PROCEDURES & ARGUMENTS PART 1

VISUAL BASIC

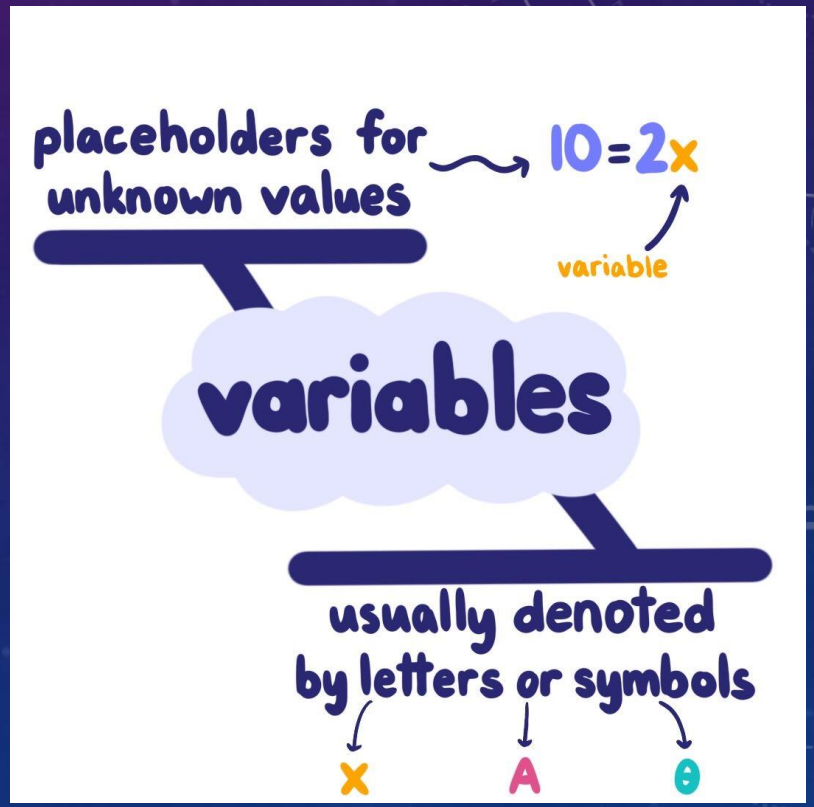
TABLE OF CONTENTS

LECTURE CONTEXT

- Most non-superficial programs are very large, with 1000s of lines of code and 100/1000s of variables.
- Programmers need a way to encapsulate portions of a program to develop and test in isolation from the rest of the code.
- It is also important to re-use resources (memory) and control the scope of variables to ensure one does not accidentally change values in other sections of code.
- Much code is written by teams and an individual's section of code also needs to easily integrate into the overall program without modification or issues.
- Procedures, such as Sub Routines facilitate all this.

VARIABLES

- Create variables (use memory) when needed + destroy (release memory) when not
- Manage by grouping and *limiting* their Scope to ***Procedure Level***
- Global variables **only** used if no other way to share data across modules - never passed!
- Procedures should operate only on Private objects / data passed to them



SUBROUTINES

- Code within *Sub/End Sub* statements
- private sub *name* (inputs)
- End Sub passes control back to calling program: line after the call is then run

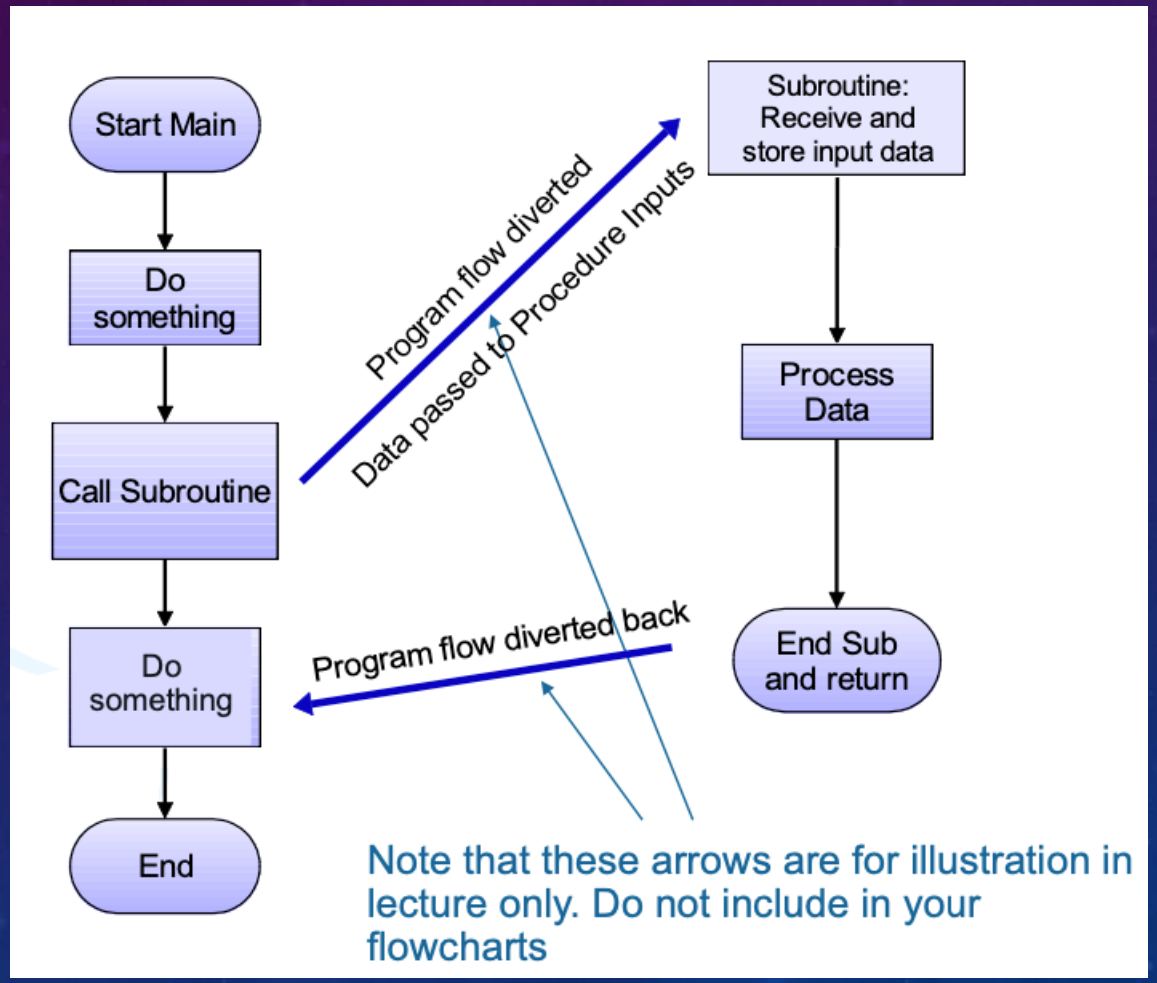
```
Private Sub DisplayCount()
    intCount = intCount +1
    txtDisplay.text = intCount
End Sub
```

SUBROUTINES

- Invocation by name: *Call DisplayCount*
- May pass data into Sub using brackets with ‘Call’ or none without Call command
- Call FindSum(23, 34) or FindSum 23, 34
- Event handlers are Subs - may be called
- Program flow immediately diverted to sub
- ‘End Sub’ returns program flow to line following the call in original routine
- In standard module use Public sub *name*()

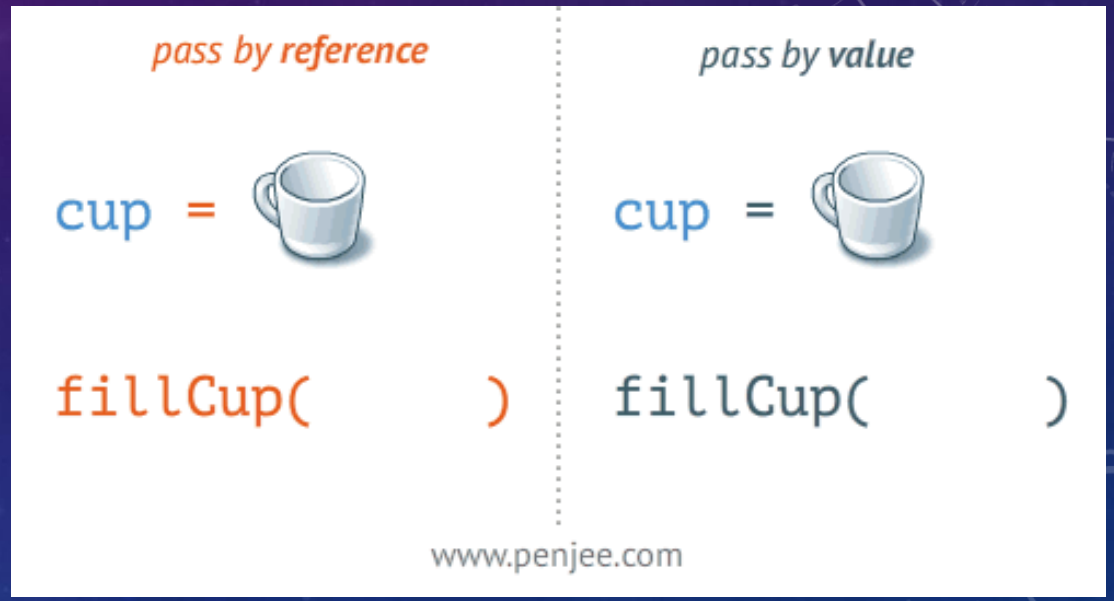
```
Private Sub DisplayCount()

    intCount = intCount +1
    txtDisplay.text = intCount

End Sub
```

HOW DOES A SUBROUTINE WORK ?



PASSING ARGUMENTS BY VALUE

- Arguments usually = data (constant or variable)
- Passes data **values** to procedure but does **not** give the procedure access to their address
- Procedure gets copy of original variable contents
- If the procedure changes the value, the change affects **only the copy** and not the variable itself
- Use the ByVal keyword to indicate an argument passed ‘by value’



PASSING BY VALUE EXAMPLE

- This Subroutine receives copies of two DATA with no link to original data
- These receive and store data for processing

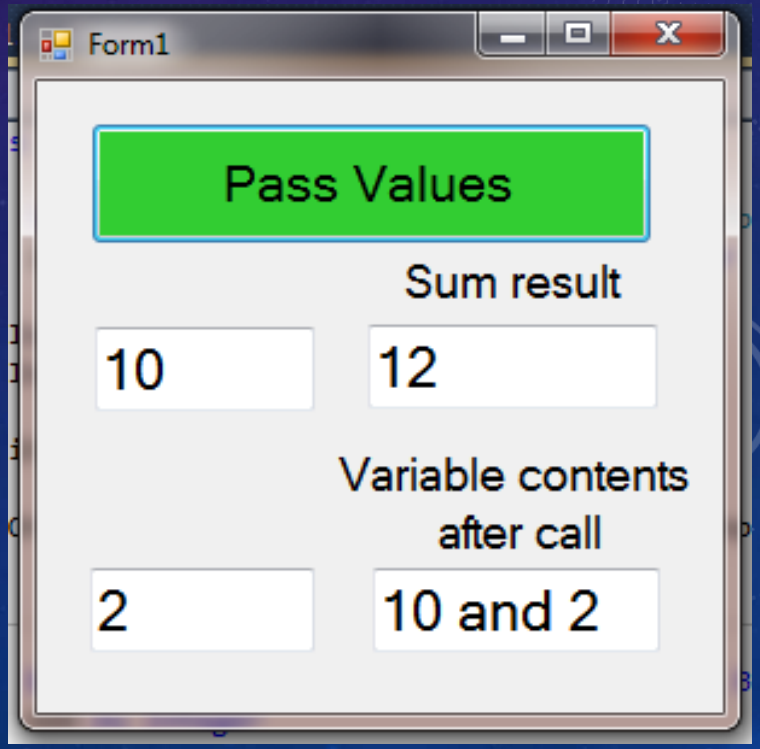
```
Private Sub Addition(ByVal intPassed1 As Integer, ByVal intPassed2 As Integer)
    Dim Add As Integer

    Add = intPassed1 + intPassed2
    intPassed1 = 0
    intPassed2 = 0
    txtResult.Text = Add

End Sub
```

Input variables declared in the brackets

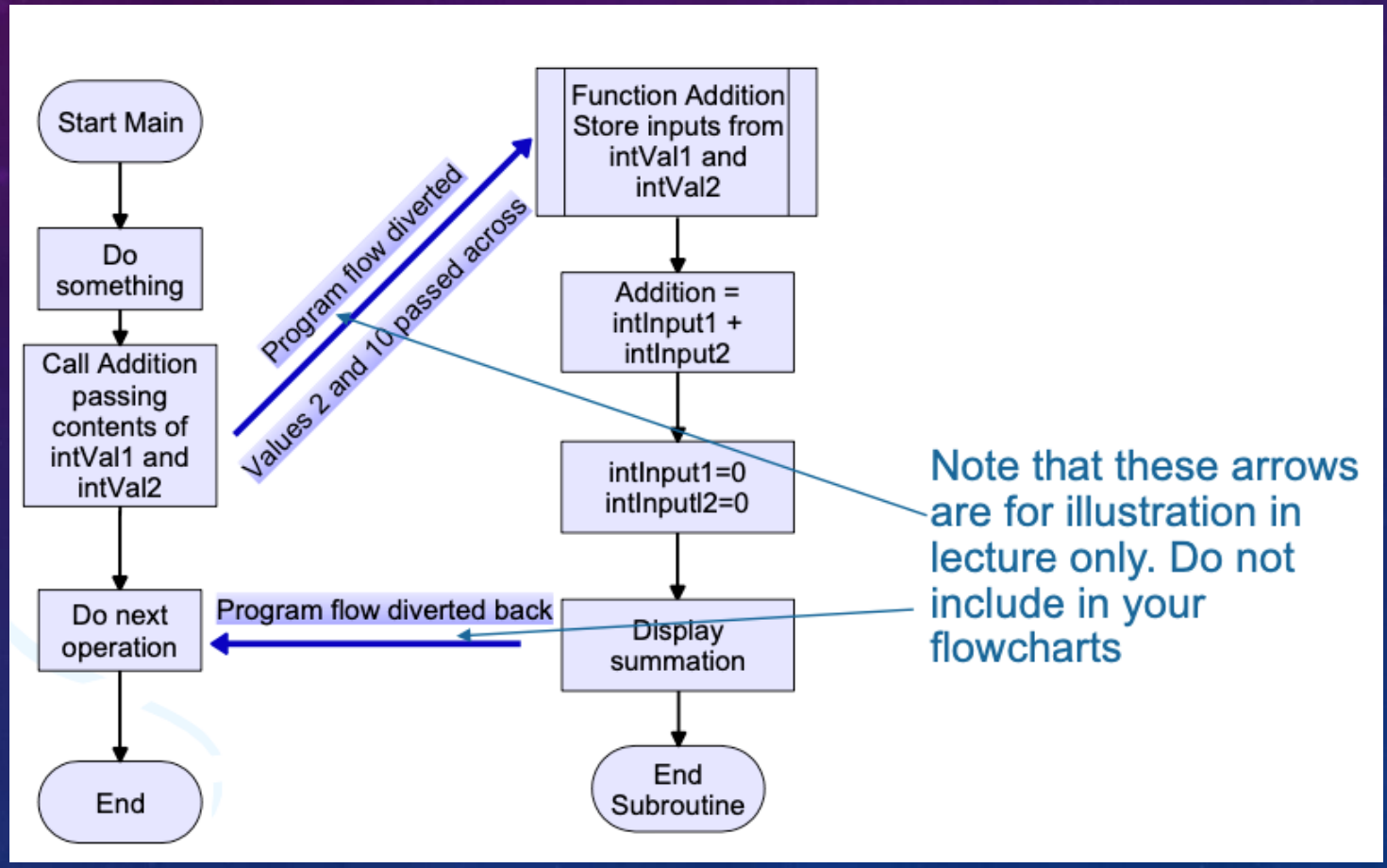
PASSING BY VALUE EXAMPLE

- Passes copy of CONTENTS of *intInput1* & *intInput 2*
- After run: intSum = 12 , *intInput1* = 10, *intInput2* = 2
- NOTE **No** change made to original variables' contents from inside the calling procedure, only changes are to those variables within the Sub

```
Private Sub Button1_Click(ByVal sender As System.Object, ByVal e As System.EventArgs)
    Dim intInput1 As Integer, intInput2 As Integer

    intInput1 = txtNumber1.Text
    intInput2 = txtNumber2.Text

    Addition(intInput1, intInput2)

    txtOrigVars.Text = intInput1 & " and " & intInput2

End Sub
```

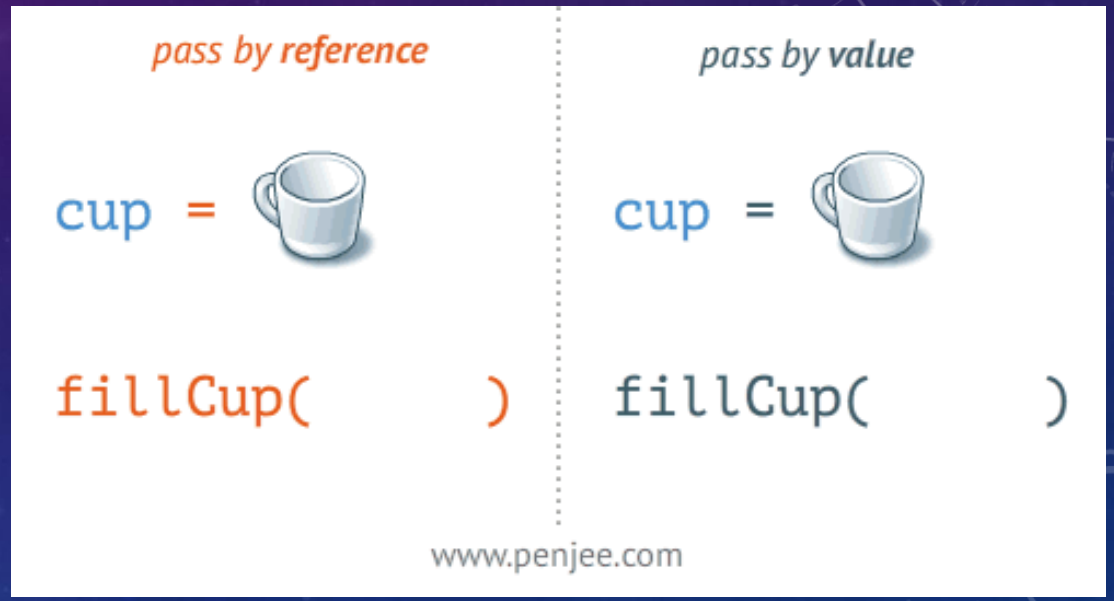


BY VALUE FLOW ILLUSTRATION



PASSING ARGUMENTS BY REFERENCE

- *An invoked Procedure* given access to *original variable's address in RAM: link to the address*
- Any changes made to passed argument in the invoked procedure affects the original variable contents too
- Data type for an argument passed by reference must match type in the Procedure *declaration*
- *Good* practice to use different names for data in sending procedure and receiving procedure



PASSING BY VALUE EXAMPLE

- This Subroutine receives copies of two DATA with no link to original data
- These receive and store data for processing

```
Private Sub Addition(ByVal intPassed1 As Integer, ByVal intPassed2 As Integer)
    Dim Add As Integer

    Add = intPassed1 + intPassed2
    intPassed1 = 0
    intPassed2 = 0
    txtResult.Text = Add

End Sub
```

Input variables declared in the brackets

PASSING ARGUMENTS BY REFERENCE

- This Subroutine receives reference to two ADDRESSES = links to original data
- Any changes made to passed argument in the invoked procedure affects the original variable contents too
- Data type for an argument passed by reference must match type in the Procedure *declaration*
- *Good* practice to use different names for data in sending procedure and receiving procedure

```
Private Sub Addition(ByRef intPassed1 As Integer, ByRef intPassed2 As Integer)

    Dim Add As Integer

    Add = intPassed1 + intPassed2
    intPassed1 = 0
    intPassed2 = 0
    txtResult.Text = Add

End Sub
```

put variables declared ByRef which is the only change to the previous ByVal program

PASSING ARGUMENTS BY REFERENCE

- Passes ADDRESSES of *intInput1* & *intInput2*
- After run: intSum = 12, *intInput1* = 0, *intInput2* = 0
- NOTE original variables' contents were set to ZERO by the sub routine's code setting its local variables to zero because of the addresses being passed

```
Private Sub Button1_Click(ByVal sender As System.Object, ByVal e As System.EventArgs)
    Dim intInput1 As Integer, intInput2 As Integer

    intInput1 = txtNumber1.Text
    intInput2 = txtNumber2.Text

    Addition(intInput1, intInput2)

    txtOrigVars.Text = intInput1 & " and " & intInput2

End Sub
```