If Statement Practice

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Mechanical Engineering 209

Computer Programming for Mechanical Engineers

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California State University Northridge

Outline

- Solution to Second Quiz
- Relational and logical operators used to form conditions
- If Statements
- Practice writing if statements
- Work on Exercise 3 using if statements for solution to quadratic eqation: $ax^2 + bx + c = 0$ (after completing exercise 2)

Operators for Conditions

- A condition is an expression or a Boolean variable that has a value true or false
- True or false values can be generated by relational operators: < <= = >= > <>
- Such operators can compare numerical and string values, e.g.: course = "ME 209", b^2 – 4 * a * c < 0, temp < 68

Logical Operators

- Not, And, Or (in precedence order)
- Other less important operators available in VBA not covered here
- Type Boolean variables have values true or false: TooHot = Temp > 100
  - LeapYear = (Year Mod 4 = 0 And Year Mod 100 <> 0) Or (Year Mod 400 = 0)
- Boolean variables or conditions used in If statements for program choices

Simple If Statements

- If <condition> Then <single statement>
- If <condition> Then
  <Statements done if condition is true>
  Else 'Else part is optional
  <Statements done if condition is false>
  End If
  <Transfer control here after either statement block is executed>

If – Else If

```
If <condition1> Then
   <Statements done if condition1 is true>
ElseIf <condition2> Then
   <Statements done if condition2 is true>
ElseIf <condition3> Then
   <Statements done if condition3 is true>
<May be other conditions>
Else
   <Statements done if all conditions false>
End If
<Execute here after any statements done>
```

May have zero or many ElseIf's; Else is otional

If – Else If Explained

- For the first true condition, statements following the If or Else If are executed
- Once any statements are executed, transfer to the first statement after the End If
- Statements for only the first true condition are executed
- The Else block is optional
  - If no conditions are true those statements are executed

```
If <condition1> The
    <Statements don
Else If <condition2>
    <Statements don
Else If <condition3>
    <Statements don
<May be other cond
Else
    <Statements don
End If
<Execute here after
```


Review Previous Exercise

- Write a function that accepts a type double variable x and uses an if-elseif structure to return a string value of "Positive", "Negative" or "Zero" depending on the value of x
- Test your function with positive, negative and zero values from the worksheet
- Hint: What is your function header?

Function <name>(x As Double) as String

Previous Exercise Solution

```
Function test(x As Double) As String
    If x < 0 Then
        test = "Negative"
    ElseIf x > 0 Then
        test = "Positive"
    Else
        test = "Zero"
    End If
End Function
```


Previous Function Test Example

	A	B
1	-2.9357	Negative
2	-8.0183	Negative
3	-5.9738	Negative
4	0.0000	Zero
5	5.3204	Positive
6	2.1422	Positive
7	-0.0305	Negative
8	-2.9766	Negative
9	3.2078	Positive
10	-3.8545	Negative
11	0.0000	Zero
12	2.0952	Positive
13	4.4570	Positive
14	-4.4392	Negative
15	2.6949	Positive
16	3.6464	Positive
17	-2.2486	Negative
18	-8.8598	Negative
19	-1.4102	Negative
20	6.0504	Positive

	A	B
1	-2.93571919514939	=test(A1)
2	-8.01834574278976	=test(A2)
3	-5.97376074259558	=test(A3)
4	0	=test(A4)
5	5.32038389201792	=test(A5)
6	2.14215082763222	=test(A6)
7	-0.030534303348296	=test(A7)
8	-2.97663386174548	=test(A8)
9	3.20784907196064	=test(A9)
10	-3.85453315369816	=test(A10)
11	0	=test(A11)
12	2.09516544984009	=test(A12)
13	4.45700395179576	=test(A13)
14	-4.43922656689628	=test(A14)
15	2.69492077519676	=test(A15)
16	3.64638089903226	=test(A16)
17	-2.24862176314026	=test(A17)
18	-8.85975102989967	=test(A18)
19	-1.41019404190708	=test(A19)
20	6.05039394442719	=test(A20)

Normal view on left

Equation view on right

In Class Exercise

- Write a VBA grading function that accepts a numerical score, a mean, $\bar{x}$, and a standard deviation, s, from a worksheet and returns a letter grade according to the following conditions:

A: score > $\bar{x}$ + 1.2s

B: score > $\bar{x}$ + 0.52s

C: score > $\bar{x}$ - 0.52s

D: score > $\bar{x}$ - 1.2s

F: score <= $\bar{x}$ - 1.2s

	A	B	C
1	Name	Score	Grade
2	Name1	76.9	
3	Name2	78.1	
4	Name3	39.1	
5	Name4	85.9	
6	Name5	98.6	
7	Name6	90.0	
8	Name7	78.1	
9	Name8	87.9	
10	Name9	75.1	
11	Name10	18.5	
12	Name11	9.3	
13	Name12	85.1	
14	Name13	27.0	
15	Name14	45.5	
16	Name15	65.6	
17	Name16	30.4	
18	Name17	59.9	
19	Name18	75.2	
20	Name19	29.1	
21	Name20	50.8	
22	Name21	26.9	
23	Name22	10.7	
24	Name23	16.1	
25	Name24	51.0	
26	Name25	42.9	
27	Name26	59.9	
28	Name27	56.4	
29	Name28	29.4	
30			
31	Mean	53.55	
32	Standard Deviation	26.84	

- Download workbook, IfStatementGrades.xlsm, from course web site home page
- Write function code that accepts three inputs
  - Individual score from column B
  - Mean from cell B31
  - Standard Deviation from B32
- Function should determine letter grade from rules on previous slide
- Enter the formula to call your function in cells C2:C29
- OPTIONAL: Use a worksheet formula to check your VBA

Work on Program Assignments

- Assignment two: same ideal gas density calculation as assignment one
  - Due next Tuesday (2/28) at 11:59 pm
  - Two functions and two macros
  - One function and one macro uses molar mass; others ones use substance name
- Assignment three: uses if statements to solve quadratic equation
  - Due March 16 at 11:59 pm

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Programming Assignment Three

- Apply if-else if structure to solution of quadratic equation: $ax^2 + bx + c = 0$
- Consider cases of improper specification (e.g.: a = 0)
- Regular results include $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
  - Two distinct real roots
  - Duplicate real root when $b^2 = 4ac$
  - Complex roots when $b^2 < 4ac$

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Input-Output Example

Description of Output Situation

Description of Individual Output Items

Numerical Results

Solution of Quadratic Equation		
Input Data		
a	b	c
1	4	1
Output Results		
Two real roots		
X1	X2	
-0.26795	-3.73205	

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Another Input-Output Example

Description of Output Situation

Description of Individual Output Items

Numerical Results

Solution of Quadratic Equation		
Input Data		
a	b	c
1	2	5
Output Results		
Complex Roots		
Real Part	Imaginary Part	
-1	2	

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Example of Output For Input Error

Description of Input Error

Description of Result Implied by Bad Input

No Numerical Results

Solution of Quadratic Equation		
Input Data		
a	b	c
0	0	0
Input Error a=b=c=0		
Infinite Roots		

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What Is Required

- Write a macro that gets data from the worksheet using statements like a = Range("A1").Value
- Returns labels and results to worksheet using statements like Range("G4").Value = "Two Real Roots"
- Table on next page, copied from assignment, shows required output for all possible cases

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Output Requirements Table				
Situation	Output 1 descriptor	Output 1 Equation	Output 2 descriptor	Output 2 Equation
Non-numeric data in a, b, or c	Use MsgBox function to give error message			
a=b=c=0, infi-nite solutions				
a=b=0, c<>0, no solution				
Linear equation (a=0), only one solution	x	-c/b		
Duplicate real root	x1 = x2	-b/(2a)		
Two real roots	x1	$\frac{-b+\sqrt{b^2-4ac}}{2a}$	x2	$\frac{-b-\sqrt{b^2-4ac}}{2a}$
Complex Root, real part ± i(complex part)	Real part	$\frac{-b}{2a}$	Complex part	$\frac{\sqrt{4ac-b^2}}{2a}$
Macro will always use same input and output cells. Copy input and results from each case given on assignment to separate area on worksheet before running another case.				