

Answer the following questions NEATLY. Show all necessary work directly on the exam. Scratch paper will be discarded unread. 1 point each part unless otherwise marked. Final score: (# Right)*1.5. Total points: 36.

- 1) A firm wants to select 3 employees to take a survey about attitudes towards working for the firm. Ten employees are listed.
- a) Randomly select the 3 that should be interviewed. Circle their names and explain the scheme you used to select them:

Answers
will vary

Richards, Baxter, Fleming, Rod, Bow, Gates, Mourning, Santi, Brown, Goel.

Enter names in column in Minitab.
Sample from columns

- b) Why is it important to select them at random?

Reduce/eliminate bias.

- 2) Four students at a local high school conducted surveys.
- a) Shannon got the names of all 800 children in the high school and put them in a hat, and then pulled out 60 of them.

- A. Good method for sampling.
B. Biased sample. Fill in the type/origin of bias: _____

- b) Claire set up a booth outside of the school. Anyone who wanted to stop and fill out a survey could. She stopped collecting surveys when she got 60 students to complete them.

- A. Good method for sampling.
B. Biased sample. Fill in the type/origin of bias: convenience

- 3) A random sample of 1200 teenagers are chosen from numerous youth groups in New York City to conduct a survey about their interests in after-school programs. The population is

- A. New York teenagers
B. New York youth groups
C. All teenagers
D. The 1200 teenagers from youth groups in New York City

- 4) Classify each of the following studies as an experiment, survey, or observational study. Explain your reasoning in a short sentence.
- a) A study of the effect of exercise on risk for coronary heart disease. A questionnaire was given to people who have suffered a heart attack, asking about their exercise habits.

- A. Experiment
- B. Survey
- C. Observational study

- b) A study of the effectiveness of several antibiotics in controlling lung congestion in newborns. Antibiotics were randomly assigned to each newborn.

- A. Experiment
- B. Survey
- C. Observational study

- 5) Suppose two researchers wanted to determine if aspirin reduced the chance of a heart attack. Researcher 1 studied the medical records of 500 patients. For each patient, he recorded whether the person took aspirin every day and if the person had ever had a heart attack. Then he reported the percentage of heart attacks for the patients who took aspirin every day and for those who did not take aspirin every day. Researcher 2 also studied 500 people. He randomly assigned half (250) of the patients to take aspirin every day and the other half to take a placebo everyday then after a certain length of time he reported the percentage of heart attacks for the patients who took aspirin every day and for those who did not take aspirin every day. Suppose that both researchers found that there is a statistically significant difference in the heart attack rates for the aspirin users and the non-aspirin users, and that aspirin users had a lower rate of heart attacks. Can both researchers conclude that aspirin caused the reduction?

- A. Yes, because aspirin users had a lower heart attack rate in both studies.
- B. Yes, because aspirin is known to reduce heart attacks.
- C. No, only researcher 1 can conclude this.
- D. No, only researcher 2 can conclude this.

- 6) Hospital floors are usually covered by bare tiles. Carpets would cut down on noise but might be more likely to harbor germs. To study this possibility, investigators randomly assigned 8 of 16 available hospital rooms to have carpet installed. The others were left bare. Later, air from each room was pumped over a dish of agar. The dish was incubated for a fixed period, and the number of bacteria colonies were counted.

Matching: Select the appropriate statistical term for each. (3 points total)

- | | | |
|------------------------|----------|---------------------------|
| A. Experimental Units. | <u>A</u> | the 16 hospital rooms |
| B. Treatments. | <u>D</u> | the 8 rooms left bare |
| C. Response | <u>B</u> | carpeting and bare floors |
| D. Control Group | <u>C</u> | colonies in a dish |

- 7) A certain state lottery awards 18 \$200 prizes, 120 \$25 prizes and 270 \$20 prizes, for every 10,000 tickets sold.
- a) Set up the probability distribution model for the amount one can win (consider only gross, not net amounts):

x	200	25	20	0
$P(X=x)$.0018	.012	.027	.9592

- b) Use a sample of size 1,000,000 to provide an estimate for the expected winnings per ticket. Briefly explain your procedure.

$$\approx 1.205$$

* Random Data > Discrete
* Find mean.

- c) If you used a sample of size 100, how would your answer compare to the previous question?

- A. The new answer would be different, but just as accurate as the first answer.
B. The new answer would be more accurate.
 C. The new answer would be less accurate.

- d) Approximately what should the lottery charge per ticket if they want to make a profit?

more than \$1.205 per ticket

- e) If someone buys 100,000 tickets, are they guaranteed to win a prize of some kind?

- A. Yes, they would win a prize after playing 10,000 times.
B. Yes, the expected value is positive.
C. No, they need to play it approximately 1,000,000 times.
 D. No, it is possible that each ticket still loses.

- f) Bob and Bill each bought one ticket each week for the past 100 weeks. Bill has not won a single prize yet. Bob just won a \$20 prize last week. Who is more likely to win a prize this coming week? Select the best answer.

- A. Bill
B. Bob
 C. They have an equal chance of winning
D. Not enough information to tell

8) A sample of students of high academic ability under 13 years of age was given the SAT math exam, which is usually taken by High School seniors. The mean score for the females in the sample was 386, whereas the mean score of the males was 416. Is 386 a parameter or a statistic?

a) 386: Statistic

9) A die is tossed 3 times. What is the probability of

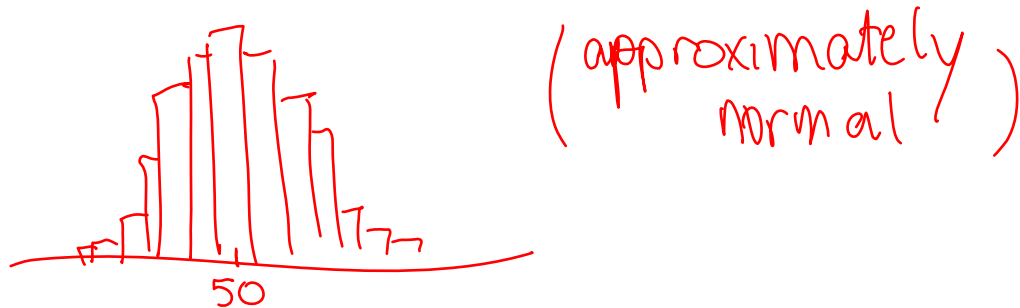
a) Exactly 3 fives? .005

b) No fives turning up? .578

c) At least 1 five? .422

10) Now consider tossing the die 300 times.

a) Provide a rough sketch for the distribution of tosses.



b) What is the mean of the distribution?

$$n \cdot p = (300) \left(\frac{1}{6} \right) = 50$$

c) What is the standard deviation of the distribution?

$$\sqrt{npq} = \sqrt{300 \left(\frac{1}{6} \right) \left(\frac{5}{6} \right)} = \sqrt{41.67} = 6.45$$

d) Bonus (1 extra point). What percent of values are within 2 standard deviations of the mean for that distribution?

95%