Data 301 Data Analytics Microsoft Execl VBA

Dr. Irene Vrbik

University of British Columbia Okanagan
irene.vrbik@ubc.ca

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VBA allows for expanding the capabilities of Excel and adding user-interface elements (buttons, lists) to your spreadsheet.

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Using Excel VBA will be our first practice with programming and allow us to explore fundamental programming concepts of commands, variables, decisions, repetition, objects, and events.

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For a Mac, go to **Excel**, **Preferences**, **View**. Under the *In Ribbon, Show* heading, select the checkbox marked “Developer Tab"

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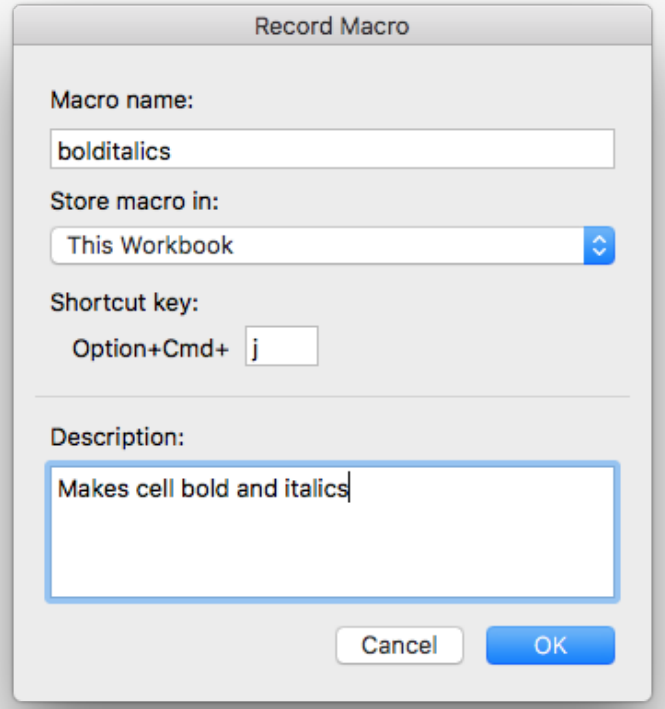
A macro can be created without assigning it a shortcut key.

As a simple example, we could create a macro that bold and italicizes a cell.



Excel will record your actions until you select **Stop Recording**.

- Note: Cursor movement is not captured.

Recording Macros

Make sure we don't move out of the active cell once we start to record our macro.

By default, macros are created using absolute references

- To use Relative references, we need turn on the "Use Relative References" button, before we record.

While the Macro Recorder makes creating macros very easy, it has it's limitations:

- ☹☹ There is no way (that I can find) to do this on a Mac ☹☹
- eg. cannot handle "loops" (more on loops later)
- generates more code than is necessary (which can slow down your process).

Using a Macro

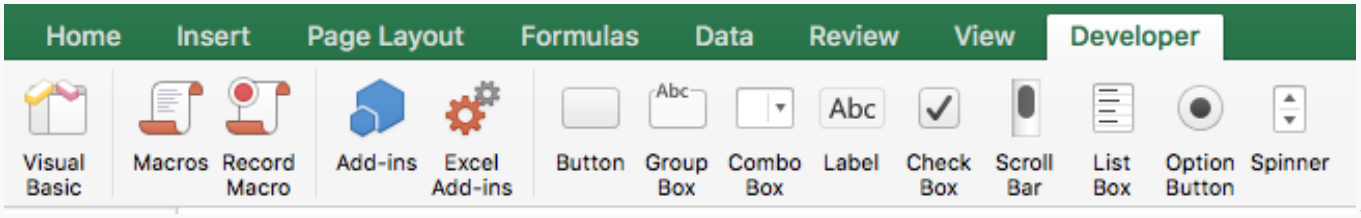
There are a number of ways you can use your macro:

1. With the shortcut key if defined
2. Under **Macros**, Select **View Macros** then pick the macro and **Run**.
3. Assign a macro to a button or on the toolbar

Macro Buttons

To assign a macro button:

1. Select the **Developer** tab and click



2. To prompt the Assign Macro popup window, click where you would like this button to appear on your worksheet.
   - Note: If you have already inserted a button (eg. **Insert** "Shapes"), you can right-click on it, and select **Assign Macro**.
3. Assign a macro to the button by selecting one from the list of existing macros or creating a brand new one and click OK.

Macro Toolbars

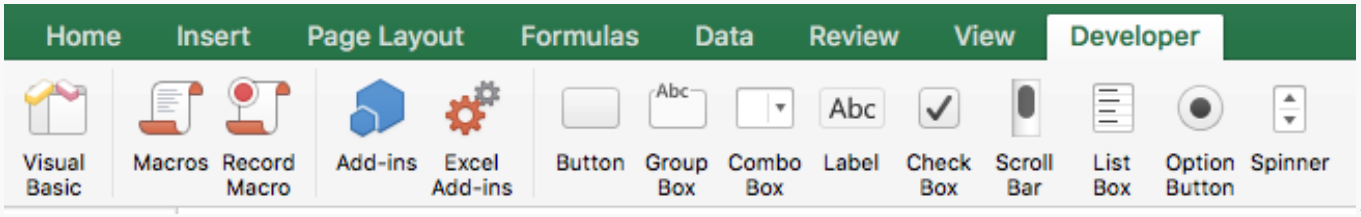
To add a macro to The Quick Access Toolbar, select:

1. PC **File** → **Options** → *Quick Access Toolbar*.
   Mac **Excel** → **Preferences** and click *Ribbon and Toolbar* → *Quick Access Toolbar* header
2. In the "Choose commands" drop-down menu, select **Macros**
3. Select the macro and add to your toolbar (click this ›)
4. Modify the button with a unique symbol (eg. ☺).
   - ☹☹ Feature not available on a mac? ☹☹

Macro Buttons

You can assign multiple macros to a single button! To assign multiple macro button:

1. Select the **Developer** tab and click



2. To prompt the Assign Macro popup window, click where you would like this button to appear on your worksheet.
3. Select "New" and the VBA editor will open. Type the name of the macros you wish to assign in the body of the Sub.

```
Sub ButtonX_Click()
    bolditalics
    undercenter
End Sub
```

Try It: Macros

Question

Create a macro called `MyFormat` that does the following tasks:

1. Use a shortcut of Ctrl + Shift + b (PC)/Opt + Cmd + b (Mac).
2. Bolds the cell and makes the font Courier 20
3. Sets the cell background to orange.
4. Centers the text in the cell.
5. Add it to a button in the shape of a star that says OC20

Try-out your macro using 1) the shortcut key, 2) the macro dialog, and 3) the macro button, and

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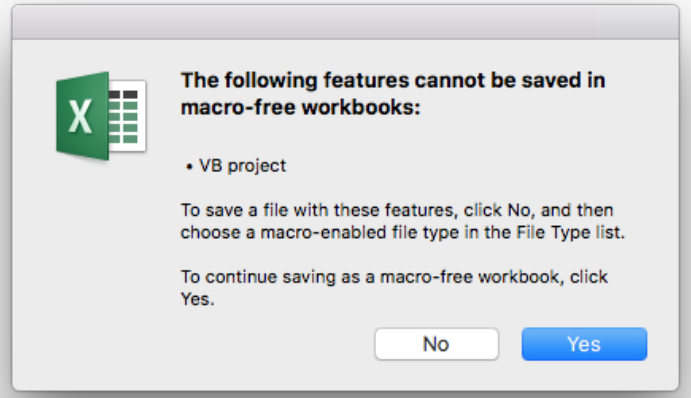
In order to save the workbook with the macros we've created while it was open, we need use a "macro-enabled" file format.

When you go to save a workbook containing macros, you will receive the following popup



- 'Yes' will save it as as macro-enabled workbook (*.xlsm file)
- 'No' will save it as as macro-free workbook (*.xlsx file)

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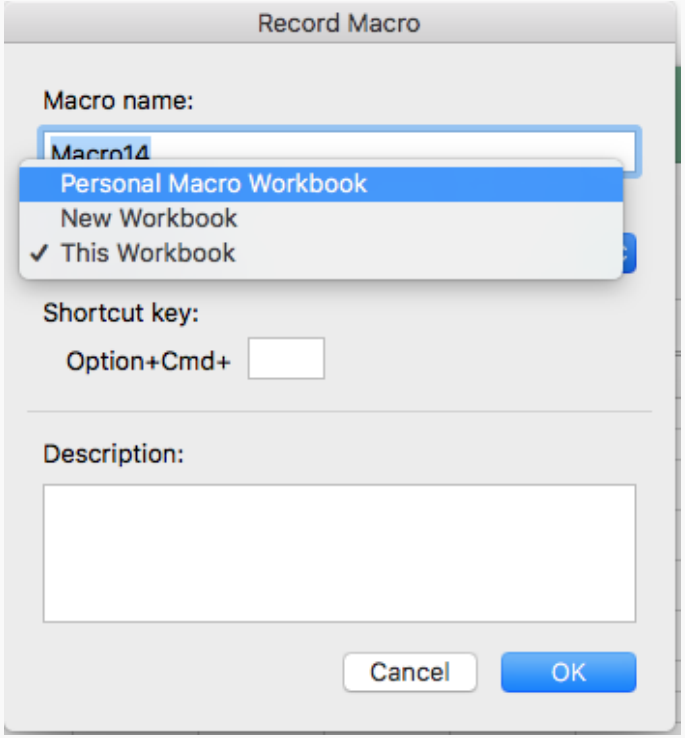
Hence saving a macro to **personal.xlsb** will allow you to use that macro on any workbook that you open on your computer

Saving macros

To save it to your personal workbook, select the "Personal Macro Workbook" option in the drop-down menu for "Store Macro in"



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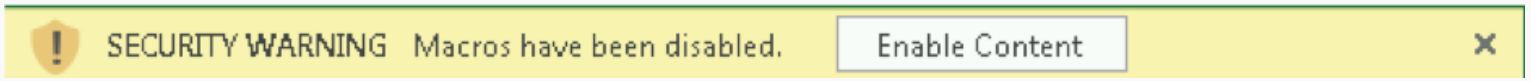
Spreadsheets with macros often will generate a warning when opening them:



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On the **Developer** tab, click "Macro Security" located below the "Record Macro" button. Select a desired option in Macro Settings category, under the *Macro Settings* header (PC)/ or in **Excel** → **Preference** "Security & Privacy"

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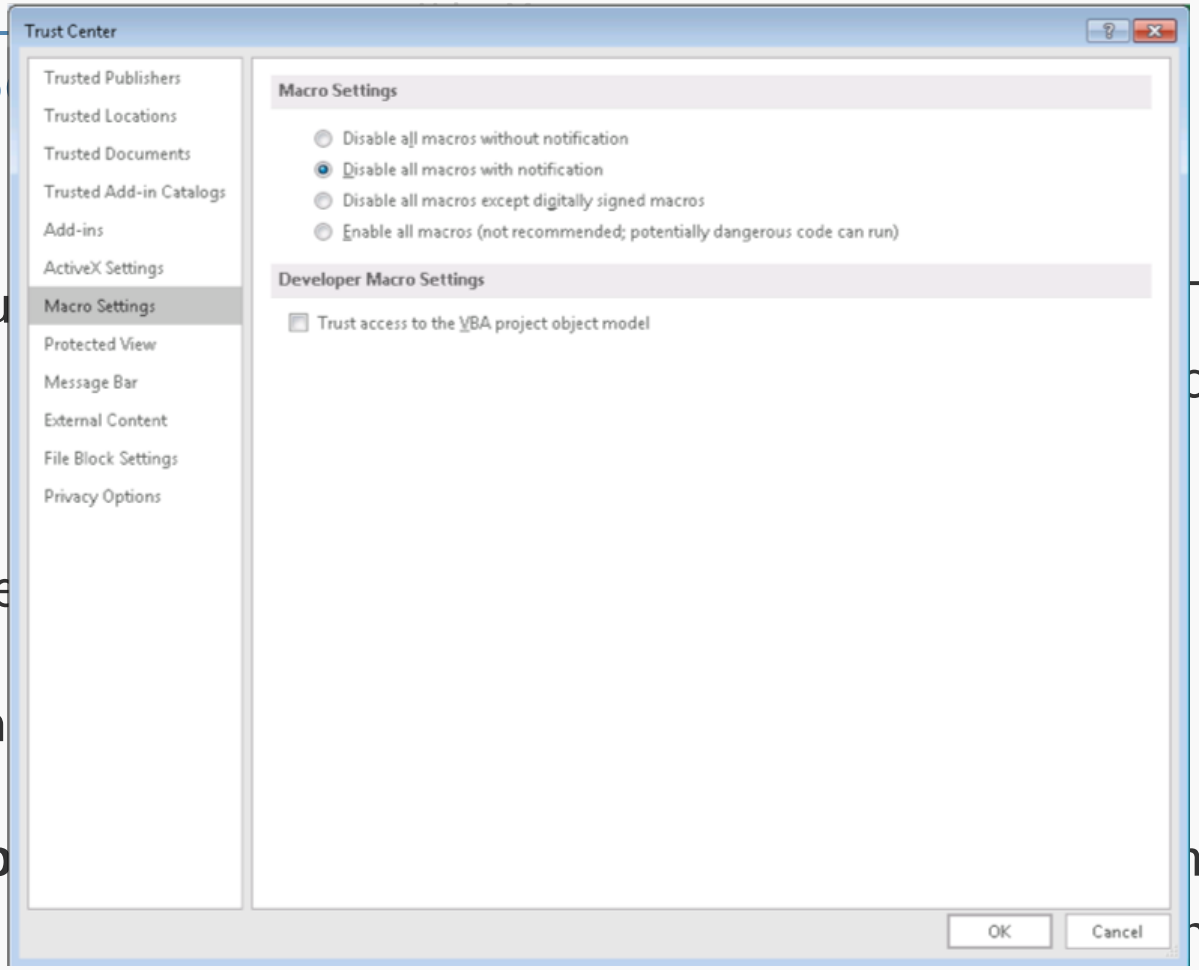

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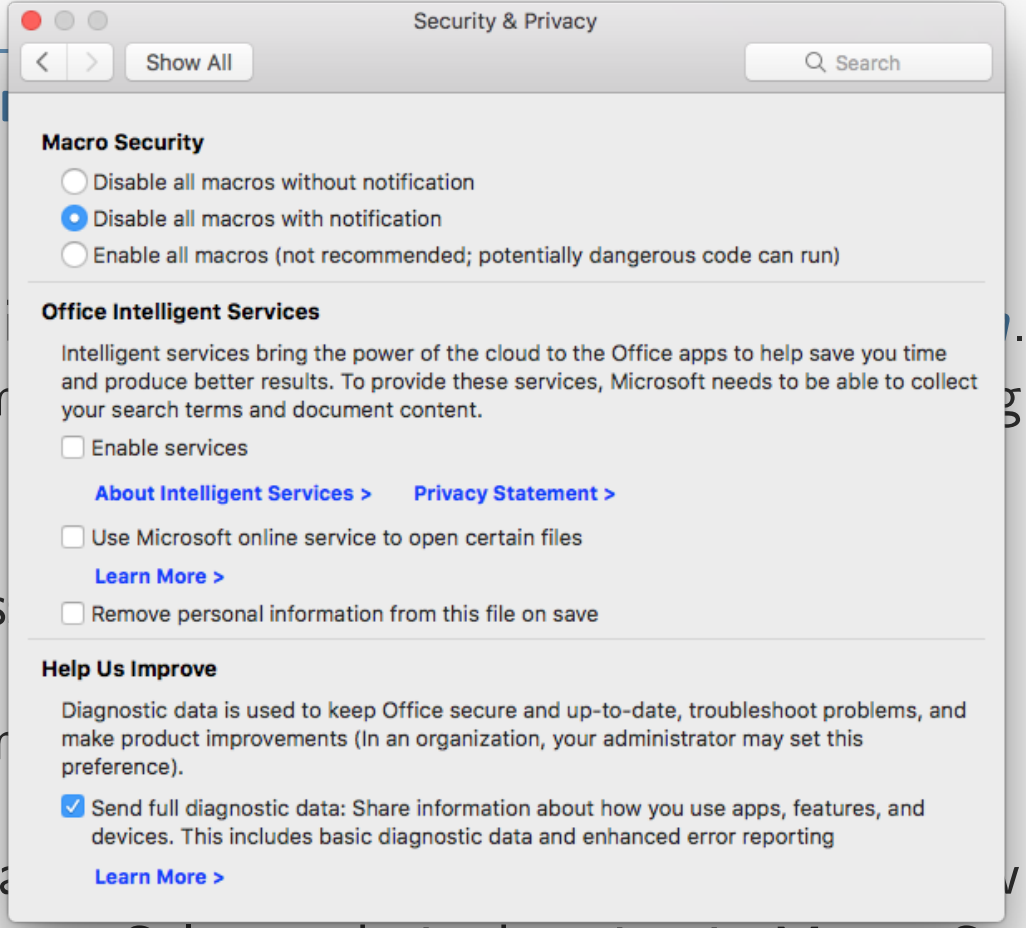

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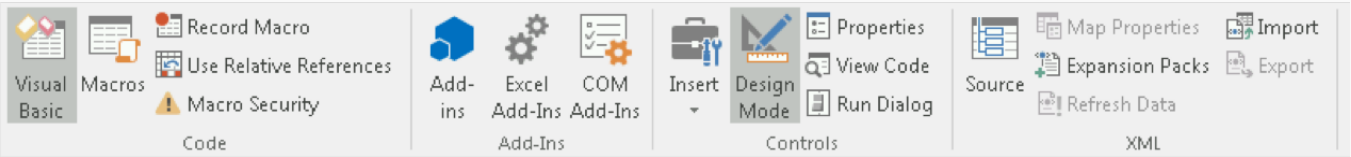
There is also a quick button for this in the left hand side of the Developer tab:



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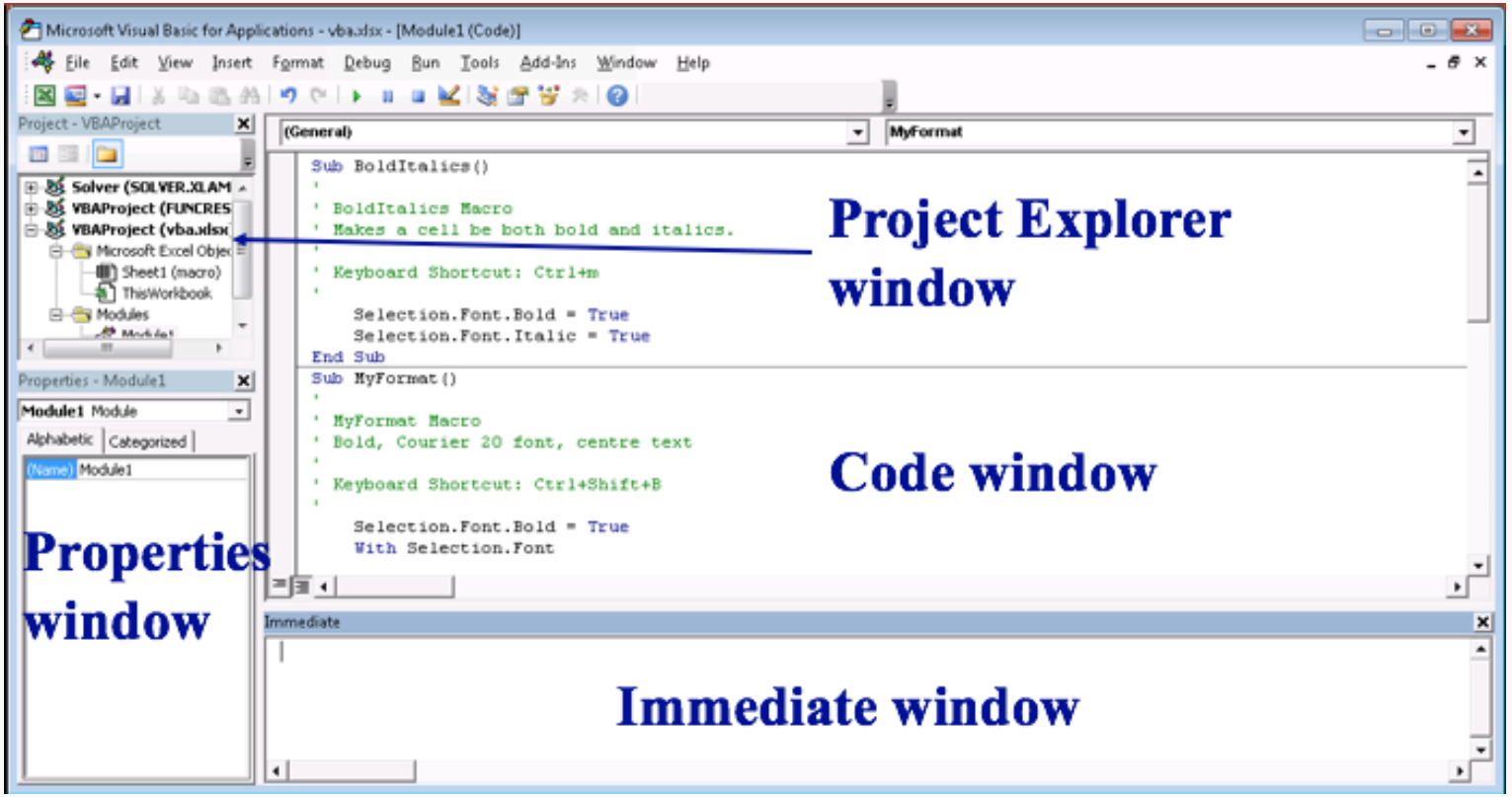
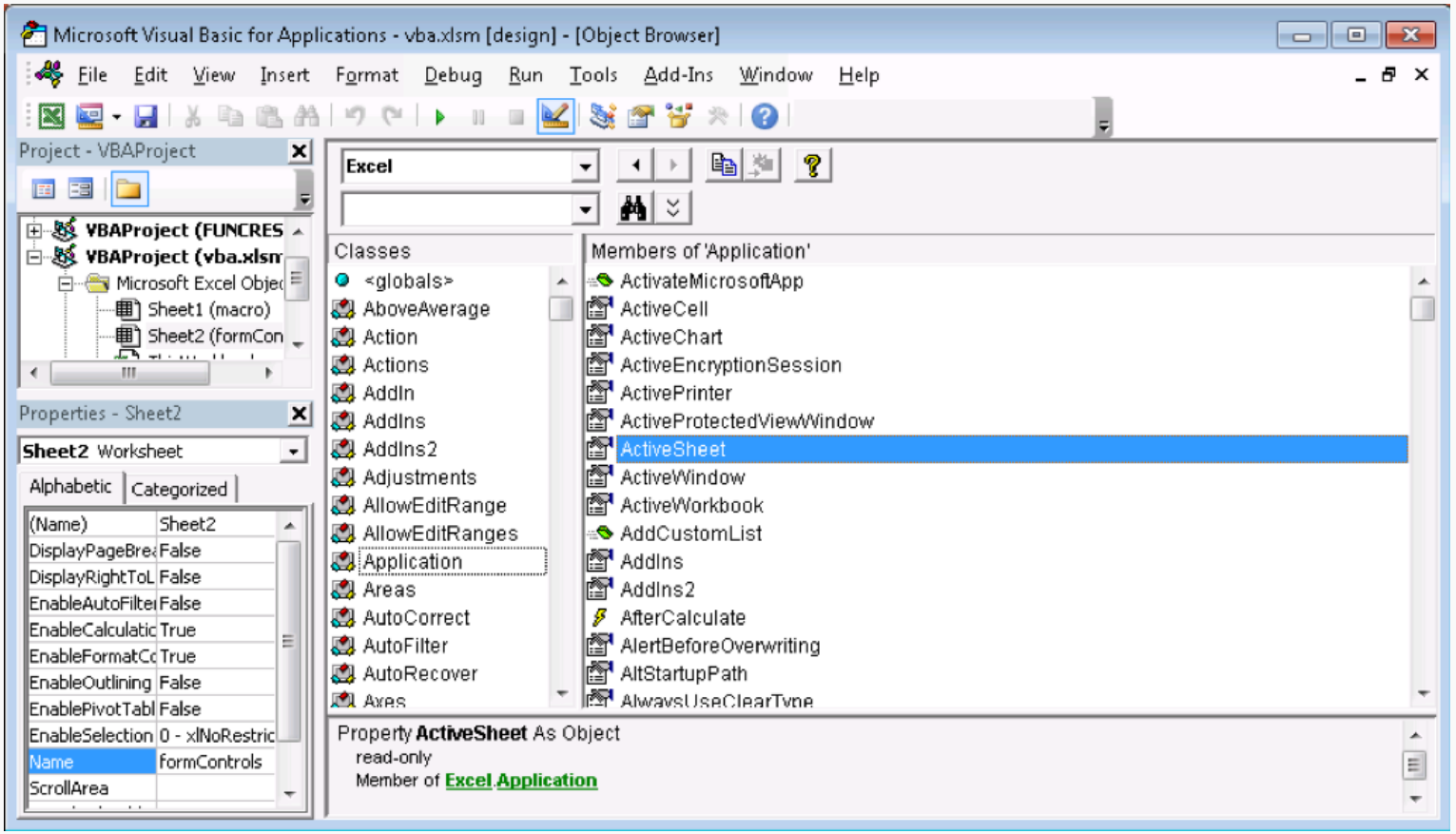


Object Browser

Object browser allows for exploring objects and methods (the application programming interface (API)) of Excel VBA. Open with F2 or using **View** → **Object Browser** from the menu



Macro Code in Visual Basic Editor

Subroutine with name and no arguments

```
Sub BoldItalics()
'
' BoldItalics Macro
' Makes a cell be both bold and italics.
'
' Keyboard Shortcut: Ctrl+m
'
    Selection.Font.Bold = True
    Selection.Font.Italic = True
End Sub
```

Comments start with '

Every statement is on its own line.

Dot notation to separate "items" (objects, methods, properties).

WITH Statement in Visual Basic Code

```
Sub MyFormat()
'
' MyFormat Macro
' Bold, Courier 20 font, centre text
'
' Keyboard Shortcut: Ctrl+Shift+B
'
    Selection.Font.Bold = True
    With Selection.Font
        .Name = "Courier New"
        .Size = 20
        .Strikethrough = False
        .Superscript = False
        .Subscript = False
        .OutlineFont = False
        .Shadow = False
        .Underline = xlUnderlineStyleNone
        .ThemeColor = xlThemeColorLight1
        .TintAndShade = 0
        .ThemeFont = xlThemeFontNone
    End With
    With Selection.Interior
        .Pattern = xlSolid
        .PatternColorIndex = xlAutomatic
        .ThemeColor = xlThemeColorAccent2
        .TintAndShade = 0
        .PatternTintAndShade = 0
    End With
```

`WITH` syntax simplifies typing same object many times.

These lines all apply to `Selection.Font`.

Visual Basic Editor: Immediate Window

The Immediate window allows entering of single line commands.

- Use `PRINT` or `?`
- In code, use `Debug.Print` to print to immediate window.

Immediate

```
? "Hello world!"
Hello world!
? Range("A2").Value
 1
Range("A2").Value = 10
? Range("A2").Value
 10
```

Try It: Immediate Window

Question:

Try do these actions using the immediate window:

1. Print `"Hey There!"`
2. Calculate the answer of 765 * 39.
3. Select a cell then call the macro RedItalics.
4. Change the value of cell B4 to "DATA".
5. Change the value of cell A6 to 100.

Challenge Try it: Create a Macro in VBE

Question

Copy the `MyFormat` macro and edit to produce a new macro called `RedUnderline` that: Underlines the text in the cell. Makes the cell background red. If the cell was bold or italics before, resets to not have bold and italics.

Hints:

- Underline property in Excel is `Font.Underline` and can set to constant `xlUnderlineStyleSingle`.
- Can change background color with `Interior.Color` and set to `RGB(redValue, greenValue, blueValue)` where the colour values are numbers from 0 to 255.

Introduction to Programing

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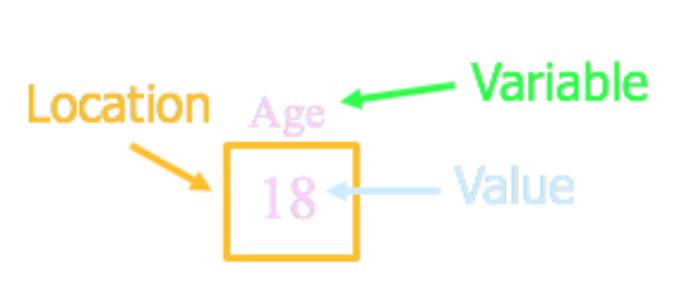
We will start with Excel VBA but also study Python and R.

The goal is to understand fundamental programming concepts that apply to all languages.

Variables

A *variable* is a name that refers to a location that stores a data value.



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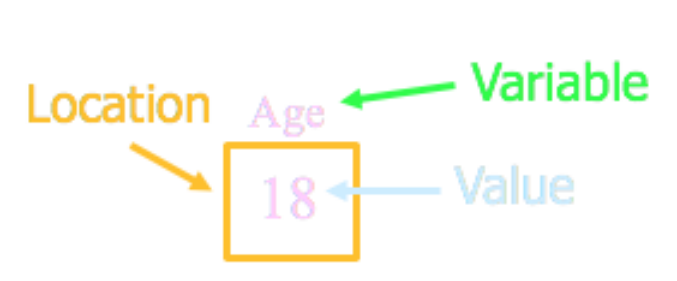

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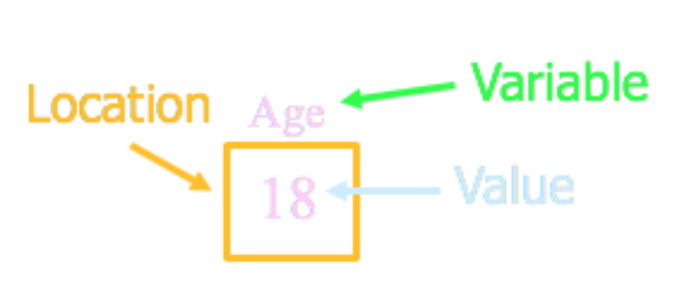

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Example:

- ```
  num = 10
  num = Range("A1").Value
  ```
  ```

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- `Dim num As Integer`

The `Dim` keyword *declares* the variable (named `num`) as an integer.

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Example:

- ```
  Dim Class_List(1 To 150) As String
  Class_List(1) = "Irene Vrbik"
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The `(1 To 150)` tells Excel that `Class_List` in an array of 150 String variables.
  ```

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The `(1 To 150)` tells Excel that `Class_List` in an array of 150 String variables.

See Part 2 of this (click me) tutorial for more on this.
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Hence `Dim Class_List(150) As String` would be recognized as an array of 150 variables, which are indexed from 0 to 149.

Collections

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  `Worksheets(2)`

`Worksheets` is a collection as there may be multiple worksheets in the workbook. Select one by name or number (starting with 1).

Another example is 'Rows' which is a collection object containing all the rows of a Worksheet.

Variables Question

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How many of the following statements are TRUE?

1. A variable name cannot change during a program.
2. A variable value cannot change during a program.
3. A collection is a variable that can store multiple data items.
4. A value in a collection can be retrieved by name or by index starting from 0.
5. In Excel, variables are declared using DIM.
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A) 0 **B)** 1 **C)** 2 **D)** 3 **E)** 4

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Example decision syntax:

- ```
  If condition Then
      statement
  End If
  ```
- ```
  If condition Then
      statement
  Else
      statement
  End If
  ```

Question: Decisions

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What is the output of the following code:

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Sub TryIf()
    Dim num As Integer
    num = 20
    If num > 10 Then
        Debug.Print num * 5
    Else
        Debug.Print num * 2
    End If
End Sub
```
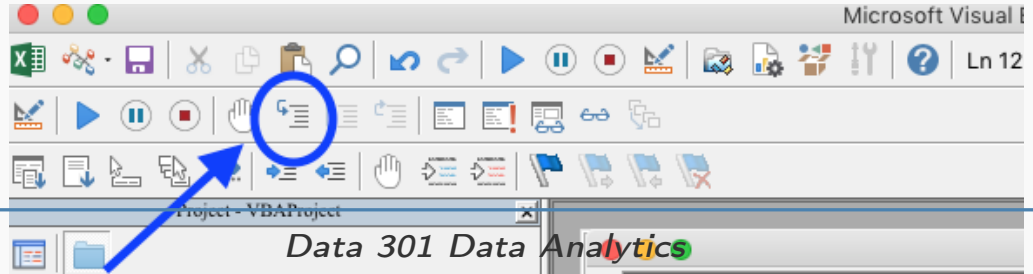

A) 100 **B)** 40 **C)** 20 **D)** error

To step through you code on a PC press F8
On a Mac Press this button:



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MsgBox function in VBA displays a message in a window and waits for click on a button.

Debug.Print is telling VBA to print that information in the Immediate Window.

Loops and Iteration

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A `for` *loop* repeats statements a given number of times. Example:

```
Dim i As Integer
For i = 1 To 5
    Debug.Print i
Next i
```

Question: loops

Question

How many numbers are printed with this loop?

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Sub TestFor()
    Dim i As Integer

    For i = 0 To 10
        Debug.Print i
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Try it: loops

Homework:

Create a method called `TryFor` that prints the numbers 1 to 20.

Challenging variants:

a) Print the numbers from 10 down to 1.

b) Print only the even numbers from 1 to 10.

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Example: UDF doubleIt will double the input argument.

```
' UDF expect a number to double
Function doubleIt(num As Integer)
    ' To return a value, assign the value to the method name
    doubleIt = num * 2
End Function
```

NOTICE: The value returned must be assigned to a variable with the same name as the Function (this variable does not need to be declared)

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Both VBA Sub procedures and UDF procedures can take arguments but they are not essential

UDF Example: Sum Cells by Background Colour

```
' Sums all the cells with the same color
Function SumColor(RangeToSum As Range, ColorID As Integer) As Long
  Dim ColorCell As Range
  Dim result As Long

  ' Loop through each cell in the range.
  For Each ColorCell In RangeToSum
    If ColorCell.Interior.ColorIndex = ColorID Then
        result = result + ColorCell.Value
    End If
  Next ColorCell

  SumColor = result
End Function
```

Click here for more on colour indexing.

Question:

Create a UDF called `CountNum` that will return a count of the number of digits (0 to 9) in a string.

Advanced: Object-Oriented Programming

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A *method* is a set of statements that performs an action.

Excel Objects

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A dot `"."` is used as a separator between objects and subobjects, methods, and properties.

Examples:

- Top-level object: `Application`
- `Workbook` – individual Excel file
- `Worksheet` - sheet in a workbook

```
Application.ActiveWorkbook.Worksheets("macro").Range("A1").Value
```

Excel Objects

Range Object The `Range` object selects a cell or group of cells.

Example:

- `Worksheets("Sheet1")`
  `.Range("A1:C3").Font.Italic = True`

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Object Methods Methods perform an action.

Example:

- `Worksheets("macro").Activate`

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How many of the following statements are TRUE?

1. A method can have no parameters.
2. Two objects of the same class have the same properties.
3. Two objects of the same class may have different values for their properties.
4. Workbook is the top-level object in Excel.

A) 0 **B)** 1 **C)** 2 **D)** 3 **E)** 4

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Try it: Excel Objects

Question

Using the Immediate window try to perform the following actions with methods on Excel objects:

1. Switch the active worksheet to form.
2. Switch the active cell to macro sheet A4.
3. Use `msgbox` to display value in current cell (`ActiveCell`).

Forms and Input Controls

Excel allows the creation of forms with controls for a better interface.

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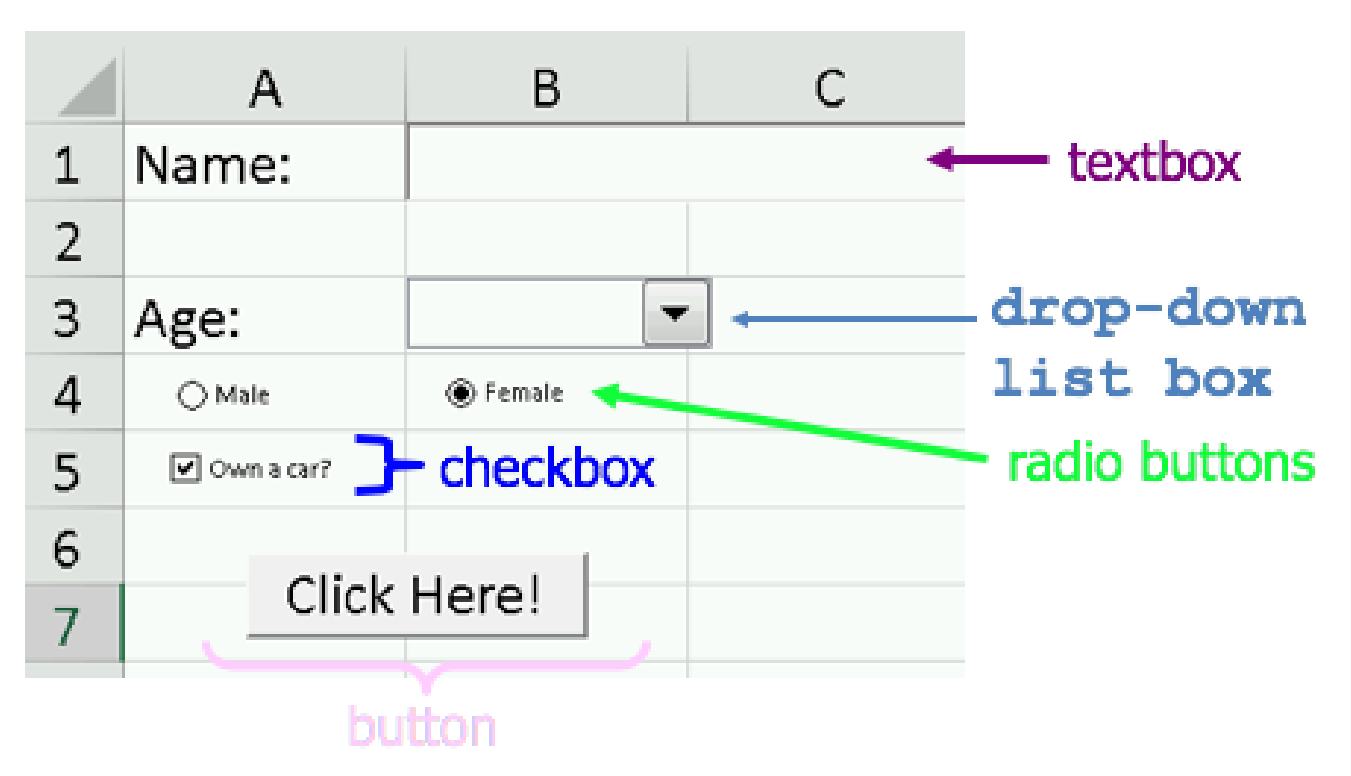
There are two types of controls in Excel:

1. Form controls – default
2. ActiveX controls – allow more flexibility and customization

Controls can be inserted from the Developer tab. Select **Insert**, pick control, and then click and drag the size and shape of the control on the spreadsheet.

Input Controls



Events

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Events in Excel:

- add a worksheet
- double-click on a cell
- change a cell value
- calculating a formula
- click on a button (can execute a macro)

Worksheet-level events on a particular worksheet and workbook level events for entire file.

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Excel VBA uses *object-oriented programming* that structures code as object, classes, methods, and properties. A developer can control and automate everything with Excel using VBA.

Objectives

- List some reasons to use Excel VBA
- Define macro and explain the benefit of using macros
- Be able to record and execute a macro
- Explain the security issues with macros and how Excel deals with them
- List and explain the use of the four main windows of the Visual Basic Editor
- Explain the role of the object browser
- Explain and use the WITH statement syntax
- Be able to write simple macros using the VBE
- Define: algorithm, program, language
- Define: object-oriented programming, object, class, property, method
- Understand and use dot-notation
- Use the Range object to select a group of cells

Objectives (2)

- Define: variable, value, location
- Create and use Excel variables
- Explain how a collection is different from a typical variable
- Use If/Then/Else syntax to make decisions
- Use For loop for repetition
- Create user-defined functions and use them in formulas
- Define: event
- List some typical user interface controls
- Understand that Excel allows for forms and controls to be added to a worksheet which respond to events

Questions