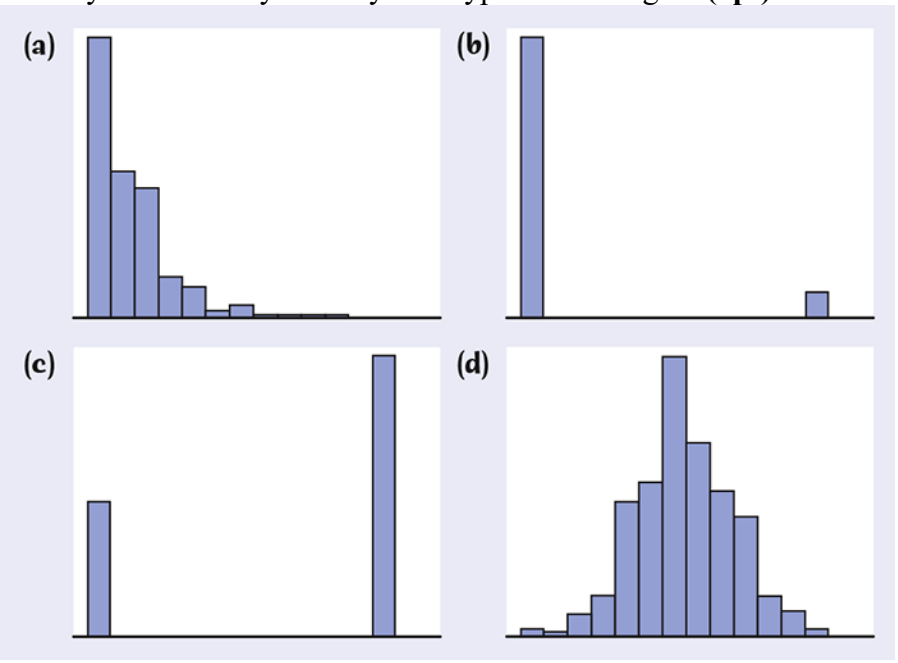
Final Exam (150 pts)

SHOW WORK AND/OR PROVIDE REASONING! DON'T FORGET UNITS!

1. A store manager wants to know customers' opinions of the service at the store. All the customers who entered the store during the Thanksgiving holiday were given a survey to fill out. It turns out 70% of the female customers and 50% of the male customers answered "satisfied" with the service at the store.
    a. What is the population in this investigation? Briefly explain your reasoning. **(3pts)**
    b. Does "70%" describe the population or the sample? Briefly explain. **(3pts)**
    c. Is this sample a representative sample of the population of interest? Briefly explain. **(5pts)**
    d. Is this an experiment or an observational study? Briefly explain. **(5pts)**
2. Indicate whether the following variables are quantitative or categorial. Explain your reason for each choice.
    a. The model of the car last sold by a particular car dealer **(3pts)**
    b. The movie ratings G, PG, PG-13, R, and NC-17 **(3pts)**
    c. The seating capacity of an auditorium **(3pts)**
3. Each of the following variables corresponds to one of the histograms below, which are shown in scrambled order and without scale markings. Which graph goes with which variable? Explain your reasoning.
    (1) Are you female or male? (In the data, male = 0, female = 1.) **(1pt)**
    (2) Are you right-handed or left-handed (In the data, right =0, left=1.) **(1pt)**
    (3) What is your height, in inches? **(1pt)**
    (4) How many minutes do you study on a typical weeknight? **(1pt)**



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4. A utility company determined that the average number of days between when a bill was sent out and when the payment was made is 32 with a standard deviation of 7 days. Assume the number of days is normally distributed.
   a. According to 68-95-99.7 empirical rule, between what two values will approximately 68% of the number of days be? **(5pts)**
   b. Estimate the percentage of customer accounts for which the number of days is less than 20. **(5pts)**
   c. Calculate the 78th percentile of this distribution. **(5pts)**
5. State whether anything is wrong with the statement. If there is something wrong, state what is wrong. If nothing is wrong with it, briefly explain why it is right.
   a. An economist discovers that there is a positive correlation between the average salary of college professors and the amount of beer consumed in the United States in the past several years. Therefore, the increase in beer consumption must be caused by professors spending their additional money on beer. **(3pts)**
   b. If a 95% confidence interval for a population mean is $1.7 < \mu < 2.3$, then the probability is 0.95 that μ is between 1.7 and 2.3. **(3pts)**
   c. Two variables are negatively associated if large values of one variable are associated with large values of the other. **(3pts)**
   d. In a boxplot, if the lower whisker is much longer than the upper whisker, then the data are skewed to the left. **(3pts)**
   e. The standard deviation is resistant to outliers. **(3pts)**
   f. For most data sets that are skewed to the right, the mean is less than the median. **(3pts)**
6. The heights (y) and lengths of forearms (x) were measured in inches for a random sample of 50 men. The following summary statistics were obtained:

$$\bar{x} = 10.1, \quad s_x = 0.8, \quad \bar{y} = 70.1, \quad s_y = 2.5, \quad r = 0.81$$

   a. Compute the least-squares regression line for predicting height from forearm length. **(8pts)**
   b. Predict the height of a man whose forearm is 9.5 inches long. **(6pts)**
7. Paving stones: Two hundred paving stones were examined for cracks, and 15 were found to be cracked. The same 200 stones were examined for discoloration, and 27 were found to be discolored. A total of 4 stones were both cracked and discolored. One of the 200 stones is selected at random.
   a. Find the probability that it is NOT cracked. **(5pts)**
   b. Find the probability that it is cracked or discolored. **(5pts)**
8. The National Health and Nutrition Examination Survey reported that in a recent year, the mean serum cholesterol level for U.S. adults was 202, with a standard deviation of 41

(the units are milligrams per deciliter). A simple random sample of 110 adults is chosen.

a. What are the mean and standard deviation of the sampling distribution of $\bar{x}$? **(5pts)**
b. What is the probability that the sample mean is between 190 and 200? **(5pts)**

9. A college admissions officer takes a simple random sample of 100 entering freshmen and computes their mean mathematics SAT score to be 458. Assume the population standard deviation is $\sigma = 116$.
   a. Construct a 99% confidence interval for the mean mathematics SAT score for the entering freshman class. **(5pts)**
   b. If the sample size were 75 rather than 100., would the margin of error be larger or smaller than the result in part (a)? Explain. **(3pts)**
   c. If the confidence level were 95% rather than 99%, would the margin of error be larger or smaller than the result in part (a)? Explain. **(3pts)**
10. The mean annual tuition and fees for a sample of 14 private colleges in California was $37,900 with a standard deviation of $7200. Assume the annual tuition and fees follows normal distribution. Can you conclude that the mean tuition and fees for private institutions in California differs from $35,000?
    a. State the appropriate hypotheses for the test of interest. **(6pts)**
    b. Compute the value of the test statistic. **(6pts)**
    c. State your conclusion. Use 0.05 significance level. **(6pts)**
11. A group of 71 people enrolled in a weight-loss program that involved adhering to a special diet and to a daily exercise program. After six months, their mean weight loss was 25 pounds, with a sample standard deviation of 9 pounds. A second group of 41 people went on the diet but didn't exercise. After six months, their mean weight loss was 14 pounds, with a sample standard deviation of 7 pounds.
    a. Construct a 95% confidence interval for the mean difference in weight losses between the two groups. **(9pts)**
    b. Does your answer to part a suggest that there is a statistically significant difference between the means? Why or why not? **(6pts)**
12. A math teacher has developed a new program to help high school students prepare for the math SAT. A sample of 100 students enroll in the program. They take a math SAT exam before the program starts and again at the end to measure their improvement. The mean number of points improved was $\bar{x} = 2.5$. Let μ be the population mean number of points improved. Suppose the population standard deviation $\sigma = 10$. To determine whether the program is effective, a test is made of the hypotheses $H_0: \mu = 0$ versus $H_1: \mu > 0$.
    a. Compute the value of the test statistic. **(5pts)**
    b. Do you reject H_0 at the $\alpha = 0.05$ level? What is your conclusion of this study? **(5pts)**