Strict (continued)

- Select *Options* from the *Tools* menu
- In left pane, expand Projects and Solution
- Select VB Defaults
- Set Option Strict to On

Option Strict (continued)



Using Text Boxes for Input and Output

- The contents of a text box is always a string.
- Input example:

```
strVar = txtBox.Text
```

- Output example:

```
txtBox.Text = strVar
```

Data Conversion

Because the contents of a text box is always a string, sometimes you must convert the input or output.

```
dblVar = CDbl(txtBox.Text)
```

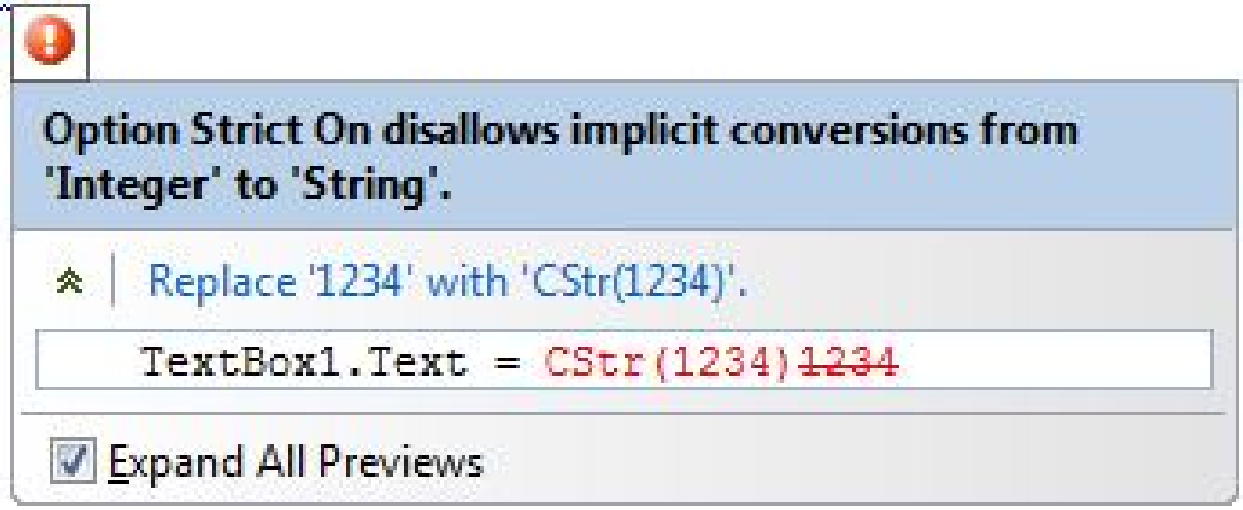
converts a String to a Double

```
txtBox.Text = CStr(numVar)
```

converts a number to a string

Auto Correction

```
TextBox1.Text = 1234
```



With Option Strict On

```
Dim dblVar As Double, intVar As Integer
Dim strVar As String
```

Not Valid:

```
intVar = dblVar
dblVar = strVar
strVar = intVar
```

Replace with:

```
intVar = CInt(dblVar)
dblVar = CDbl(strVar)
strVar = CStr(intVar)
```

Concatenation

Combining two strings to make a new string

```
quote1 = "We'll always "
quote2 = "have Paris."
quote = quote1 & quote2
txtOutput.Text = quote & " - Humphrey Bogart"
```

Output:

```
We'll always have Paris. - Humphrey Bogart
```

Appending

- To append *str* to the string variable *var*

```
var = var & str
```

- Or as a shortcut

```
var &= str
```

Appending Example

```
Dim var As String = "Good"
var &= "bye"
txtBox.Text = var
```

Output: **Goodbye**

Comment on Example 4

Consider

```
txtOutput.Text = numOfKeys & " keys"
```

The ampersand automatically converts **`numOfKeys`** into a string before concatenating.

We do not have to convert **`numOfKeys`** with CStr.

String Properties and Methods

"Visual".Length is 6.

"Visual".ToUpper is VISUAL.

"123 Hike".Length is 8.

"123 Hike".ToLower is 123 hike.

"a" & " bcd ".Trim & "efg" is abcdefg.

Positions in a String

Positions of characters in a string are numbered 0, 1, 2, ….

Consider the string “Visual Basic”.

Position 0: V

Position 1: i

Position 7: B

Substring “al” begins at position 4

Substring Method

Let *str* be a string.

`str.Substring(`*`m`*`, `*`n`*`)` is the substring of length *n*, beginning at position *m* in *str*.

“Visual Basic”.Substring(2, 3) is “sua”

“Visual Basic”.Substring(0, 1) is “V”

IndexOf Method

Let *str1* and *str2* be strings.

`str1.IndexOf(str2)`

is the position of the first occurrence of *str2* in *str1*.

(**Note:** Has value -1 if *str2* is not a substring of *str1*.)

`"Visual Basic".IndexOf("is")` is 1.

`"Visual Basic".IndexOf("si")` is 9.

`"Visual Basic".IndexOf("ab")` is -1.

The Empty String

- The string "", which has no characters, is called the **empty string** or the **zero-length string.**
- The statement `lstBox.Items.Add("")` skips a line in the list box.
- The contents of a text box can be cleared with either the statement

```
txtBox.Clear()
```

or the statement

```
txtBox.Text = ""
```

Initial Value of a String Variable

- By default the initial value is the keyword **Nothing**
- Strings can be given a different initial value as follows:

```
Dim name As String = "Fred"
```

Widening

- Widening: assigning an Integer value to a Double variable
- Widening always works. (Every Integer value is a Double value.)
- No conversion function needed.

Narrowing

- Narrowing: assigning a Double value to an Integer variable
- Narrowing might not work. (Not every Double value is an Integer value.)
- Narrowing requires the Cint function.

Comments

```
Private Sub btnCompute_Click (...)
                          Handles btnCompute.Click
  'Calculate the balance in an account
  Dim rate As Double  'Annual rate of interest
  Dim curBalance As Double  'Current balance
```

Internal Documentation

1. Other people can easily understand the program.
2. You can understand the program when you read it later.
3. Long programs are easier to read because the purposes of individual pieces can be determined at a glance.

Line Continuation

A long line of code can be continued on another line by using an underscore (_) preceded by a space

```
msg = "I'm going to make " & _
      "him an offer he can't refuse."
```

Implicit Line Continuation

The line continuation character can be omitted after a comma, ampersand, or arithmetic operator.

```
msg = "I'm going to make " &
      "him an offer he can't refuse."

average = sumOfNumbers /
          numberOfNumbers
```

Scope (continued)

- The **scope** of a variable is the portion of the program that can refer to it.
- Variables declared inside an event procedure are said to have **local scope** and are only available to the event procedure in which they are declared.

Scope

- Variables declared outside an event procedure are said to have **class-level scope** and are available to every event procedure.
- Usually declared after

```
Public Class formName
```

(In Declarations section of Code Editor.)

Automatic Colorization

Comments – green

String literals – maroon

Keywords – blue

Class Name – turqoise

Note: Examples of keywords are Handles, Sub, and End. Examples of class names are Form1, Math, and MessageBox.

3.3 Input and Output

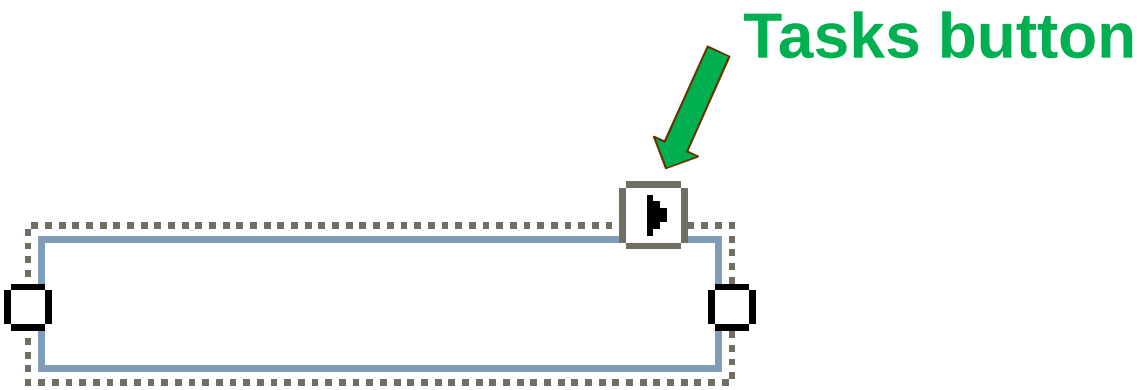
- Formatting Output with Format Functions
- Using a Masked Text Box for Input
- Dates as Input and Output
- Getting Input from an Input Dialog Box
- Using a Message Dialog Box for Output
- Named Constants
- Sending Output to the Printer

Formatting Output with Format Functions

Function	String Value
FormatNumber(12345.628, 1)	12,345.6
FormatCurrency(12345.628, 2)	$12,345.63
FormatPercent(0.183, 0)	18%

Masked Text Box Control

Similar to an ordinary text box, but has a Mask property that restricts what can be typed into the masked text box.



Masked Text Box Control

Click on the Tasks button to reveal the Set Mask property.

Click Set Mask to invoke the Input Mask dialog box.

Input Mask Dialog Box

Input Mask

Select a predefined mask description from the list below or select Custom to define a custom mask.

Mask Description	Data Format	Validating Type
Numeric (5-digits)	12345	Int32
Phone number	(574) 555-0123	(none)
Phone number no area code	555-0123	(none)
Short date	12/11/2003	DateTime
Short date and time (US)	12/11/2003 11:20	DateTime
Social security number	000-00-1234	(none)
Time (European/Military)	23:20	DateTime
Time (US)	11:20	DateTime
Zip Code	98052-6399	(none)
<Custom>		(none)

Mask:

Use ValidatingType

Preview:

OK Cancel

Mask

A Mask setting is a sequence of characters, with 0, L, and & having special meanings.

- 0 Placeholder for a digit.
- L Placeholder for a letter.
- & Placeholder for a character

Sample Masks

- State abbreviation: LL
- Phone number: 000-0000
- Social Security Number: 000-00-0000
- License plate: &&&&&&

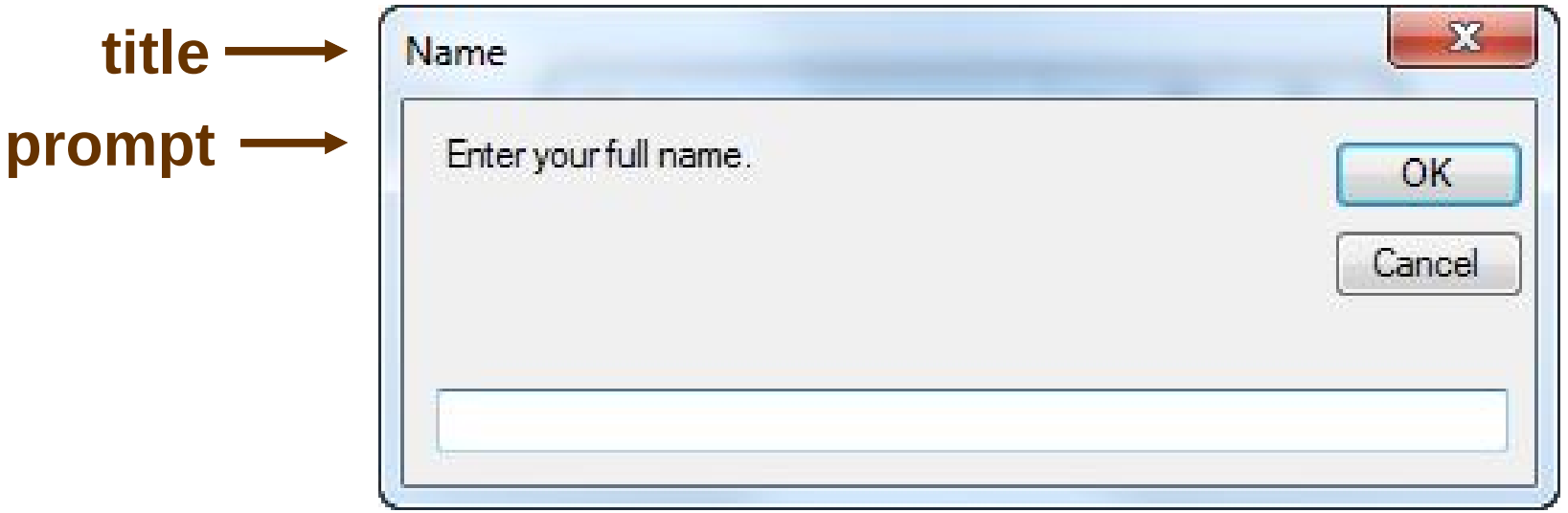
Dates as Input and Output

- Date literal: #7/4/1776#
- Declarations:

```
Dim indDay As Date
Dim d As Date = CDate(txtBox.Text)
Dim indDay As Date = #7/4/1776#
```

Getting Input from an Input Dialog Box

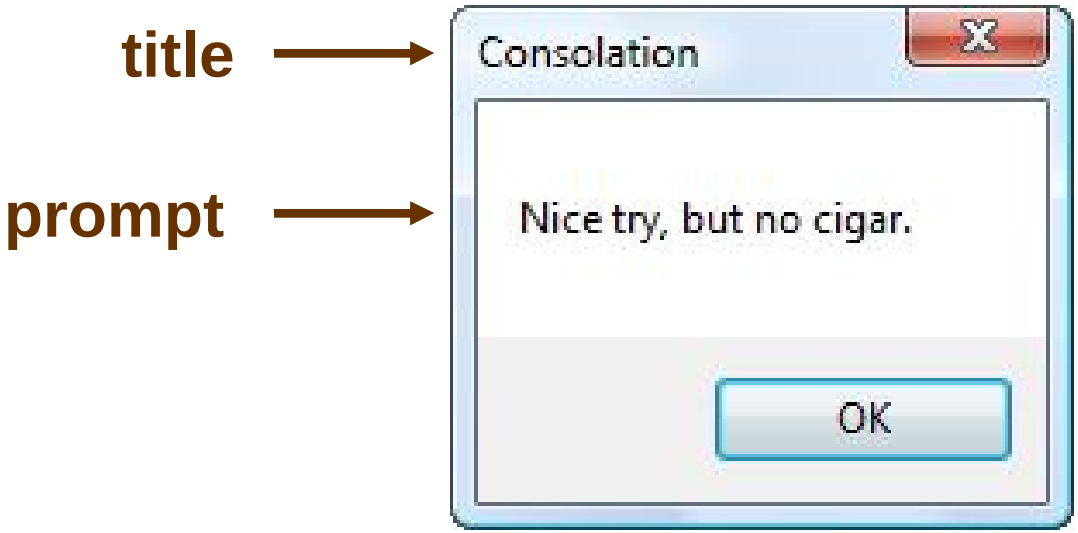
```
stringVar = InputBox(prompt, title)
fullName = InputBox("Enter your full name.",
                    "Name")
```



Using a Message Dialog Box for Output

```
MessageBox.Show(prompt, title)

MessageBox.Show("Nice try, but no cigar.",
                                    "Consolation")
```



Named Constants

- Declared with

```
Const CONSTANT_NAME As DataType = value
```

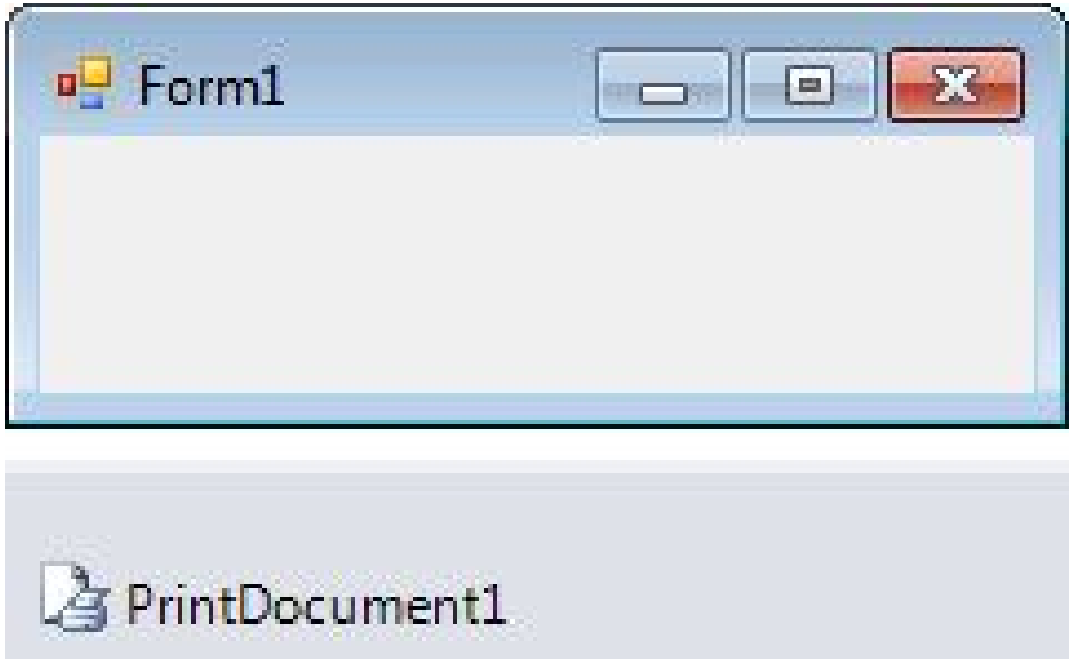
- Value cannot be changed.

Examples:

```
Const MIN_VOTING_AGE As Integer = 18
Const INTEREST_RATE As Double = 0.035
Const TITLE As String = "Visual Basic"
```

Sending Output to the Printer

Double-click on the PrintDocument control in the Toolbox. (The control will appear in the form's component tray.)



Output to Printer (continued)

- Double-click on PrintDocument1 to obtain its default event procedure PrintPage.
- All printing statements appear inside this procedure. They begin with the statement

```
Dim gr As Graphics = e.Graphics
```

- Most subsequent statements have the form

```
gr.DrawString(str, font, Brushes.color, x, y)
```

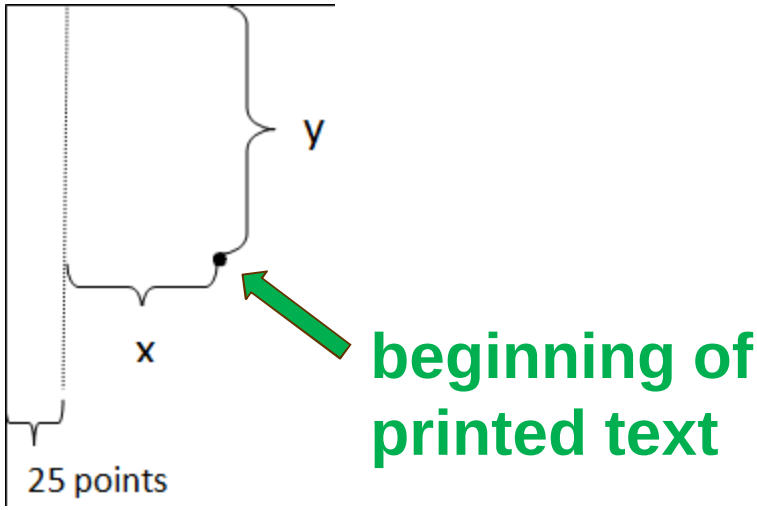
Output to Printer (continued)

```
gr.DrawString(str, font, Brushes.color, x, y)
```

- *str* is string to be printed
- *font* specifies name, size, and style of font used (can be set to Me.Font for form's font)
- *color* specifies the color of the printed text
- *x* and *y specify location of the beginning of the printed text*

Output to Printer (continued)

x and y are distances measured in points (1 point = 1/100 inch)



Output to Printer (continued)

- Execute the statement

  ```
  PrintDocument1.Print()
  ```

  to invoke actual printing
- A PrintPreviewDialog control can be added to the form. Then you can preview the printed page with the statement

  ```
  PrintPreviewDialog1.ShowDialog()
  ```