MTH 245, Final Exam, Spring 2022 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 questions, 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 Final Exam Part 1 submission tool in Canvas.

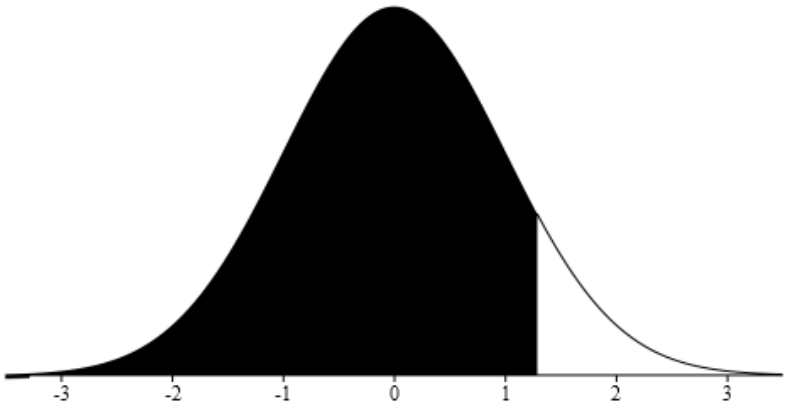
1. A charity sells 450 tickets for a raffle, costing $10 per ticket. The top prize is $500, a second prize of $100, and two third prizes of $50. For someone purchasing a ticket, what is the expected value? Interpret the value in the context of the problem. (10 points)

Value				
Probability				

2. Four-fifths of drivers put their seat belt on when they get into a driving simulator. Use that fact to answer the following questions. (7 points each)
   a. If 20 people get into the simulator, what is the probability that exactly 8 of the people will put on their seat belts?

   b. If 20 people get into the simulator, what is the probability that at least than 15 people will put on their seat belts?

3. Find the probability under the curve of the given normal distributions. Standard normal distribution. Z-score at the boundary is 1.38. (6 points)



4. The SAT has a mean score of 1498 and a standard deviation of 199. (6 points each)
   a. What is the z-score of 1840?

   b. What score represents the 80^{th} percentile of the distribution? Round your answer to the nearest 10 points.

   c. If a school wants to admit only students with the top 10% of SAT scorers, what cut-off score is needed? Round your answer to the nearest 10 points.

   d. The mean score on the ACT is 21 with a standard deviation of 5.2. Which student scored higher: Abby with a score of 31 on the ACT, or Barbara with a score of 2130 on the SAT?

5. For each of the following variables, determine i) is the variable qualitative or quantitative? ii) the level of measurement: nominal, ordinal, interval, or ratio? iii) if the variable is quantitative, is it discrete or continuous? (6 points each)
   a. Date of birth

   b. Credit card brand

   c. Social security number

   d. Body weight

6. Using the data on Sheet 1 in the data file **245final_data.xlsx**, find the following statistics of the Ounces column:
   a. The mean, median and mode (9 points)

   b. The standard deviation and range (6 points)

   c. Calculate the five-number summary for this data. (5 points)

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.

7. Using the data on Sheet 1 in the data file **245final_data.xlsx**, find the following for the Ounces column:
    a. Use that information to construct a simple box plot. Paste your graph here. (7 points)

    b. Construct a comparative box plot that shows the different filling machines. (7 points)

8. Complete the table below. Two of the boxes are labeled "Correct Decision"; label the other two boxes Type I Error or Type II Error as appropriate. (8 points)

	H_0 True	H_0 False
Reject H_0		
Fail to Reject H_0		

For each of the problems that follow, you will be asked to conduct hypothesis tests. For each problem clearly state the hypothesis test to be conducted using proper notation. State the test score and the p-value. Say whether to reject or fail to reject the null hypothesis. Then clearly, in plain English and in the context of the problem, state your conclusion. Use $\alpha = 0.05$ unless stated otherwise in the problem.

9. In a survey conducted by the American Animal Hospital Association, 37% of respondents stated that they talk to their pets on the answering machine or telephone. A vet found this hard to believe so he questioned 150 pet owners and discovered that 54 of them spoke to their pets on the answering machine or telephone. Does the vet have sufficient evidence to maintain his skepticism? (10 points)

10. In 1990, the mean height of women 20 years of age or older was 63.7 inches based on data from the CDC, with a standard deviation of 3.4 inches. Suppose that a random sample of 45 women who are 20 years old or older today produced a mean of 63.9 inches. Is this strong evidence that women are taller now than 25 years ago? (10 points)

11. An experiment was conducted on patients with bipolar disorder. 55 patients received a new medication, while the control group of 60 patients received a placebo. Both patients were rated on the Young-Mania scale to measure their improvement. The experimental group had a mean improvement of 14.8 with a standard deviation of 12.5, while the control group had a mean improvement of 8.1 with a standard deviation of 12.7. Determine if the experimental group had a larger mean improvement than the control group with significance level $\alpha = 0.01$. (13 points)

12. Use the data in the table below to conduct a two-sample proportion test to determine if there is sufficient evidence to think that rates of infection for those inoculated with the cholera vaccine were lower than the rate among those who were not inoculated. (10 points)

	infected	not infected	
inoculated	3	276	279
not inoculated	66	473	539
	69	749	818

Cholera Inoculation Study, 1894-96

13. Using the data on Sheet 2 of the data file **245final_data.xlsx**, conduct a paired t-test to determine if Ad A was scored differently than Ad B. (10 points)

14. Using the data on Sheet 3 of the data file **245final_data.xlsx**, conduct a test of independence to determine if the favorite search engine is independent of the browser used. (10 points)

15. Using the data on Sheet 1 of the data file **245final_data.xlsx**, conduct an ANOVA test to see if there are meaningful differences in the number of ounces produced by each filling machine. (10 points)

16. Using the data on Sheet 4 of the data file **245final_data.xlsx**, perform the following: (5 points each)
    a. Construct a scatterplot of the data using advertising to predict quantity sold. Paste your graph here.

    b. Does the data appear to have a linear or nonlinear relationship?

    c. Construct a regression line for the data. Report the equation here.

    d. What is the correlation coefficient?

    e. What is the proportion of variability in quantity sold that can be explained solely by advertising?

    f. Construct a residual plot of the data and paste it here.

    g. Do there appear to be any outliers? If so, which observation is it?

    h. Conduct a hypothesis test on the slope of the regression line. Is there strong evidence to conclude that the slope is different from 0?