STA 291 Exam 2

13 November 2007

Name ____________________________

Problem	Points
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Total	/100

You are allowed pen or pencil and calculator.

Multiple choice questions:

1. Which of these values cannot be the probability of an event? *Circle the correct answer.*

(a) 0.00 (b) 1.00 (c) 0.34 (d) –2.00

2. If two events are mutually exclusive, what is the probability that both occur at the same time? *Circle the correct answer.*

(a) 0.00 (b) 0.50 (c) 1.00 (d) Cannot be determined from the information given.

3. A card is drawn from an ordinary deck of 52 cards. The probability that a card is a diamond is 1/4. The probability that it is a king is 1/13. The probability that it is the king of diamonds is 1/52. Which of the following statements is true? *Circle the correct answer.*

(a) The events “king” and “diamond” are mutually exclusive but not independent.
(b) The events “king and “diamond” are neither independent nor mutually exclusive.
(c) The events “king” and “diamond” are independent but not mutually exclusive.
(d) The events “king” and “diamond” are independent and mutually exclusive.

4. Refer to the description of the previous problem. What is the probability that the card is a king, but not a diamond? *Circle the correct answer.*

(a) 4/52 (b) 3/52 (c) 12/52 (d) 11/52

5. Which of the following about the binomial distribution is not a true statement? *Circle the correct answer.*

(a) The outcome of each trial is one of two values, often classified as “success” or “failure”.
(b) The outcome of each trial is independent of each other.
(c) The binomial distribution is a continuous distribution.
(d) The probability of success must be constant from trial to trial.

6. The final exam in a small statistics course of 50 students is taken on December 11th. Students who are sick or have other legitimate reasons for missing the exam are allowed to take a make-up exam the next day. A statistics professor has observed that about 6% of all students have legitimate reasons for missing the final exam on December 11th.
How many students can the professor expect to miss the December exam? *Circle the correct answer.*

(a) 0 (b) 0.06 (c) 3 (d) 6

7. Refer to the description of the previous problem. What is the probability that the professor will not have to create a make-up exam? *Circle the correct answer.*

(a) 0.0453 (b) 0.06 (c) 0.94 (d) 0.9547

8. The amount in a retiree's savings account is known to have mean $3,200 and standard deviation $2,800—the distribution of these values is also tremendously right-skewed. We decide to take a random sample of 625 retirees', finding (with their permission) their savings account balances and the resulting sample mean. Which of the following statements are true? *Circle all the correct answers.*

(a) The sampling distribution of the sample mean will also be right-skewed.
(b) The sampling distribution of the sample mean will be approximately normal.
(c) The mean of the sampling distribution of the sample mean will be $3,200.
(d) The standard deviation of the sampling distribution of the sample mean will be $112.

9. Bill scores 313 on an entrance exam whose mean is 300 and whose standard deviation is 10. Jim scores 45 on an entrance exam whose mean is 35 and whose standard deviation is 4. Which friend, Bill or Jim, has bragging rights, as far as doing better on their respective test, assuming scores on both tests are normally distributed? *Circle the correct answer.*

(a) We can't tell with the given information.
(b) Bill
(c) Jim
(d) They're both above the mean, so it's a tie.

10. In the construction of confidence intervals of the population mean, if all other quantities are unchanged, an increase in the sample size will lead to a: (*Circle the correct answer.)*

(a) Wider interval
(b) Narrower interval.
(c) Less significant interval.
(d) Biased interval.

11. A 99% confidence interval estimate of the population mean can be interpreted to mean:

(a) If 100 samples are taken and confidence interval estimates are developed, 99 of them would include the true population mean somewhere within their interval.
(b) We have 99% confidence that we have selected a sample whose interval does NOT include the population.
(c) We estimate that the population mean falls between the lower and upper confidence limits, and this type of estimator is correct 99% of the time.
(d) We are 99% confident that 1% of the values of the sample means will result in a confidence interval that includes the population mean.

Long-answer section: show all work to earn all possible credit.

12. The following table lists the joint probabilities associated with smoking and lung disease among 60- to 65-year-old men.

	He is a smoker	He is a nonsmoker
He has lung disease	0.12	0.03
He does not have lung disease	0.19	0.66

One 60- to 65-year-old man is selected at random. What are the probabilities of the following events?

(a) He is a smoker.

(b) He does not have lung disease.

(c) He has lung disease given that he is a smoker.

(d) He has lung disease given that he does not smoke.

13. Approximately 10% of people are left-handed. If two people are selected at random, what is the probability of the following events?

(a) Both are right-handed.

(b) Both are left-handed.

(c) At least one is right-handed.

14. On a particular stretch of road, it is believed that half of the drivers are speeding. We are going to take a sample of n = 129 cars and find the sample proportion, $\hat{p}$, which are speeding.
(a) Give the values of the mean and standard deviation of the sampling distribution of $\hat{p}$.

(b) Find the probability that $\hat{p} <.4$

(c) Find the probability that $\hat{p}$ is between .4 and .55

15. Yields on a particular form of investment are normally distributed with a mean of 2.8% and a standard deviation of 4.8%.
(a) If we take a sample of n = 16 of these investments, what would be the mean and standard deviation of our resulting sample mean? Do the calculation or explain why it cannot be done.

(b) If we take a sample of n = 16 of these investments, what would be the probability that our resulting sample mean was less than 0 (zero)? Do the calculation or explain why it cannot be done.

(c) If we take a sample of n = 256 of these investments, what would be the probability that our resulting sample mean was more than 2%? Do the calculation or explain why it cannot be done.

16. In a 2004 paper, professional magician turned statistician Persi Diaconis (and associates) analyzed the mechanics and physics of coin flipping. From their models they concluded that a coin flipped in the air and caught by hand is not quite fair. In particular, there appears to be a slight bias toward the coin landing with the same face upward as when it was launched. The mathematical models predict this outcome with probability $p = 0.51$ rather than the fair toss probability of $p = 0.50$. Diaconis proposes investigating this question by actually flipping a coin many, many times.
How large a sample size would be required to verify that for a flipped coin $p = 0.51$ with a margin of error of 0.002 at the 95% level of confidence?

17. The EPA is thinking of raising fuel economy requirements for passenger cars to 30 mpg. Engineers for one auto company have developed an engine modification that they believe will exceed this high efficiency goal. Understandably, company executives need a demonstration that the modification will work before they'll be willing to make a costly change in the company's engine manufacturing plant, so the engineers plan to install prototypes on 36 cars. Some company employees will then drive these cars for a month of commuting, keeping careful records of their gas mileage. After collecting all the data, the engineers will test a hypothesis about the new engines at a = 0.05.

(a) What null hypothesis will the engineers test?

(b) What's their alternative hypothesis?

(c) Supposed based on the sample of 40 cars, the P-value to test the hypothesis is calculated to be 0.032, what conclusion should you draw regarding the hypothesis at a-level 0.05?