MTH 324, Exam #1, Fall 2022 Name _____

Instructions: Answer each question thoroughly. For questions in Part 1, use the work you did at home to answer the questions. Be sure to answer each part of each question. In Part 2, report exact answers unless directed to round.

Part I:
Use the work you did at home to answer these questions about tax paid and the neighborhoods in our dataset.

1. What is the modal class on your histogram?

2. What is the shape of the Tax Paid histogram? Roughly symmetric, right-skewed, left-skewed?

3. Which neighborhood has the fewest members in the sample? How many homes is that?

4. Based on your comparative box plot, which neighborhood appears to be the most different from the other neighborhoods? Explain why you think so.

5. Calculate the upper and lower fences for the Tax Paid data, and the extreme upper and lower fences. Are there any outliers in the data? Are there any extreme outliers in the data?

6. Find the indicated probabilities.
    a. A particular assembly line produces working computers 99% of the time and computers with malfunctions 1% of time. A sample of 10 computers is sent to quality control. What is the probability of having a sample with no malfunctions?

    b. A security check line at a particular airport sees 100 travelers pass through during a particular hour of the day. Determine the probability that the check line will see 30 or more passengers in the next 10 minutes?

    c. The weight of a particular colony of feral cats has a mean of 7.8 pounds and a standard deviation of 0.6 pounds. What is the probability that a cat in the colony will weigh more than 10 pounds?

Part II:

7. Describe the procedure for calculating a cluster sample, and a stratified sample. Highlight how they differ from each other. Describe a situation in which each method is used.

8. What is the purpose of doing a block design in an experiment?

9. Why are medical studies often double blind?

10. For each of the following variables, identify whether the variable is i) categorical or numerical, ii) it's level of measurement (nominal, ordinal, interval or ratio), and if it is numerical iii) whether it is discrete or continuous (write NA if it does not apply).
    a. Favorite color

    b. Level of pain on a scale of 1 to 10

    c. Football jersey number

    d. Number of books in a library

    e. SAT score

11. Use the contingency table below to answer the probability questions that follow.

		Sport Preference			
		Archery	Boxing	Cycling	
Gender	Female	35	15	50	**100**
	Male	10	30	60	**100**
		45	**45**	**110**	**200**

    a. What is the probability that someone selected randomly from this sample prefers boxing?

    b. What is the probability that someone selected randomly from this sample is female?

c. What is the probability that someone selected randomly from this sample is a female and prefers boxing?

d. What is the probability that someone selected randomly from this sample is a female or prefer boxing?

e. What is the probability that someone selected randomly from this sample is a female given that they prefer boxing?

f. What is the probability that someone selected randomly from this sample does not prefer boxing?

g. Are sports preference and gender independent events? Explain your reasoning. Show math to support your conclusion.

12. A particular rare disease occurs in just 5 out of 1000 people in population. A test for that disease correctly identifies those with the disease 99% of the time. For people without the disease, the test correctly identifies that they do not have the disease 99.2% of the time. If a patient tests positive for the disease, what is the probability that they actually have the disease?

13. Consider the probability distribution given by $\int_{-1}^{1} K(x^4)dx$.
    a. Find the value of K that makes this a valid probability distribution.

    b. Find the probability that $P(0.5 \leq X \leq 1)$.

    c. Find the mean of the distribution.

    d. Find the variance of the distribution.

    e. What value of X represents the 90th percentile?

14. Use the joint probability table below to answer the questions that follow.

		x_2			
		0	1	2	3
x_1	0	.08	.07	.04	.00
	1	.06	.15	.05	.04
	2	.05	.04	.10	.06
	3	.00	.03	.04	.07
	4	.00	.01	.05	.06

    a. What is $P(X_1 = 2, X_2 = 3)$.

b. What is $P(X_1 > X_2)$

c. Find the marginal probability distributions of X_1 and X_2.

d. Find the mean of X_2.

e. Find $P(X_1 = 2|X_2 = 1)$