

## Statistics 151 Practice Midterm 4 – Multiple Choice + Written (80 minutes)

Instructions:

1. This is a closed book exam.
2. You may use the STAT 151 formula sheets and tables provided and a NON-PROGRAMMABLE calculator only.
3. You have 80 minutes to complete the exam.
4. The exam is out of a total of 40 marks (25 multiple choice and two long answer problems worth a total of 15 marks).
5. Show all your work for the long answer section to receive full credit.
6. Topics covered: Chapters 1 – 7 in Agresti/Franklin 2.

### Part 1: Multiple Choice (25 question's worth 1 mark each)

Use the following to answer question 1:

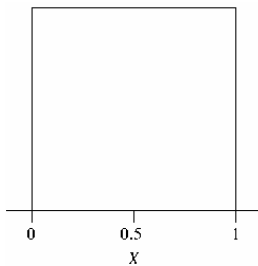
I wish to determine the correlation between the height (in inches) and weight (in pounds) of 21-year-old males. To do this, I measure the height and weight of two 21-year-old men. The measured values are

	Male #1	Male #2
Height	70	75
Weight	160	200

1. The correlation  $r$  computed from the measurements of these males is
  - A) **1.0.**
  - B) positive and between 0.25 and 0.75.
  - C) near 0, but could be either positive or negative.
  - D) exactly 0.
  
2. A statistic is said to be unbiased if
  - A) it is used for only honest purposes.
  - B) **the mean of its sampling distribution is equal to the true value of the parameter being estimated.**
  - C) the survey used to obtain the statistic was designed so as to avoid even the hint of racial or sexual prejudice.
  - D) both the person who calculated the statistic and the subjects whose responses make up the statistic were truthful.
  
3. Ignoring twins and other multiple births, assume babies born at a hospital are independent events with the probability that a baby is a boy and the probability that a baby is a girl both equal to 0.5. If the first 4 children born are girls, what is the probability the next born child is a boy?
  - A) **0.50.**
  - B) 0.75.
  - C) 0.80.
  - D) 1.00.

4. A television station is interested in predicting whether or not voters are in favor of an increase in the state sales tax. It asks its viewers to phone in and indicate whether they support or are opposed to an increase in the state sales tax in order to generate additional revenue for education. Of the 2633 viewers who phone in, 1474 (55.98%) are opposed to the increase. The sample obtained is
- A) **probably biased.**
  - B) a simple random sample.
  - C) a stratified random sample.
  - D) a probability sample in which each person in the population has the same chance of being in the sample.

5. Let the random variable  $X$  be a random number with the uniform density curve given below.



$P(0.6 < X < 1.2)$  is

- A) 0.30.
  - B) 0.40.**
  - C) 0.60.
  - D) 0.90.
6. There are three children in a room, ages three, four, and five. If a four-year-old child enters the room the
- A) **mean age will stay the same but the standard deviation will decrease.**
  - B) mean age will stay the same but the standard deviation will increase.
  - C) mean age and standard deviation will increase.
  - D) mean age and standard deviation will stay the same .
7. A phone-in poll conducted by a newspaper reported that 73% of those who called in liked business tycoon Donald Trump. The number 73% is a
- A) sample.
  - B) parameter.
  - C) population.
  - D) statistic.**
8. In a certain game of chance, your chances of winning are 0.2. If you play the game five times and outcomes are independent, the probability that you win at least once is
- A) 0.2000.
  - B) 0.3277.
  - C) 0.6723.**
  - D) 0.9997.
9. A set of data is found to have a sample standard deviation of 25. Suppose 9 were added to each of the numbers in the data. The standard deviation of the resulting data
- A) cannot be determined.
  - B) would be 34.
  - C) would be 28.
  - D) would be 25.**

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10. A consumer group surveyed the prices for a certain item in five different stores, and reported the average price as \$15. We visited four of the five stores, and found the prices to be \$10, \$15, \$15, and \$25. Assuming that the consumer group is correct, what is the price of the item at the store that we did not visit?  
A) **\$10**                      B) \$15                      C) \$20                      D) \$25
11. Suppose that  $A$  and  $B$  are two independent events with  $P(A) = 0.2$  and  $P(B) = 0.4$ .  $P(A \text{ or } B)$  is:  
A) 0.08.                      B) 0.12.                      C) **0.52.**                      D) 0.60.
12. When water flows across farm land, some of the soil is washed away, resulting in erosion. An experiment was conducted to investigate the effect of the rate of water flow on the amount of soil washed away. Flow is measured in liters per second and the eroded soil is measured in kilograms. The data are given in the following table.
- |             |     |      |      |      |      |
|-------------|-----|------|------|------|------|
| Flow rate   | .31 | .85  | 1.26 | 2.47 | 3.75 |
| Eroded Soil | .82 | 1.95 | 2.18 | 3.01 | 6.07 |
- The association between flow rate and amount of eroded soil is  
A) **positive.**  
B) negative.  
C) neither positive nor negative.  
D) impossible to determine since both variables are categorical.
13. I toss a penny and observe whether it lands heads up or tails up. Suppose the penny is fair, i.e., the probability of heads is  $1/2$  and the probability of tails is  $1/2$ . This means  
A) every occurrence of a head must be balanced by a tail in one of the next two or three tosses.  
B) regardless of the number of flips, half will be heads and half tails.  
C) **if I flip the coin many times the proportion of tails will tend to get closer to  $1/2$ .**  
D) All of the above.
14. In a particular game, a fair die is tossed. If the number of spots showing is either four or five, you win \$1. If the number of spots showing is six, you win \$4. And if the number of spots showing is one, two, or three, you win nothing. You are going to play the game twice. The probability that you win \$4 both times is  
A)  $1/3$ .                      B)  $1/4$ .                      C)  $1/6$ .                      D)  **$1/36$ .**

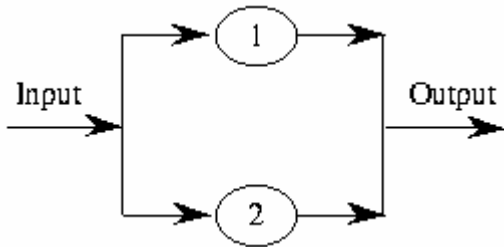
Use the following to answer question 15:

Let the random variable  $X$  represent the profit made on a randomly selected day by a certain store. Assume  $X$  is normal with a mean of \$360 and standard deviation \$40.

15. The value of  $P(X > \$400)$  is  
A) **0.1587.**                      B) 0.2881.                      C) 0.7119.                      D) 08413.
16. An event  $A$  will occur with probability 0.4. An event  $B$  will occur with probability 0.6. The probability that both  $A$  and  $B$  will occur is 0.24. We may conclude  
A) **that events  $A$  and  $B$  are independent.**    C) that either  $A$  or  $B$  always occurs.  
B) that events  $A$  and  $B$  are disjoint.                      D) None of the above.

Use the following to answer question 17:

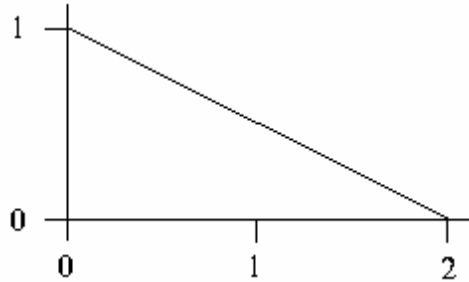
A system has two components that operate in parallel, as shown in the diagram below. Because the components operate in parallel, at least one of the components must function properly if the system is to function properly. The probabilities of *failures* for the components 1 and 2 during one period of operation are .20 and .03, respectively. Let  $F$  denote the event that the component 1 *fails* during one period of operation and  $G$  denote the event that component 2 *fails* during one period of operation. The component failures are independent.



17. The event corresponding to the above system functioning properly during one period of operation is  
A)  $F$  and  $G$ .                      B)  $F$  or  $G$ .                      C) **not  $F$  or not  $G$ .**                      D) not  $F$  and not  $G$ .

Use the following to answer question 18:

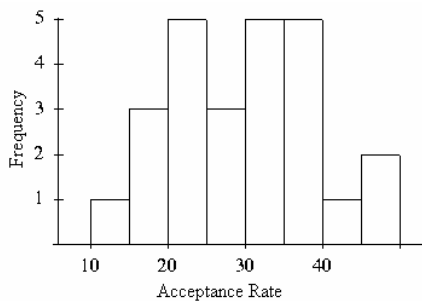
Suppose  $X$  is a continuous random variable taking values between 0 and 2 and having the probability density function below.



18.  $P(0 \leq X \leq 1)$  has value  
 A) 0.25.                      B) 0.33.                      C) 0.66.                      **D) 0.75.**
19. An event  $A$  will occur with probability 0.5. An event  $B$  will occur with probability 0.6. The probability that both  $A$  and  $B$  will occur is 0.1. The conditional probability of  $A$  given  $B$  is  
 A) Cannot be determined from the information given.  
**B) is 0.167.**  
 C) is 0.200.  
 D) is 0.833.

Use the following to answer question 20:

The following histogram represents the distribution of acceptance rates (percent accepted) among 25 business schools in 1997. In each class interval, the left endpoint is included but not the right.



20. Which interval contains fewer than half of all the observations?  
 A) acceptance rate  $\geq 30\%$                       **C) acceptance rate  $< 30\%$**   
 B)  $25\% \leq$  acceptance rate  $< 40\%$                       D) None of the above.

21. Two machines work independently. Machine *A* works with probability 0.8. The conditional probability that machine *B* works given that machine *A* works is 0.5. The conditional probability that machine *A* works, given that machine *B* works is:
- A) 0.3                      B) 0.5                      C) 0.7                      **D) 0.8**
22. The correlation coefficient measures
- A) the strength of the relationship between two variables.  
B) whether or not a scatterplot shows an interesting pattern.  
C) whether a cause and effect relation exists between two variables.  
**D) the strength of a straight line relation between two variables.**
23. The number of undergraduates at Johns Hopkins University is approximately 2000, while the number at Ohio State University is approximately 40,000. At both schools a simple random sample of about 3% of the undergraduates is taken. We conclude that
- A) the sample from Johns Hopkins has almost the same sampling variability as that from Ohio State.  
B) it is impossible to make any statements about the sampling variability of the two samples because the students surveyed were different.  
**C) the sample from Johns Hopkins has more sampling variability than that from Ohio State.**  
D) the sample from Johns Hopkins has less sampling variability than that from Ohio State.

Use the following to answer question 24-25:

In a statistics course a linear regression equation was computed to predict the final exam score from the score on the first test. The equation of the least squares regression line was

$$y = 10 + 0.9x$$

where *y* represents the final exam score and *x* is the score on the first exam.

24. Suppose Joe Scores a 90 on the first exam. What would be the predicted value of his score on the final exam?
- A) **91**  
B) 89  
C) 81  
D) Cannot be determined. We also need to know the correlation.
25. The first test score is
- A) the intercept.  
B) the slope.  
**C) the explanatory variable.**  
D) the response variable.

**Part 2 Long Answer (Show all your work)**

**Problem 1 (8 marks):**

The grade point averages of a large population of university students are approximately normally distributed with mean 2.4 and standard deviation 0.8.

- a) (3 marks) If you need to finish in the top 25% of your class to earn a certain scholarship, what must your grade point average be?

2.94

- b) (3 marks) Suppose that four students are randomly selected from the student body. What is the probability that at least one will earn the scholarship?

0.684

- c) (2 marks) Suppose that four students are randomly selected from the student body. What is the probability their average grade point average is above 3.5?

0.003

**Problem 2: (7 marks)**

Diseases I and II are prevalent among people in a certain population. It is assumed that 10% of the population will contract disease I sometime during their lifetime, 15% will contract disease II eventually, and 3% will contract both diseases.

- a) (2 marks) Find the probability that a randomly chosen person from this population will not contract either disease.

0.78

- b) (3 marks) Given that a randomly selected person has contracted at least one disease, what is the probability this person will contract both diseases.

0.1364

- c) (2 mark) Are the two diseases independent? Defend your answer!

No.