Module #1 Engr 124 – Excel, F20	Name:

Objective: To create and use spreadsheets in Microsoft Excel, including:
- implementing basic mathematical operations (adding/subtracting/multiplying, etc.);
- plotting graphs (scatter plots and pie charts);
- using the **IF** function;
- formatting text, cells, etc.

Instructions
- Answer each problem on a different worksheet in **one workbook** (one Excel file).
- Rename each worksheet with a one or two-word title that is descriptive of the problem (e.g., Balance Sheet, Stress-Strain, Math, Pie). To rename the worksheet, **RIGHT-CLICK** on its Tab (at the bottom left of the worksheet), and **SELECT Rename**.
- Since there are four problems, you will likely need to add a three sheets. **CLICK** on the plus sign within a circle to the right of the rightmost sheet's tab ⊕.
- Save an electronic copy of your file for reference. Name the file: **Last_name_Mod_1.xlsx**, e.g., Hancock_Mod_1.xlsx.
- When you have **completed all the problems in the module**, upload the Excel file (workbook) to the Canvas web site for ENGR 124.

Formatting
- In the first Column (**A**), and in the first 3 rows of each worksheet, enter your **Name** (in **A1**), the **Problem Title** (**A2**) and the Date completed (**A3**).
- Start all work below **Row 4**.
- Make sure that you format each worksheet and use appropriate text (titles, prompts, etc.) so:
  (1) someone who opens the worksheet knows what the worksheet does, and
  (2) the user can easily use the sheet.
  (3) It looks good (background fill, borders, font).

A reminder of some types of Excel entries:

1. **Text** (e.g., **Monday, Debits, Balance**)
2. **Numbers** (e.g., **23, $32, 10.00, 22-Oct-99, 2.3%**)
3. **Formulas** are always preceded by an **equal** sign (to indicate to Excel it is a formula)
   Examples: **=A1+B1-C2 =A1*C3 =SUM(A1:A5)**
4. **Functions** – all, or part, of a formula (a function is a predefined formula in Excel)

   4a. The **SUM** function: **SUM(***values_to_be_summed***)**
   =SUM(A1:A5) the sum of all values in the cells in the ***range*** **A1** to **A5**
   =SUM(5, A3:B12) sums the number **5** and the sum of the values in all cells in the *range* **A3** to **B12**.

   4b. The **conditional IF** **IF(***if_this_is_true*, *then_do_this*, *else_do_that***)**

   =IF(E4>0,1,−1) If **E4>0** (true), the function returns a value of **1**.
   If **E4** is NOT > 0, the function returns a value of **−1**.
   Text (in quotes) may also be used.

   =IF(E4>0, "positive", "not") If **E4>0**, the function returns the word **positive**. Otherwise it returns the word **not**.

   =IF(E4>0, "positive", "") If **E4>0**, the function returns the word **positive**. Otherwise it returns a blank (do not put anything between the quotes.

Problem 1 *Checkbook Balance Sheet*

Create a spreadsheet to calculate the balance of the ACME Engineering Company's checking account. Use the screenshot below as a guide.

(a) Enter the titles (**No., Date, Description, Credit,** etc.) as ***text*** (just **CLICK** on a cell and type).
- Use **HOME Tab/Font(Format Cells)** so that the heading line (font, center align, borders, background fill) "look good."

(b) Format the date and currency columns.
- SELECT the range of cells under **Date**, and use **HOME Tab/Number(Format Cells)/Date** to specify the date format.
- Select the cells under Credit and Debit, and use: **HOME Tab/Number/Currency** so that dollar signs $ will be attached to the entries.
- Repeat for the **Balance** column. Format the Balance Column so that if the Balance is negative, then the value is displayed in RED and in PARENTHESES (using parenthesis is a traditional accounting format for a *negative*).

(c) Start with a balance of $5,000.00. Leave room for eight transactions (8 rows).

(d) Any user should be able to enter/edit the **Dates**, **Descriptions**, and enter a positive amount in either the **Credit** (money you get) or the **Debit** (money you spend) column. An entry will be a Credit or a Debit. Always enter positive values in the **Credit** and **Debit** columns.

(e) **Use a formula** to calculate the new **Balance** in the cell just under the original Balance. Copy your formula down the Balance Column (use Copy/Paste). Do not do the math by hand and fill in the table; the point is to let Excel do the work. You should be able to change Credit/Debit entries and have Excel automatically update the Balance.

(f) Use the **IF function** in the **"Balance over $2,000?"** column.
- if the balance is over $2,000 display "**OK**"
- if the balance is less than $2,000 display "**DANGER**".

(g) As the "user", enter the dates, descriptions, and credit/debit values. The **Balance** column should update automatically.

(h) Experiment with formatting borders (with different weights), fill colors, text, etc.

	A	B	C	D	E	F	G
1	**Joe Student (your name)**						
2	**Balance Sheet**						
3	**Date**						
4							
5	**Balance Sheet for ACME Engineering Company**						
6							
7	**No**	**Date**	**Description of Transaction**	**Credit**	**Debit**	**Balance**	**Balance over $2,000?**
8		10/1/20	**Opening Balance**			**$5,000.00**	OK
9	1	10/1/20	Payment from Mr. Rich Client	$3,000.00		$8,000.00	OK
10	2	10/1/20	Monthly Rent		$2,500.00	$5,500.00	OK
11	3	10/5/20	Payment from Paige Turner	$2,000.00		$7,500.00	OK
12	4	10/8/20	Legal Fees		$2,400.00	$5,100.00	OK
13	5	10/15/20	Biweekly Payroll		$5,000.00	$100.00	DANGER
14	6	10/20/20	Office Lunch		$250.00	($150.00)	DANGER
15	7	10/28/20	Payment from Les Moore, Ltd.	$4,000.00		$3,850.00	OK
16	8	10/30/20	Biweekly Payroll		$5,000.00	($1,150.00)	DANGER
17		10/30/20	**Ending Balance**			**($1,150.00)**	DANGER
18							

Balance Sheet | Stress-Strain | Sheet3 | Sheet4

Format Date column using **Format Cells/Date.**

Entries shown are samples. You should be able to change Credit and Debit entries, with the Balance, and OK/Danger columns automatically updating.

The new Balance should automatically be calculated using a formula. The formula should work no matter if a Credit or a Debit is entered into the row. Only cell **F8** should start with a number ($5000). The rest should have a formula; they will fill as data is entered.

Use the **IF** function so the cells in Column **G** automatically display "OK" or "Danger."

Figure 1.1 Screenshot of Balance Sheet worksheet.

Problem 2 *Stress-Strain Plot*

A plastic specimen is stretched until it breaks, producing the stress-strain data in *Table 1.1*. A model of the final Excel product (without the table being formatted), is shown in the screenshot below.

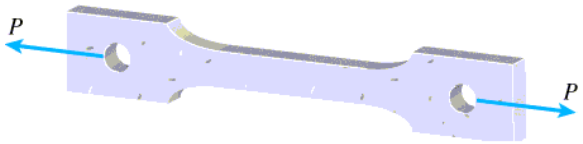
Some Background: Stress is force divided by area (10^6 N/m^2 = 10^6 Pa = 1 MPa); strain is change of length divided by the original length (no units). The Greek letters in the table heading are σ (sigma) and ε (epsilon). Engineers use the stress-strain data to determine a material's strength and stiffness, among other properties. A graph of stress vs. strain is called a *stress-strain curve*.

(a) Enter the data from *Table 1.1* in the second sheet of your Excel workbook.

(b) Plot the stress-strain curve (stress vs. strain). Use a **scatter plot** with **stress on the *y*-axis**, and **strain on the *x*-axis**. Use a smooth line through the data points (markers). Use the **Chart Tools/Layout** to modify the axes, titles, etc. as necessary.

- Label the axes with the quantity being plotted and its units (strain has no units).
  To create the Greek letters sigma σ and epsilon ε, apply the Symbol font to the letters **s** and **e**.
- Both the horizontal and vertical axes should start at zero.

(c) The initial part of the stress-strain curve is approximately linear. Use the **SLOPE** function to determine the slope of a line that would go through the first six data points (where the data looks linear), starting at and including point (0,0). The slope is the stiffness (elastic modulus) of the material. You do not need to draw the curve fit, just let Excel determine the slope of the line that is the best-fit through the first six points using the **SLOPE** function. Place the slope (in MPa), in a labeled cell in the worksheet.



Stress: $\sigma = \frac{P}{A}$ [force / cross-sectional area]

Figure 1.2a Axial member in tension.

Table 1.1 Stress-Strain Data.

Strain, ε	Stress, σ (MPa)
0	0
0.0032	8.2
0.0074	17.5
0.0112	25.6
0.0135	31.1
0.0175	39.8
0.0196	44.0
0.0221	48.2
0.0267	54.3
0.0331	58.1
0.0523	62.1
At 62.1 MPa, the specimen fractures (breaks in two)	

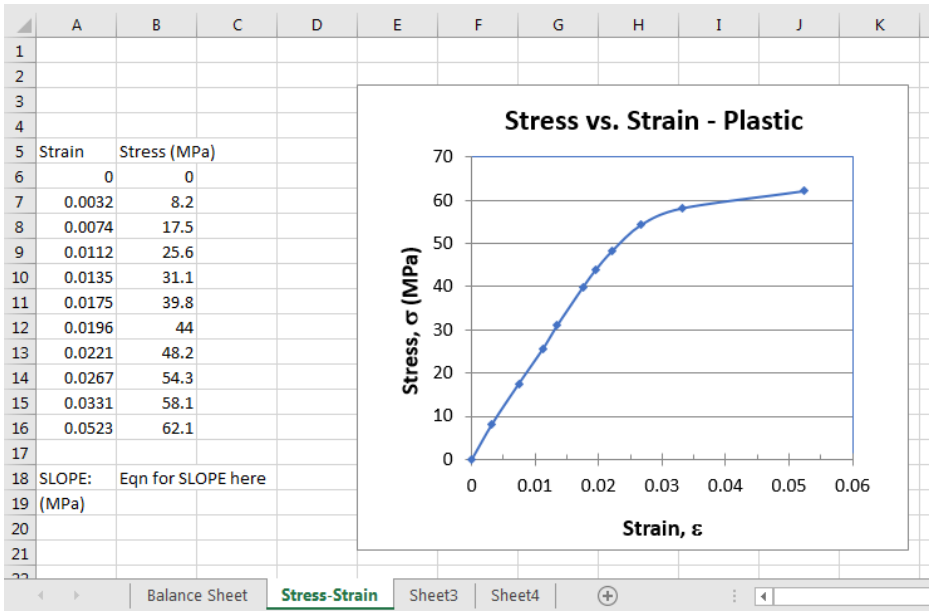


Figure 1.2b Screenshot stress-strain curve.

Problem 3 *Math and Geometry*

Create a worksheet that has various formatted regions to solve the following five mathematical problems. Format each area so that anyone who opens the worksheet knows what to do with it (i.e., use cells for labels/headings to prompt the user to enter the appropriate number, etc.). See a sample layout area below.

Calculate Geometry

(a) *Input the Length and Width of a Rectangle.*
Calculate and display the Perimeter and the Area.

(b) *Input the Radius of a Circle.*
Calculate and display the Circumference and the Area.
Use the **PI()** function.

Convert Temperature

(c) *Input Degrees Celsius.* **Calculate and display Degrees Fahrenheit**.

(d) *Input Degrees Fahrenheit.* **Calculate and display Degrees Celsius.**

The conversion formula is: $F = \frac{9}{5}C + 32$ OR there may be another way to convert the values.

Solve for Roots of a Quadratic Equation

(e) Solve for the roots of a quadratic equation: $\boldsymbol{ax^2 + bx + c = 0}$ using the *Quadratic Formula.*
The user should enter coefficients ***a***, ***b*** and ***c***. The tool should **calculate and display the roots of the equation. Recall:**

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

(e1) You only need to solve for real roots. However, you should display warnings if:
(1) $\boldsymbol{a = 0}$, e.g., "The value of a must be non-zero."
(2) $\boldsymbol{b^2 - 4ac < 0}$, e.g., "The roots are imaginary."
The warnings should be placed in cells off to the side. The warnings are so the user – who is using your tool – understands the error messages that Excel will display: **#DIV/0!** and **#NUM!**, respectively.

(e2) ***Optional***. Better yet, use **IF** statements and extra cells to solve for cases that have:
(1) a single root (when a=0), and
(2) two complex roots.
For the complex roots, you will likely need to have output cells for the real and imaginary parts. (While Excel can work with complex numbers, in this case, it is more trouble than it is worth).

Sample layout for Circle calculator

The cells can be filled with different colors to help guide the user. Although not seen well in grayscale, the title "Circle Calculator" cells are blue; the "Enter radius of Circle" cell is green; the cell where the users enters data (right column, second row) has no fill color (so appears white); and the output cells – both the heading and where the numbers will appear – are yellow. I used three greater-than symbols >>> to "point" the reader to the cell to enter the data.

Circle Calculator	
Enter Radius of Circle >>>	
Circumference	
Area	

Figure 1.3 Circle Calculator Tool.

Problem 4 *Business Sheet and Pie Chart*

You are the owner of **Pi al a Mode**, a store that sells … pies (and gives out bad math puns for free). You are interested in tracking Fourth Quarter (October to December) sales for each type of pie.

(a) Create the worksheet, something like what is shown below. The formatting does not need to be exactly the same, but should look presentable (as if you would put it in a report for publication). Use **HOME Tab/FONT(Format Cells)/Border** and **FONT(Format Cells)/Fill to create borders and to fill heading rows and columns.**

(b) *Center-align* "**Type**", the month and "**Total**" headings in each cell in **Row 7**. Change the width of each column as necessary (hover the mouse curser between the lettered column headings). The month columns should all have the same width, and should be neither too wide, nor too narrow.

(c) Fill in the numbers shown for the pie sales.

(d) Calculate and display the Fourth Quarter sales totals for the pies **by type** (**Column E**), and **by month** (**Row 15**). Use the **SUM function** ,which lets you sum many quantities at once. Do not just sum the apple pies by entering in **E9**: **=B9+C9+D9** (such a method is inflexible/limiting).

(e) Calculate and display in **Cell E16** the total number of pies sold. In **D16**, place a descriptive label for the value in **E16**. ***Right Justify*** this label so it can be read.

(f) Create a **Pie Chart** displaying the *Pie Type* and *Percentage* of each type of pie sold in the fourth quarter.

	A	B	C	D	E
1	**Joe Student (your name)**				
2	**Balance Sheet**				
3	**Date**				
4					
5	**Pie a la Mode - 4th Quarter Sales**				
6					
7	**Type**	**Oct.**	**Nov.**	**Dec.**	**Total by Type**
8	Apple	82	67	43	
9	Boysenberry	67	78	127	
10	Lemon	52	34	19	
11	Pumpkin	45	155	123	
12	Rhubarb	38	49	68	
13	**Total by Month**				
14				**Grand total**	

Figure 1.4a Screenshot of Pi a la Mode worksheet.

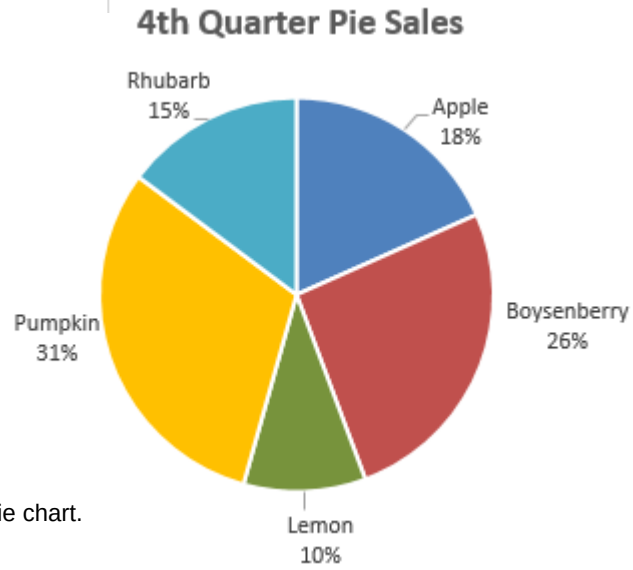


Figure 1.4b Screenshot of Pi a la Mode pie chart.