Integers, Strings, Precedence and Boolean Variables

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Mechanical Engineering 209

Computer Programming for Mechanical Engineers

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California State University Northridge

Outline

- Review last class
- Using the \ and MOD operators for integer variable types
- String variables and constants
- Relational operators
- Logical operators
- Overall operator precedence

Review Functions

```
Function cylVol(R As Double, _
                H As Double) As Double
    'Compute cylinder Volume
    Const PI As Double = 3.14159265358979
    cylVol = PI * R ^ 2 * H
End Function
```

- First statement is function header with argument list that transfers information to and from functions and subs

Review Information Transfer

- Variables listed in function (or sub) header, called argument list, transfers information based on the **order** of the arguments

```
cylVol(radius As Double, height As Double)
```

- What is result of cylvol(1,2), cylvol(2,1)?
- Subs without arguments, called macros, may be used on worksheet via macros icon (Developer tab)

Review Declaring Variables

- Use the following examples

```
Dim x As Double
Dim k As Long   'Count variable
Dim s As String, d As Date
Dim y As Double, z As Double
```

- Do ***not*** use the following syntax

```
Dim x, y As Double
```

- In statement above x has default data type of Variant

Integer Division

- What is the result when we divide two integer variables or constants?
  - In VBA an operation like 1/3 gives .333333
  - In most computer languages, dividing two integer variables truncates the result
    - Truncation means that the decimal part, no matter how large, is simply eliminated
    - To get integer division with truncation in VBA we use the \ operator for division
    - 13/5 gives 2.6; 13\5 gives 2; -13\5 gives -2
    - What is the result of (a) 25\12, (b) of 25\13?

25\12 = 2 25\13 = 1

Integer Remainders

- This is like your introduction to division in third(?) grade
- 23 divided by 7 was written as 3 with a remainder of 2
- If we use integer division, 23\7 = 3
- The remainder is given by the mod operator such that 23 mod 7 = 2
  - Generally used in programs to see if one number is evenly divisible by another

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Exercise

- What are the results of the following operations with integer variables?

• 25 Mod 7	4	• 24 Mod (7\2)	0
• 25/7	3.57…	• 12/24/3	0.1666…
• 25\7	3	• 12\24\3	0
• 5/9	0.555…	• 5 + 7/9	5.777…
• 5\9	0	• 5 + 7\9	5
• 5 Mod 9	5	• (5 + 8) Mod 9	4

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Arithmetic Operator Precedence

- Operators in order of precedence:
  - Exponentiation ^
  - Unary minus – (*E.g.* –x)
  - Multiply/Divide * /
  - Integer Division \ (any decimal is truncated)
  - Remainder Mod (*E.g.* 7 Mod 4 = 3)
  - Addition/Subtraction + –
- Use parentheses to overrule normal rules of precedence
  - Compare x / y + z *vs* x / (y + z)

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String Variables

- String variables hold text information
- Declare string variables using Dim <variable> As String
  - E. g.: `Dim s As String, msg as String`
- String constants defined with quotation marks: “ME 209” is a string constant
  - String assignment: `s = “ME 209”`
- Concatenate (join) two strings with the concatenation (&) operator

```
msg = “This course is ” & s
```

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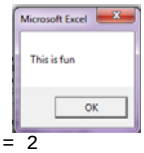
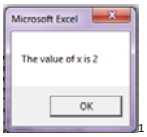
The MsgBox Tool

- This is a tool for displaying information
  - It can also be used for getting choices (Yes, No, Cancel, Abort) from the user
  - Its simplest from is MsgBox <message>




```
MsgBox "This is fun”
```

```
x = 2
MsgBox "The value of x is " & x
```



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Exercise

- Open Excel, go to the VBA editor, add a module and type the following code

```
Sub test()
    Dim x As Integer
    x = 100 * Rnd()
    MsgBox "Random number: " & x
End Sub
```

- Press F5 (in VBA editor) to run the code
  - Note that although x is an integer it is automatically converted to a string

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Program Control

- Statements usually are executed in the order they appear
- Loops can be used to repeat statements
- Choice statements can direct the program in different directions depending on a condition in the code
- Conditions are variables or expressions that can have a value of TRUE or FALSE

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Relational Operators

- Program logic requires choices based on expressions that are true or false
- Relational operators compare other variables and have true or false results
- VBA operators are <, <=, =, >, >=, <>
  - Usual definitions with <> as not equal
    - Literally <> is less than or greater than
  - 7 < 7 is false
  - 7 <= 7 is true

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More Complex Conditions

- Some decisions are made based on more than one item being true or false
- Air conditioning systems can be triggered to start if certain conditions of high temperature and high humidity are present
  - Example a temperature of 75ºF or more and a relative humidity greater than 60%
  - How do we express such conditions?

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Logical Operators

- Combine true/false values
- Operators are Not, And, Or
- **x And y** is true if both x and y are true
- **x Or y** is true if either x or y is true
- **Not x** is true if x is false and is false if x is true (**Not** is like a unary –)
- Is the following true or false?

(6 < 3) Or ((12 > 2) And (Not (6<>6)))

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Operations with Parentheses

- (6 < 3) Or ((12 > 2) And (Not (6<>6)))
- Do innermost parentheses
- False Or (True And (Not False))
- False Or (True And True)
- False Or True
- True

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Truth Tables

X	Y	X and Y	X or Y	Not X	Not Y
True	True	True	True	False	False
True	False	False	True	False	True
False	True	False	True	True	False
False	False	False	False	True	True

(Not X) and (Not Y)	(Not X) or (Not Y)	Not (X or Y)	Not (X and Y)
False	False	False	False
False	True	False	True
False	True	False	True
True	True	True	True

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Operators in Precedence Order

Parentheses (Evaluate me first)
Exponentiation ^
Unary minus – (*E.g.* –x)
Multiply/Divide * /
Integer Division \
Remainder Mod (*E.g.* 7 Mod 4 = 3)
Addition/Subtraction + –
String concatenation &
Relational < <= = >= > <>
Logical in following order: Not And Or

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Individual Steps/Precedence

- 6 < 3 Or 12 > 2 And Not 6<>6
- Relational operators have precedence
- False Or True And Not False
- Logical operators in order Not, And, Or
- False Or True And True
- And operator is next
- False Or True
- True

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Programming Assignment Two

	A	B	C	D	E	F	G
1	Molar mass	28.966	kg/kmol		Molar mass	28.966	kg/kmol
2	Pressure	101.325	kPa		Pressure	101.325	kPa
3	Temperature	300	K		Temperature	300	K
4	Density	1.176657	kg/m^3		Density	1.176657	kg/m^3
5							
6					Find Ideal Gas Density		
7							

- Results of first two exercises
- Results on left from function call, on right from macro
- Button used to start macro calculation

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