Mini Lesson: Tax Systems and Nested IF Function
Revised August 2016

Taxation refers to the act of a taxing authority levying tax. Some types of taxes include employment tax, sales tax, or import tax. In this worksheet, we will focus on Income Tax. Specifically for income tax, there are three ways of being taxed. The three ways of being taxed are regressive, flat rate, and progressive.

- A **flat rate tax** is a system of taxation where one tax rate is applied to all amount subject to taxation.
- A **regressive tax** is a system of taxation where the tax rate decreases as the amount subject to taxation increases.
- A **progressive tax** is a system of taxation where the tax rate increases as the amount subject to taxation increases.
    - A nested IF Function can be used to determine progressive tax

Nested IF Function

Nested IF functions are IF functions that measures multiple conditions. The syntax of nested IF functions are as follows:

=IF(condition1, value_if_true1, IF(condition 2, value_if_true2,value_if_false2))

Example

Elizabeth works at a necklace store where she is paid a value commission. The commission is based on sales indicated below:

- Less than 5 necklaces, she gets paid $50
- From 5 to 10 necklaces, she gets paid $85
- From 11 to 15 necklaces, she gets paid $150
- Greater than 15 necklaces , she gets paid $250

Yesterday Elizabeth sold 7 (in cell H19) necklaces and today she sold 4 (in cell H20). To determine how much she will get paid using an IF function, it should be as follows:

- =IF(H19<5, 50, IF(H19<=10, 85, IF(H19<=15, 150, 250)))
    - Which reads: If H19 is less than 5, then she gets paid $50 if condition is true. If H19 is less than or equal to 10, then she gets paid $85 if condition is true. If H19 is less than or equal to 15, then she gets paid $150 if condition is true, and she gets paid $250 if condition is false.
    - The first condition refers to numbers less than 5, the second condition refers to numbers from 5 to 10, and the third condition refers to numbers from 11 to 15 if true and numbers greater than 15 if false.
- =IF(H20<5, 50, IF(H20<=10, 85, IF(H20<=15, 150, 250)))

- o Which reads: If H20 is less than 5, then she gets paid $50 if condition is true. If H20 is less than or equal to 10, then she gets paid $85 if condition is true. If H20 is less than or equal to 15, then she gets paid $150 if condition is true, and she gets paid $250 if condition is false.
- o The first condition refers to numbers less than 5, the second condition refers to numbers from 5 to 10, and the third condition refers to numbers from 11 to 15 if true and numbers greater than 15 if false.

Enter formula in cells I18 and I19.

Click on the tab with the worksheet titled Activity 1 to begin.

Activity 1: Regressive Tax System

Suppose all of the employees in the table given live in a country where they are taxed $10,000 of their annual salary regardless of how much income they make. Determine each employee's annual salary, salary after tax, the tax rate for each employee based on their salary, and the amount of employees who are being taxed more than 25% of their annual salary.

Directions:

a. Create a copy of this worksheet into a new worksheet and title it "Activity 1 Solution."
b. Enter formula in cell E6 to calculate Annual Salary using a relative cell reference to the Monthly Salary and a constant for months. Use the Fill Handle on cell E6 to apply to cells E7:E18.
c. Enter formula in cell F6 to calculate Annual Salary after Tax using an absolute cell reference to the Tax Amount from cell E3. Use the Fill Handle on cell F6 to cells F7:F18.
d. Enter a formula in cell G6 to calculate the Tax Rate using an absolute cell reference to the Tax Amount from cell E3. The Tax Rate is a percentage of the Tax Amount to the Annual Salary. Use the Fill Handle on cell G6 to cells G7:G18.
e. Format cells D6:F18 to Currency with 2 decimal places, comma separator, and $ symbol.
f. Format cells G6:G18 to Percentage with 2 decimal places and % symbol.
g. Set column widths of columns B and C to 20, columns D and E to 15, column F to 23, and column G to 12.
h. Center align headings in row 5.
i. Use Thick Box Borders in cell areas B5:G18, B5, C5, D5, E5, F5, and G5.
j. Use Right Border in cells B6:B18, C6:C18, D6:D18, E6:E18, and F6:F18.
k. Fill color for cell areas B5:G5 to Light Orange.
l. Change cells B5:G5 to Bold Font size 12 and Wrap Text.
m. Use font color red across columns B through G for employees with a Tax Rate greater than 25%.
n. Save file as Personal Income Tax XX, where XX are your initials.
o. Click on the tab with the worksheet titled Activity 2 to continue.

Activity 2: Flat Rate Tax System

Several low income workers were unhappy with the regressive tax system. They made several requests for a change in the tax system, so the government decided to implement a flat tax rate of 10%. Determine each employee's annual salary, the amount each employee is taxed, and each employee's annual salary after tax.

Directions:
   a. Create a copy of this worksheet into a new worksheet and title it "Activity 2 Solution."
   b. Enter formula in cell E6 to calculate Annual Salary using a relative cell reference to the Monthly Salary and a constant for months. Use the Fill Handle on cell E6 to apply to cells E7:E18.
   c. Enter formula in cell F6 to calculate the Tax amount using an absolute cell reference to the Tax Rate. Use the Fill Handle on cell F6 to apply to cells F7:F18.
   d. Enter formula in cell G6 to calculate Annual Salary after Tax. Use the Fill Handle on cell G6 to apply to cells G7:G18.
   e. Format cells D6:G18 to Currency with 2 decimal places, comma separator, and $ symbol.
   f. Set column widths of columns B and C to 20, columns D and E to 15, column F to 12, and column G to 23.
   g. Center align headings in row 5.
   h. Use Thick Box Borders in cell areas B5:G18, B5, C5, D5, E5, F5, and G5.
   i. Use Right Border in cells B6:B18, C6:C18, D6:D18, E6:E18, and F6:F18.
   j. Fill color for cell areas B5:G5 to Light Orange.
   k. Change cells B5:G5 to Bold Font size 12 and Wrap Text.
   l. Save file.
   m. Click on the tab with the worksheet titled Activity 3.1 Tutorial to continue.

Tutorial 3.1: Progressive Tax

As mentioned previously, **progressive tax** is a type of tax which rate increases as the amount being taxed increases. Below is a fictitious tax table that depicts a progressive tax system for a weekly salary. A tax bracket is a range of incomes taxed at a given rate. Use the different tax brackets in the table below to write a formula in Activity 3.1 that will calculate an employee's tax.

Weekly Tax Table				
Taxable income:		**Tax:**		
From	**To**	**Tax**	**+ %**	**On amount over**
$0	$500	$0	10	$0
$501	$1000	$50	15	$500
$1001	$1500	$125	20	$1000
$1501	or more	$225	25	$1500

- In the first tax bracket where taxable income is greater than $0 but not greater than $500, the tax is 10%.
- In the second tax bracket where taxable income is greater than $500 but not greater than $1000, the total tax is 10% of the first $500 (which is $50) **plus** 15% of the amount over $500.
  - This can be calculated using the formula: ($50+(Taxable Income-$500)*15%))
- In the third tax bracket where taxable income is greater than $1000 but not greater than $1500, the total tax is 10% of the first $500 (which was $50) **plus** 15% of the amount from $500 to $1000 (which is $75) **plus** 20% of the amount over $1000.
  - This can be calculated using the formula: ($125+(Taxable Income-$1500)*20%))
  - The $125 comes from the sum of Tax Bracket 1 ($50) and Tax Bracket 2 ($75)
- In the final tax bracket where taxable income is greater than $1500, the total tax is at 10% of the first $500 (which was $50) **plus** 15% of the amount from $500 to $1000 (which was $75) **plus** 20% of the amount between $1000 and $1500 (which is $100) **plus** 25% of the amount over $1500.
  - This can be calculated using the formula ($225+(Taxable Income-$1500)*20%))
  - The $225 comes from the sum of Tax Bracket 1 ($50), Tax Bracket 2 ($75), and Tax Bracket 3 ($100)

The **effective tax rate** is the average rate at which an employee is taxed.
    - Effective tax rate = Tax amount/Salary

Click on the tab with the worksheet titled Activity 3.1 to continue.

Activity 3.1: Introducing Progressive Tax

a. Joshua is paid $400 every week. Under the tax system in his country, weekly pay from $0 to $500 (Tax Bracket 1) is taxed at a rate of 10%. Based on this information, calculate the difference between his weekly pay and the amount over in this tax bracket ($0) and determine the amount of Total Tax he will have to pay.
   - The maximum for Tax Bracket 1 is $500. Calculate the difference and tax for a weekly pay of $500. This tax amount is the set amount for Tax Bracket 1.
b. Joshua received a pay raise and now earns $600 every week. Due to his pay raise, he has moved to a new tax bracket (Tax Bracket 2) where the amount from $0 to $500 are still taxed at 10%, but amounts from $501 to $1000 are taxed at 15%. Based on this information, calculate the difference between his weekly pay and the amount over in this tax bracket ($500) and determine the amount of Total Tax he will have to pay.
   - The maximum for Tax Bracket 2 is $1000. Calculate the difference and tax for a weekly pay of $1000. This tax amount is the set amount for Tax Bracket 2.

c. Joshua received a promotion and now earns $1100 every week. Due to his pay raise, he has moved to a new tax bracket (Tax Bracket 3) where the amount from $0 to $500 are still taxed at 10%, the amounts from $501 to $1000 are still taxed at 15%, but the amounts from $1001 to $1500 are now taxed at 20%. Based on this information, calculate the difference between his weekly pay and the amount over in this tax bracket ($1000) and determine the amount of Total Tax he will have to pay.

- The maximum for Tax Bracket 3 is $1500. Calculate the difference and tax for a weekly pay of $1500. This tax amount is the set amount for Tax Bracket 3.

d. Joshua received a promotion and now earns $1600 every week. Due to his pay raise, he has moved to a new tax bracket (Tax Bracket 4) where the amount from $0 to $500 are still taxed at 10%, the amounts from $501 to $1000 are still taxed at 15%, the amounts from $1001 to $1500 are still taxed at 20%, but the amounts over $1500 are now taxed at 25%. Based on this information, calculate the difference between his weekly pay and the amount over in this tax bracket ($1500) and determine the amount of Total Tax he will have to pay.

Directions:

a. Create a copy of this worksheet into a new worksheet and title it "Activity 3.1 Solution."

Tax Bracket 1: $0 to $500

b. Enter a formula in cells E7 and E8 that will calculate the difference between the weekly pay and the amount over $0.

c. Enter a formula in cells F7 and F8 to calculate the Total Tax using a relative cell reference to the Tax Rate in Tax Bracket 1. Total Tax = Tax Bracket 1 rate x Difference.

Tax Bracket 2: $500 to $1000

d. Enter a formula in cells E11 and E12 that will calculate the difference between the weekly pay and the amount over $500.

e. Set cells F11, F12, F15, F16, and F19 equal to the Total Tax in Tax Bracket 1 (cell F8).

f. Enter a formula in cells G11 and G12 to calculate Tax Bracket 2 using a relative cell reference to the Tax Rate in Tax Bracket 2. Tax Bracket 2 = Tax Bracket 2 rate x Difference.

g. Enter a formula in cells H11 and H12 to calculate the Total Tax. Total Tax = Tax Bracket 1 + Tax Bracket 2.

Tax Bracket 3: $1000 to $1500

h. Enter a formula in cells E15 and E16 that will calculate the difference between the weekly pay and the amount over $1000.

i. Set cells G15, G16, and G19 equal to the Total Tax in Tax Bracket 2 (cell G12).

j. Enter a formula in cells H15 and H16 to calculate Tax Bracket 3 using a relative cell reference to the Tax Rate in Tax Bracket 3. Tax Bracket 3 = Tax Bracket 3 rate x Difference.

k. Enter formula in cells I15 and I16 to calculate Total Tax. Total Tax = Tax Bracket 1 + Tax Bracket 2 + Tax Bracket 3.

Tax Bracket 4: $1500 or more

l. Enter a formula in cell E19 that will calculate the difference between the weekly pay and the amount over $1500.
m. Set cell H19 equal to the Total Tax in Tax Bracket 3 (cell H16).
n. Enter formula in cell I19 to calculate Tax Bracket 4 using a relative cell reference to the Tax Rate in Tax Bracket 4. Tax Bracket 4 = Tax Bracket 4 rate x Difference.
o. Enter formula in cell J19 to calculate the Total Tax. Total Tax = Tax Bracket 1 + Tax Bracket 2 + Tax Bracket 3 + Tax Bracket 4.
p. Enter in cells E23:E26 the correct Tax and % amount for each tax bracket. For example in cell E23, Tax Bracket 1 would be $0 + 10%.
q. Hold down on the CTRL key to select non-adjacent cells G2:G5, C6:F6, C10:H10, C14:I14, C18:J18, B8, B12, B16, B19, C21:G21, and C22:G22 and Fill color to Light Orange.
r. Change cells G2:G5, C6:F6, B8, C10:H10, B12, C14:I14, B16, C18:J18, B19, C21:G22 to Bold Font.
s. Save file.
t. Click on the tab with the worksheet titled Activity 3.2 Tutorial to continue.

Activity 3.2 Tutorial: Progressive Tax using IF Functions

As mentioned previously, **progressive tax** is a type of tax which rate increases as the amount subject to taxation increases. Below is a fictitious tax table that depicts a progressive tax system for a weekly salary. Use the table below to write a formula that will calculate the tax for the four employees.

Weekly Tax Table				
Taxable income:		Tax:		
From	To	Tax	+ %	On amount over
$0	$500	$0	10	$0
$501	$1000	$50	15	$500
$1001	$1500	$125	20	$1000
$1501	or more	$225	25	$1500

Using Nested IF functions to calculate Progressive Tax

Suppose there are 4 employees who are paid different wages in a firm. The first earns $1254, the second earns $455, the third earns $762, and the fourth earns $1521. To determine how much they will each be taxed, a Nested IF Function can be used.

Nested IF functions are IF functions that measures multiple conditions. The syntax of nested IF functions are as follows:

• =IF(condition1, value_if_true1, IF(condition 2, value_if_true2, value_if_false2))

Based on the example and given tax table, the formula that would be used to determine the tax is:

- =IF(M3>1500, 225+(M3-1500)*25%, IF(M3>1000, 125+(M3-1000)*20%, IF(M3>500, 50+(M3-500)*15%, IF(M3>0, (M3-0)*10%, 0))))
  - This reads: If M3 is greater than 1500, then 225 plus M3 minus 1500 multiplied by the tax % of that bracket if condition is true. If M3 is greater than 1000, then 125 plus M3 minus 1000 multiplied by the tax % of that bracket if condition is true. If M3 is greater than 500, then 50 plus M3 minus 500 multiplied by the tax % of that bracket if condition is true. If M3 is greater than 0, then M3 minus 0 multiplied by the tax % of that bracket if condition is true, and 0 if condition is false.

Each IF condition checks whether the value of the salary is above a specific range. If that condition is true, then it adds the amount subject to taxation to the previous range (ie. salary minus the previous range to get the amount in that range only) multiplied by the rate for that range. If any IF condition is false, then it simply goes to the next condition. The last condition has an IF false value, which is 0 because if there are no amounts greater than 0 (meaning the M3 value must be 0 or below 0), then it would equal to 0.

Enter formula in cell N3, then apply the Fill Handle on cell N3 to cells N4:N6.

Click on the tab with the worksheet titled Activity 3.2 to continue.

Activity 3.2: Progressive Tax System using Nested IF Function

There were several employees who were still unhappy with the flat rate tax system. They made several requests to demand a better taxation system until the government finally decided to implement a progressive tax system. The employees on the given table are employees who make less than $89,350 annually. Use the table below to determine each employee's annual salary, the amount each employee is taxed, and their annual salary after tax.

Yearly Tax Table 2013-2014				
Taxable income:		Tax:		
From	To	Tax	+ %	On amount over
$0	$9,075	$0	10	$0
$9,076	$36,900	$907.50	15	$9,075
$36,901	$89,350	$5,081.25	25	$35,900

Directions:
a. Create a copy of this worksheet into a new worksheet and title it "Activity 3.2 Solution."
b. Enter formula in cell E4 to calculate Annual Salary using a relative cell reference to Monthly Salary and a constant for months. Use the Fill Handle on cell E4 to apply to cells E5:E9.

c. Use an IF function in cell F4 to calculate the Tax amount. Use the given tax table and refer to the tutorial if needed. There should be 3 IF conditions in this formula. Use the Fill Handle on cell F4 to apply to cells F5:F9.

d. Enter formula in cell G4 to calculate the Annual Salary after Tax. Use the Fill Handle on cell G4 to apply to cells G5:G9.

e. Format columns D, E, F, and G for Currency with 2 decimal places and set symbol to $.

f. Set column widths of columns B and C to 20, columns D and E to 15, column F to 12, and column G to 23.

g. Center align headings in row 3.

h. Use Thick Box Borders for cells B3:G9, B3, C3, D3, E3, F3, and G3.

i. Use Right Border for cells B4:B9, C4:C9, D4:D9, E4:E9, and F4:F9.

j. Fill color for cell areas B3:G3 to Light Orange.

k. Change cells B3:G3 to Bold Font, font size 12, and then Wrap Text.

l. Save file.

m. Click on the tab with the worksheet titled Activity 3.3 to continue.

Activity 3.3: Progressive Tax System using Nested IF Function

The table given in Activity 3.2 consisted of employees who earned below $89,350. The table given in this activity consists of all the employees and an extended tax table. Use the table below to determine each employee's annual salary, the amount each employee is taxed, and their annual salary after tax.

Yearly Tax Table 2013-2014				
Taxable income:		Tax:		
From	To	Tax	+ %	On amount over
$0	$9,075	$0	10	$0
$9,076	$36,900	$907.50	15	$9,075
$36,901	$89,350	$5,081.25	25	$35,900
$89,351	$186,350	$18,193.75	28	$89,350
$186,351	$405,100	$45,353.75	33	$186,350
$405,101	$406,750	$117.541.25	35	$405,100
$406,751	or more	$118,118.74	39.6	$406,750

Directions:

a. Create a copy of this worksheet into a new worksheet and title it "Activity 3.3 Solution."

b. Enter formula in cell E4 to calculate Annual Salary using a relative cell reference to the Annual Salary and a constant for months. Use the Fill Handle on cell E4 to apply to cells E5:E16.

c. Use an IF function in cell F4 to calculate the Tax amount.

d. Calculate the amount of tax by using an IF function in cell F4.Use the given tax table and refer to the tutorial if needed. There should be 7 IF conditions in this formula. Use the Fill Handle on cell F4 to apply to cells F5:F16.

e. Enter formula in cell G4 to calculate Annual Salary after Tax. Use the Fill Handle on cell G4 to cells G5:G16.

f. Format columns D, E, F, and G for Currency with 2 decimal places and set symbol to $.

g. Set column widths of columns B and C to 20, columns D and E to 15, column F to 12, and column G to 23.

h. Center align headings in row 3.

i. Use Thick Box Borders for cells B3:G16, B3, C3, D3, E3, F3, and G3.

j. Use Right Border for cells B4:B16, C4:C16, D4:D16, E4:E16, and F4:F16.

k. Fill color for cell areas B3:G3 to Light Orange.

l. Change cells B3:G3 to Bold Font, font size 12, and Wrap Text.

m. Save file.

n. Click on the tab with the worksheet titled Activity 4.

Activity 4: Graphing the Different Tax Systems

a. Sammy, Yolanda, and Paz would like to determine which type of tax system was most beneficial to them. Create one column graph that depicts each employee's Annual Salary, Regressive Tax, Flat Rate Tax, and Progressive Tax.

b. Written Response: Which tax system is most fair and which tax system is least fair? Explain why.

Directions:

a. Create a copy of this worksheet into a new worksheet and title it "Activity 4 Solution."

b. Link the cells that contain the Annual Salary amount of Sammy, Yolanda, and Paz from Activity 3.3 Solution to the current worksheet in cells C4:E4.

c. Link the cells that contain the Regressive Tax amount of Sammy, Yolanda, and Paz from Activity 1 Solution to the current worksheet in cells C5:E5.

d. Link the cells that contain the Flat Rate Tax amount of Sammy, Yolanda, and Paz from Activity 2 Solution to the current worksheet in cells C6:E6.

e. Link the cells that contain the Progressive Tax amount of Sammy, Yolanda, and Paz from Activity 3.3 Solution to the current worksheet in cells C7:E7.

f. Format columns C to E to Currency with 2 decimal places and $ symbol.

g. Set column widths of columns B:F to 20.

h. Center align headings in row 3.

i. Use Thick Box Borders for cells B3:E7, B3, C3, D3, and E3.

j. Use Right Border for cells B4:B7, C4:C7, D4:D7, and E4:E7.

k. fillFill color for cell areas B3:E3 to Light Orange.

l. Change cells B3:E3 to Bold Font, font size 12, and then Wrap Text.

m. Highlight cells C3:E7 and create a 3-D Clustered Column graph with the the three employees and their Annual Salary, Regressive Tax, Flat Rate Tax, and Progressive Tax. The Legend Entries (Series) should contain 4 series (Annual Salary, Regressive Tax, Flat Rate Tax, and Progressive Tax). The Horizontal (Category Axis Label) should contain 3 series (Sammy, Yolanda, and Paz). Place a title above the chart and title it "Comparison of Employee's Salary to Tax."

n. Expand the graph and place it below the table.

o. Insert a new textbox and place it below the graph with your written response answers.

p. Save file.