MTH 154, Final Exam, Spring 2023   Name _____

Instructions: Show all work to receive full credit. You should note any formulas used or calculator functions used, their inputs and outputs, or attach a spreadsheet with your calculations. I cannot grade work if I don't know where an answer came from. Be sure complete all parts of each question, including requests for interpretation and explanations. Be as thorough as possible.

This exam will be submitted in 2 parts. Part 1 are numerical or multiple-choice responses that will be submitted separately and graded by the computer. The second part will consist of explanatory responses, working with graphs and other questions that will be submitted as scanned documents and graded by hand.

Part 1: Answer these questions using your calculator or Excel. Show your work on this page or in Excel and submit along with part 2. Then submit your answers to these questions in the Exam #1 Part 1 submission tool in Canvas.

1. Using the data on Sheet 1 of the Excel file **154final_data.xlsx**, complete the following: (4 points each)
    Make a scatterplot of the advertising and quantity sold data with advertising on the horizontal axis and quantity on the vertical axis. Add a descriptive title and axis labels. Be sure to adjust the axes to eliminate as much unnecessary white space as possible. Add a linear trendline, find the regression equation and R^2.

    a. **Report the regression equation**.

    b. **Report the correlation value and the coefficient of determination**.

    c. **Is the correlation positive or negative?**

    d. **Is the correlation strong, moderate or weak?**

    e. **Does the relationship in the scatterplot appear to be linear or nonlinear?**

2. Using the data on Sheet 2, calculate a complete set of descriptive statistics for machine hours. Report the following below.
   a. **Mean and standard deviation**. (6 points)

   b. **Five-number summary**. (6 points)

   c. **Range and mode**. (4 points)

3. Using the same data on Sheet 2, make a histogram of machine hours. Label your graph appropriately with axis labels and a descriptive title. **Describe the shape of the graph: is it symmetric, left skewed, right skewed or some other shape?** (5 points)

4. The standard deviation of the speed of 17 vehicles on a certain highway is 13.4 mph. **Find the standard error if $SE = \frac{SD}{\sqrt{n}}$.** (5 points)

5. The formula for the standard score is $Z = \frac{x-\mu}{\sigma}$. The mean height of women is 64.2" with a standard deviation of 3.3", and the mean height of men is 70" with a standard deviation of 3.5". Richard is 6'2" and Pamela is 5'9". **What is Richard's standard score? What is Pamela's standard score? Which of them is taller for their gender? Explain.**
   (8 points)

6. Using the data on Sheet 2, **find the 20ᵗʰ percentile of machine hours from the data**. (5 points)

7. Using an amortization table or a built-in financial formula in Excel, **find the amount in a savings account** if it collects 2.6% interest, compounded daily, for 10 years, if a $3 deposit is made every day. (6 points)

8. Employees are surveyed and a scatterplot of the relationship between total experience (work experience plus education) is plotted against salary. A linear regression line is found, and the equation and coefficient of determination is on the graph. Use this graph to answer the questions that follow.

Total Experience vs. Salary $y = 817.43x + 23479$
$R^2 = 0.6043$
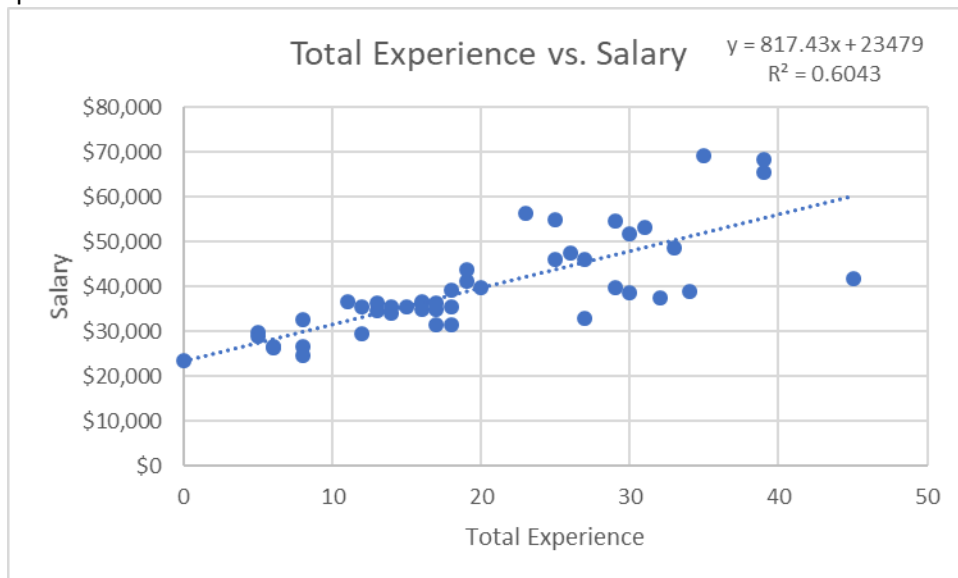
a. State the slope of the regression line. (5 points)

b. State the y-intercept. (5 points)

c. If a new employee has a total of 6 years of experience credits (two years on the job plus a 4-year degree), what kind of salary can they expect according to the regression line? (5 points)

d. What is the proportion of the variability in salary that can be explained by total experience? (5 points)

9. What values are used to create a boxplot? (4 points)

10. A table of unit conversions is shown below. Use it to perform the following unit conversions. (4 points each)

Temperature
SI unit : kelvin (K)

Length
SI unit : meter (m)

1 km = 0.62137 mi
1 mi = 5280 ft
     = 1.6093 km
1 m = 1.0936 yd
1 in = 2.54 cm (exactly)
1 cm = 0.3937 in

0 K = -273.15°C
      = -459.67°F
K = °C + 273.15

$$°C = \frac{5}{9}(°F - 32°)$$

$$°F = \frac{9}{5}°C + 32°$$

a. Convert 27 kilometers to miles

b. Convert $-30°C$ to degrees Fahrenheit

11. Shown below is a pivot table of Gender, and whether or not the person lives alone. Use the table to answer the questions that follow. (5 points each)

	Column Labels		
Row Labels	Does not live alone	Lives Alone	Grand Total
Female	330	68	398
Male	371	87	458
Grand Total	701	155	856

a. If a person is randomly selected from the data, what is the probability that the person is female?

b. What is the probability that the person lives alone?

c. What is the probability that the person lives alone and is a woman?

d. What is the probability that the person lives alone or is a woman?

e. What is the probability that the person lives alone given that they are female?

Part 2: Answer these questions in this file, using Excel (copy and paste solutions into this document), show work, etc. Don't make me hunt through Excel looking for answers to these questions! Submit your work for Part 1, work and solutions for Part 2, and any Excel file(s) you used to get your answers in the Final Exam Part 2 submission folder.

12. On Sheet 3, make a pivot table of the data of purchases and coupons. **Copy the table below**. (6 points)

13. Using the data on Sheet 3, make a summary table of purchases, and make a bar graph of it. Label it appropriately and **write a sentence that summarizes what it tells you**. (6 points)

14. Using the data on Sheet 11, make a summary table of the coupons and make a pie graph of it, and label it appropriately. **What percent of the sample received a coupon?** (6 points)

15. Employees are surveyed and a scatterplot of the relationship between total experience (work experience plus education) is plotted against salary. A linear regression line is found, and the equation and coefficient of determination is on the graph. Use this graph to answer the questions that follow.

Total Experience vs. Salary $y = 817.43x + 23479$ $R^2 = 0.6043$
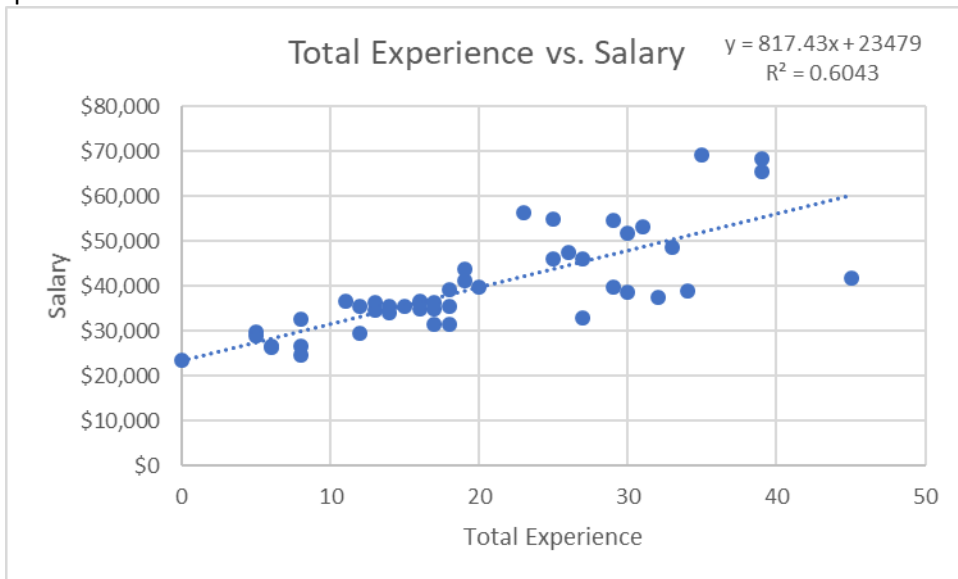
a. Write a sentence to interpret the slope in the context of the problem. (5 points)

b. Write a sentence to interpret the y-intercept in the context of the problem. (5 points)

16. A screenshot below shows a small dataset, sample size 10. Based on the information shown, write the Excel formulas you'd need to calculate the requested values. (5 points each)

	AF	AG	AH	AI	AJ	AK
1		20				
2		22				
3		26				
4		23				
5		24				
6		18				
7		32				
8		24				
9		31				
10		28				
11						

a. What formula would be needed to find the median of the data?

b. What formula would be needed to find the 75th percentile?

[Hint: I want the formula you would use in Excel, not the value.]

17. Under what circumstances is it better to use a median as a measure of central tendency than the mean? (4 points)

18. Translate the logical and mathematical notation $\exists! \, x(x^2 = 1)$. Then find the value or values of x. (6 points)

19. The screenshot below shows how scientific notation appears in Excel. Write this number in standard scientific notation as it appears in normal mathematical notation and not in "computer" formatting. (4 points)
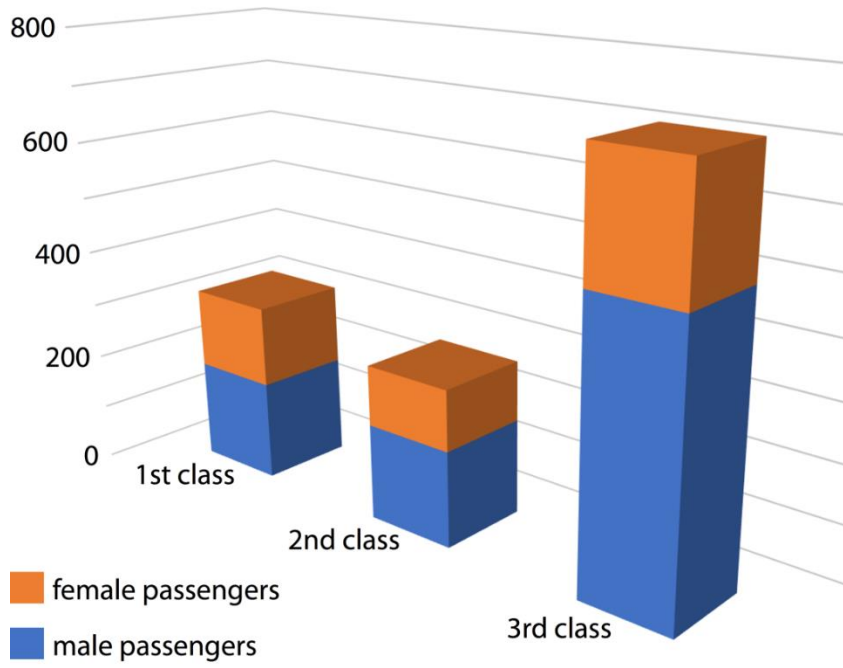
	U	V	W
1			
2			
3		3.17E-05	
4			

20. The 30th percentile of heights of men in the United States is approximately 68.2" or 5'8.2''. What does this statement mean in plain English? (5 points)

21. Using the screenshot of an Excel sheet below to write a formula that will evaluate the expression $\frac{A-C^2}{B+\sqrt{D}}$ using the cell references where the values are in the sheet. [Hint: I want the formula you would use to calculate this using cell references, not the value.] (8 points)

	A	B	C	D	Formula
3	A	B	C	D	Formula
4	13	16	13	8	
5					

22. Explain why the graph below is a bad graph. There are at least three problems with it. (8 points)

Excel work -- 35 points