Introduction to VBA

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Mechanical Engineering 209

Programming for Mechanical Engineers

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California State University Northridge

Outline

- Review last class
- Programming and variables used
  - Rules for variable names
- Assigning values to variables
  - Difference between program statements and mathematical equations
- The VBA editor (VBE)
- Getting a "Module" to write your program

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Review Last Class

- Data Tables
- Use of Marco Recorder
- Range Names
- First Programming Assignment
- Data Validation

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What is Programming

- A program is a sequence of commands that direct the operation of a computer
- Commands are executed in sequential order unless a specific command to change the order of the operations is issued
- Calculation statements, called assign-ment statements, look much like usual mathematical equations

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Program Variables

- Program variables look like mathematical variables but they are not
- Program variables describe operations on memory locations, *e. g.*,
  - Take the value from memory location 12137
  - Add to this the value from location 24357
  - Store the result in location 14926
- VBA writes this as w = x + y and trans-lates it into memory-location language

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More on Variable Names

- Rules for variable names
  - Names are not case sensitive
    - The VB editor will maintain consistent capitalization in your variables; if you type pressure it is the same as typing PRESSURE
  - The first character must be a letter or an underscore
  - After the first character you may use letters, numbers or underscores
  - Must be less than 255 characters
  - Cannot use VBA reserved words

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Some Reserved Keywords

- Not a problem – error message generated if you use one of these

alias, and, as, byte, call, case, catch, class, const, continue, date, decimal, declare, default, delegate do, double, each, else, end, error, event, exit, false, finally, for, friend, get, global, handles, if, in, is, like, long, loop, me, new, next, not, nothing, on, option, partial, private, property, public, resume, set, short, single, static, step, string, structure, throw, to, try, when, while, with

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Guidelines for Variable Names

- Use meaningful variable names
  - innerRadius, outerRadius, rInner, rOuter, rIn, rOut, are good examples
  - Referring to an inner radius and an outer radius as x and y is not a good idea
  - In lecture we will often use single letter variables for simplicity
    - This is reasonable when we represent common physical abbreviations: KE = $mV^2/2$ could use variable m for mass, V for velocity and KE

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Assignment Statements

- Assigns a value to a variable
  - Examples shown below

```
degreesToRadians = PI / 180
force = mass * accel
rho = pressure / (gasConstant * temperature)
```

- What is really being done here?
  - Names refer to computer memory locations
  - The value of the expression on the right of the equal (=) sign is assigned to the memory location of the variable on the left

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What is "=" in x = y + 3

- This is called an assignment operator
  - It is not an equal sign
- Places the value calculated on the right of the = operator in the memory location of the variable on the left
- If the table at the right is an initial memory map of a very small computer, what are the results of the statements shown on the next slide

x	1
rho	2
temp	0
PI	3.14
y2	1.1

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Effects of Assignments

1. Initial State

x	1
rho	2
temp	0
PI	3.14
y2	1.1

2. After temp = PI * rho

x	1
rho	2
temp	6.28
PI	3.14
y2	1.1

3. After rho = y2/2

x	1
rho	0.55
temp	6.28
PI	3.14
y2	1.1

4. What is the result of y2 = 1 + y2?

temp	6.28
PI	3.14
y2	2.1

(x and rho unchanged)

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Statements are Sequential

- Unless some control is used, state-ments are executed in sequential order
- What is value of x at end of this sequence:

```
y = 3
x = y
y = 4
```

- Value of x is 3 (set by x = y statement)
  - Values of variables, representing locations in computer memory, will not change unless then are assigned a new value

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Preview Choice statements

- Makes decisions on which path to take in code (*e.g.*, quadratic equation)

```
d = b^2 - 4 * a * c
If d >= 0 Then
    x1 = (-b + sqr(d)) / (2 * a)
    x2 = (-b - sqr(d)) / (2 * a)
Else
    rePart = -b/(2*a)
    imagPart = sqr(d) / (2 * a)
End If
```


Preview Looping Statements

- Do same calculations repeatedly with new data
- Two kinds of loops
  - Count-controlled loops ("For loop" in VBA) repeat calculations a fixed number of times with a counter
  - Conditional loops run while a condition is true or until a condition is true
    - Choice of while or until condition depends on application

Preview Count-Controlled Loop

- In this loop k is the counter

$$\sin(x) = x - \frac{x^3}{3!} + \frac{x^5}{5!} - \cdots$$

```
mySine = x
term = x
For k = 1 To 4
    term = -term * x ^ 2 / _
           ((2 * k + 1) * (2 * k))
    mySine = mySine + term
Next k
```


Preview Conditional Loop

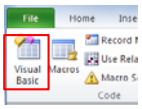
- Boolean variable Converged is true or false

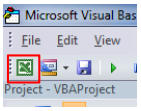
```
mySine2 = x
term = x
k = 1
Do
  term = -term * x ^ 2 / ((2 * k + 1) _
                          * (2 * k))
    mySine2 = mySine2 + term
    Converged = Abs(term) <= 1E-8 _
                          * Abs(mySine2)
    k = k + 1
  Loop Until Converged Or k > 100
```

1E-8 = 10^{-8}

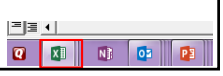
The VBA Editor (VBE)

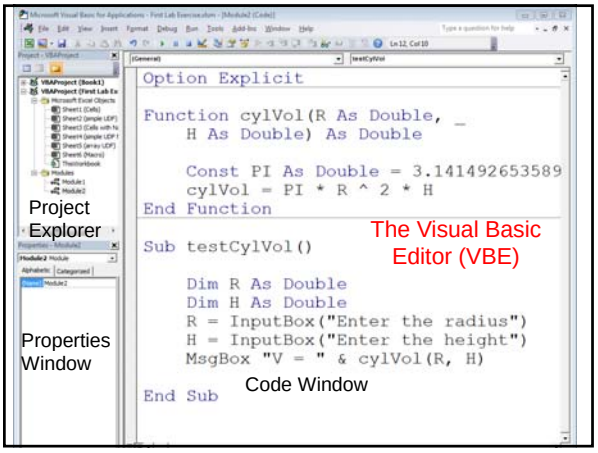
- Various ways to transfer between Excel worksheet and VBA editor
  - Click Visual Basic on Code group of developer tab
  - Use Alt-F11 shortcut key
  - Put VB icon on QAT
- Return from editor to Excel
  - Excel icon on VBE toolbar
  - Alt-F11 shortcut key





Can also use Excel taskbar icon





Properties Window

- Used mainly for advanced topics not considered in this course
  - – Graphical user interfaces
  - – Event driven code
- Can use properties window to change module name from Module1 to another name if desired
  - – Not required in ME 209
  - – **NEVER use the same name for a module that you use for a function or sub!**

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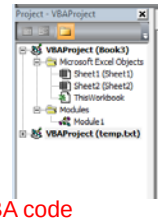
Project Explorer

– Project explorer lists all open workbooks with VBA name and Excel name

– Places to enter code can be hidden or shown by +/-

- Note VBA name and Excel name for Excel Objects



– Always use modules to enter VBA code

- Exception is for event-driven code on objects
- Insert new module if there is not already one shown in the project explorer

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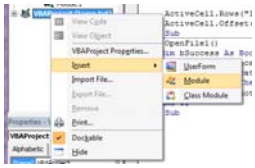
Inserting a Module

– Click VBA Editor on the Developer tab or press Alt-F11

– Insert a module by right clicking on file name, selecting Insert | Module



– Code window will appear for new module

- Can enter several functions and/or subs into one module
- Can have more than one module in workbook

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What Goes in a Module?

- The VBA code to do the necessary operations is written in a module
- The code is organized into procedures
- There are two kinds of procedures
  - – A function is a procedure that can return a value through the function name
  - – A sub is a procedure that does not return a value through the function name
  - – See examples on next chart

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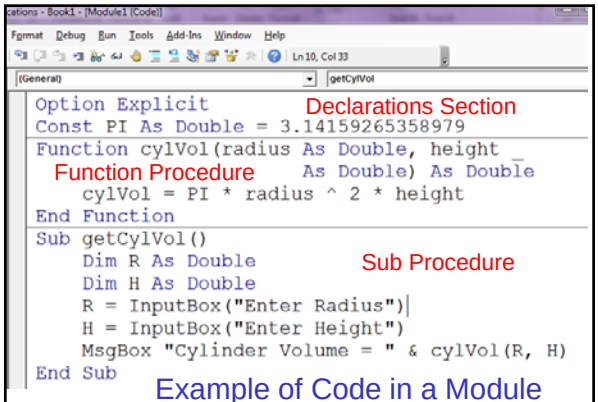

Example of Code in a Module

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Continue Project One

- Any questions on Tasks one and Two?
- Complete work on these tasks if you have not already completed them
- Start works on remaining tasks (Three, Four and Five)

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