



---

Math 1320

Final Exam

December 15, 2021

---

Name:.....

**Problem 1:** Manufacturers of low-tar, low-nicotine cigarettes claim that smokers who switch to their brands will be better off physically than those who continue to smoke regular cigarettes. However, in his annual survey, the U.S. Surgeon general reported (Time, January 26, 1981) that low-yield brands reduce the risks of developing lung cancer only slightly, and do not all reduce the risk of heart disease, emphysema, and bronchitis. In view of this fact, a manufacturer of low-yield cigarettes sends 200 questionnaires to known consumers of his product and analyses their responses to see if they are aware of the Surgeon general's report.

(1) **What is the population of interest for the manufacturer?**

(2) **What is the sample random sample of interest in this case?**

**Problem 2: Circle your choice(s)**

- (1) The median is a better measure of central tendency than the mean if
- (a) the variable is discrete.
  - (b) the distribution is skewed.
  - (c) the variable is continuous.
  - (d) the distribution is symmetric.
  - (e) none of the above is correct.
- (2) If the interquartile range is zero, you can conclude that
- (a) the range must also be zero.
  - (b) the the mean is zero.
  - (c) at least 50% of the observation have the same value.
  - (d) all the observation have the same value.
  - (e) none of the above is correct.
- (3) Let  $r$  be the Pearson correlation coefficient between two variables  $x$  and  $y$ .  
**Which of the following is True?**
- (a)  $-1 \leq r \leq 1$ .
  - (b) Interchanging the variables  $x$  and  $y$  does not change the value of  $r$ .
  - (c)  $r$  is only measures the strength of linear relationship between  $x$  and  $y$ .
  - (d)  $r$  depends on the unit of  $x$  and  $y$ .
  - (e) None of the above is correct.

**Problem 3:** 42 Students take a Statistics exam. The Professor has the following statistics about the students' scores:

Min=20, Mean=74, First quartile=68, Median= 75, Third quartile=80, Standard deviation=30, Max=100, Fifth Percentile= 30.

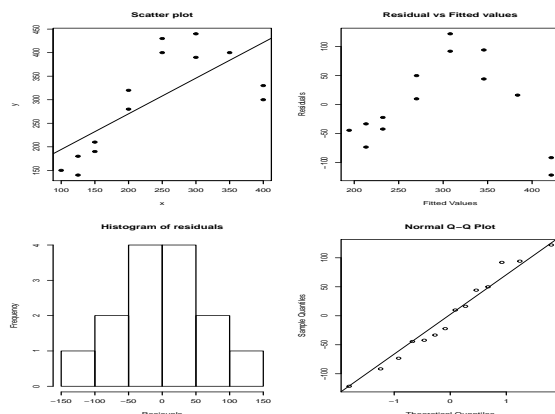
**Which of the following statement(s) is (are) correct? Circle your choice(s).**

- (a) More than half of the scores are higher than 74.
- (b) The middle 50% of scores are between 68 and 80.
- (c) 5 percent of the scores are higher than 30.
- (d) There is no outlier in the data.
- (e) None of the above is correct.

**Problem 4:** The data below are modified data from the one reported in the article “An experimental Correlation of Oxides of Nitrogen Emissions from Power Boilers Based on Field Data”, (*J. of Engr. for Power*, July 1973:173-170), with  $x$  = burner-area liberation rate (MBtu/hr-ft<sup>2</sup>),  $y$  = NO<sub>x</sub> emission rate (ppm). The plots resulting from the analysis were also provided, see below. The equation of

the regression line is given as  $\tilde{y} = 118 + 0.757x$ , and the coefficient of determination is  $COD=0.523$ .

|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| $x$ | 100 | 125 | 125 | 150 | 150 | 200 | 200 | 250 | 250 | 300 | 300 | 350 | 400 | 400 |
| $y$ | 150 | 140 | 180 | 210 | 190 | 320 | 280 | 400 | 430 | 440 | 390 | 400 | 330 | 300 |



- (1) Based on the information above, does a simple linear regression model appear to be appropriate? Explain (No Explanation=No credit).
  
- (2) True or False? Justify (No justification=No credit). Based on this model, we can estimate the NO<sub>x</sub> emission rate to be about 186.13 for a burner-area liberation rate of 90.
  
- (3) True or False? Justify (No justification=No credit). There is a strong positive linear relationship between  $x$  and  $y$ .

**Problem 5:** Consider a sample given as 12; 14; 27; 12; 34; 51; 15; 40; 12; 61; 33.  
Determine the Five-number summary for this sample.

**Problem 6:** Let  $x$  be the number of underinflated tires on an automobile of a certain type. Suppose that its pmf is  $\mathbf{p(0) = 0.3}$ ,  $\mathbf{p(1) = p(2) = p(3) = 0.1}$ ,  $\mathbf{p(4) = 0.4}$ .

(1) Find the mean number of tires underinflated at any time on the automobile.

(2) Find the standard deviation number of underinflated tires at any time on the automobile.

**Problem 7:** A national merit Scholarship award committee recently claimed that each of the ten grants applications received equal consideration in awarding three grants and that, in fact, the recipients were randomly selected (one at a time) from among the ten. Seven of the applicants were from a majority group and three were from a minority group. Suppose that the three grants were awarded to members of a majority group.

(1) What is probability of this event occurring, if, in fact, the committee's claim is true?

(2) Is the probability, in part (1), inconsistent with the committee's claim that the selection was random? Justify. (No justification=No credit)

**Problem 8:** A faculty leader was meeting two students in Paris, one arriving by train from Amsterdam and the other arriving by train from Brussels at approximately the same time. Let  $A$  and  $B$  be the events that the respective trains are one time. Suppose  $P(A) = 0.93$ ,  $P(B) = 0.89$ ,  $P(A \cup B) = 0.95$ . **What is the probability that the two trains are exactly on time?**

**Problem 9:** Responding to complains of spoiled milk being served to customers of a late-night diner, the Food and Drug Administration (FDA) has sent an official government inspector to the diner. Suppose that 10 of the 50 bottles of milk the diner currently has on hand contain spoiled milk. The FDA official randomly selects 5 bottles from the 50 (drawn one at a time) for inspection.

(1) **Given that none of first four bottles selected contain spoiled milk, what is the probability the last bottle selected will contain spoiled milk?**

(2) **What is the probability that the late-night dinner will pass the FDA test? (that is, no spoiled milk bottle will be discovered)**

**Problem 10:** According to a criminal lawyer, 60% of Americans selected for jury duty favor capital punishment. To check this claim, a random sample of 30 prospective jurors is selected, and the number of them favoring capital punishment is recorded.

- (1) **If the lawyer is correct in his assertion, what is the probability that there is fewer than 11 prospective jurors favoring capital punishment?**

- (2) **What would you think of the lawyer's assertion if the actual observed number of jurors favoring capital punishment is less than 11? Explain. (No explanation=No credit)**

**Problem 11:** A television cable company receives numerous phone calls throughout the day from customers reporting service trouble and from would-be subscribers to the cable network. Most of these callers are put "on hold" until a company's operator is free to help them. The company has determined that the length of time that a caller is on hold is normally distributed with a mean of 3.1 minutes and standard deviation of 0.9 minute. Company experts have decided that if as many as 5% of the callers are put on hold for 4.8 minutes or longer, more operators should be hired.

(1) What proportion of the company's callers are put on hold for at least 4.8 minutes?

(2) Should the company hire more operators? Justify. (No justification=No credit)

**Problem 12:** A candidate for statewide office is planning a sample survey to determine what percent  $p$  of the voters intend to vote for him. **In absence of preliminary data, how many people will he need to survey if he wants to estimate  $p$  with 99% confidence and a margin of errors of 3%?**

**Problem 13:** A student reads that a 95% confidence interval for the mean body mass index (BMI) of young American women is  $26.8 \pm 0.6$ . Asked to explain the meaning of this interval, the student says, "95% of young American women have BMI between

26.2 and 27.4". Say whether the student is right in his interpretation or otherwise correct his interpretation.

**Problem 14:** Two students A and B discuss to how make an inference about a population mean  $\mu$ . They have  $n = 35$  data points drawn from the population. From the data, they obtained the sample mean  $\bar{X} = 20$  and the sample standard deviation  $S = 4$ . Student A decides to construct a 95% confidence interval for  $\mu$  and student B decides to perform a test of hypothesis about  $\mu$ . **TRUE or FALSE?**

- (1) Both students can use a Student-t distribution.
- (2) Only A can use a normal distribution.
- (3) Only B can use a Student-t distribution.
- (4) None of them can use a Normal distribution.

**Problem 15:** A dietician has developed a diet that is low in fats, carbohydrates, and cholesterol. Although the diet was initially intended to be used by people with heart disease, the dietician wishes to examine the effect this diet has on the weight of obese people. Previous studies have shown that the weights of obese people are normally distributed. An independent random sample of 26 obese people is drawn. For each person, the amount of weight lost (or gained) in 3-week is recorded. It is assumed that the amounts of weight loss are normally distributed. The average weight loss (or gain) is 9.31 lbs with a standard deviation of 4.73 lbs.

**Based on these data, is there is enough evidence to suggest a population average weight loss (or gain) less than 6lbs? Justify.**

*Hint. You may either construct a 99% confidence interval or conduct a test of hypothesis and use it to make your point.*