Exam II-A Statistics 216 Spring 2005

Name _____ Section _____

In each of the following multiple choice questions (1-14) choose the **single best** answer. Each multiple choice question is worth 3 points.

1. A commuter must pass through 4 traffic lights on her way to work, and will have to stop at each one that is red. She estimates the probability model for the number of red lights she hits, as shown below.

No. of red lights	0	1	2	3	4
probability	0.05	0.25	0.35	0.15	0.20

   What is the average number of red lights she hits each day?

   A) 0.35

   B) 2.2

   C) 2

   D) 0.7

2. Four students in a statistics class each took a simple random sample of size 10 from their class and calculated the mean height. They got 64 inches, 67 inches, 60 inches, and 62 inches. This is an example of

   A) sampling variability.

   B) bias.

   C) confounding.

   D) lack of control.

3. Analysis of the salaries of a random sample of 288 Nevada teachers produced a 90% confidence interval for the mean salary of ($38944, $42893). Which of the following is a correct conclusion.

   A) If we took many random samples of 288 Nevada teachers, about 9 out of 10 of them would produce this interval.

   B) If we took many random samples of 288 Nevada teachers, about 9 out of 10 of them would produce an interval that contained the mean salary of all Nevada teachers.

   C) About 9 out of 10 Nevada teachers earn between $38944 and $42893.

   D) About 9 out of 10 of the 288 teachers surveyed earn between $38944 and $42893.

4. All human blood can be "ABO - typed" as one of O, A, B, or AB, but the distribution of blood types varies a bit among groups of people. Here is the distribution of blood types for a randomly chosen person in the United States.

Blood type	O	A	B	AB
U. S. Probability	?	0.4	0.11	0.04

What is the probability of type O blood in the United States?

A) 1

B) 0

C) 0.45

D) 0.5

5. A study of voting chose **663** registered voters shortly after an election. Of these **72**% said they had voted in the election. Election records show that only **56**% of registered voters voted in the election. Which of the bold-faced numbers is a parameter?

A) 663

B) 72%

C) 56%

D) All 3 of the numbers are parameters.

6. A 95% confidence interval computed from a sample size of 36 had a margin of error of 10. What is the standard deviation?

A) 60

B) 30.6

C) 36.5

D) This cannot be determined because we are not given the value of $\bar{x}$.

7. A test of the null hypothesis $H_0 : \mu = \mu_0$ gives a test statistic $z = 1.6$. What is the P-value if the alternative is $H_a : \mu \neq \mu_0$?

A) 0.0548

B) 0.9452

C) 1.96

D) 0.1096

8. Which of the following would **not** differ for 2 random samples of the same size from the same population?

   A) The sample mean $\bar{x}$.

   B) The standard deviation of the sample mean.

   C) The z-score for the sample mean.

   D) The P-value in a significance test.

9. A fair coin is tossed 3 times and the number of heads is recorded. Which of the following is the correct sample space for the number of heads observed?

   A) {H, T}

   B) {0, 1, 2, 3}

   C) {1, 2, 3}

   D) {HHH, HHT, HTH, THH, TTH, THT, HTT, TTT}

10. A professional basketball player has attempted 10,000 foul shots over the course of his long career. He has made 7,500 of them. What is the approximate probability he makes a free throw shot?

    A) 0.50

    B) 0.75

    C) 0.25

    D) 1

11. A simple random sample of 16 yields a sample mean of $\bar{x} = 15$. A 90% confidence interval is to be computed. The probability that the **sample mean** $\bar{x}$ will lie in the interval is

    A) 0.95

    B) 0.90

    C) 1

    D) 0 or 1 but we do not know which.

12. A simple random sample of size $n = 16$ is drawn from a normally distributed population with mean $\mu = 25$ and standard deviation $\sigma = 8$. The value of the sample mean is observed to be $\bar{x} = 22$. The sampling distribution of the sample mean computed from samples of size 16 from this population is

    A) $N(25, 2)$

    B) $N(25, 8)$

    C) $N(22, 8)$

    D) $N(22, 2)$.

13. Suppose 50 different survey organizations take simple random samples of 400 persons age 25 and over in the same large city. Each organization computes the mean income of it's sample and a 95% confidence interval for the true unknown population mean income. The population standard deviation is known. Which of the following statements is true?

    A) The width of the 50 intervals will be the same but they will have different centers.

    B) The width and center of the 50 intervals will be the same.

    C) The width of the 50 intervals will be the different but they will have the same centers.

    D) The width and center of the 50 intervals will all be different.

14. The Census Bureau is planning to take a sample amounting to 1% of the population in each state in order to estimate the mean income in that state. California has a population of around 30 million and Nevada has a population of around 1 million. Other things being equal:

    A) The accuracy to be expected in California is about the same as the accuracy to be expected in Nevada.

    B) The accuracy to be expected in California is quite a bit higher than in Nevada.

    C) The accuracy to be expected in California is quite a bit lower than in Nevada.

In each of the following True/False questions (15-24) circle the best answer. Each True/False question is worth 2 points.

15. **TRUE** **FALSE**
    Disjoint events can be independent.

16. **TRUE** **FALSE**
    If a statistical test is performed and H_0 is rejected at $\alpha = 0.01$ it will also be rejected at $\alpha = 0.05$.

17. **TRUE** **FALSE**
    Formal statistical inference is important because it can help correct for flaws in study design.

18. **TRUE** **FALSE**
    In repeated sampling from a population the value of a parameter does not vary but the value of a statistic will.

19. **TRUE** **FALSE**
    The margin of error of a confidence interval will increase if the confidence level increases.

20. **TRUE** **FALSE**
    A P-value cannot be greater than 1.

21. **TRUE** **FALSE**
    Larger sample sizes (from a SRS) reduce the variability of $\bar{x}$.

22. **TRUE** **FALSE**
All of statistical inference is based on one idea: to see how trustworthy a procedure is, ask what would happen if we repeated it many times.

23. **TRUE** **FALSE**
The P-value is the probability that the null hypothesis is true.

24. **TRUE** **FALSE**
A fair coin is tossed 5 times and the sequence of heads (H) and tails (T) is recorded. HTHHT has a higher probability of occurring than HHHHH.

You must show all your work in the following problems to receive full or partial credit.

25. A consumer organization estimates that over a 1-year period 17% of all cars will need to be repaired once, 7% will need to be repaired twice, and 4% will need to be repaired 3 or more times.

    A) What is the probability that a car chosen at random will need no repairs in 1 year? (3pts)

    B) What is the probability that a car chosen at random will need one or more repairs in 1 year? (3pts)

26. A questionnaire about study habits was given to a random sample of students taking a large introductory statistics class. The sample of 25 students responded that they spent an average of 110 minutes per week studying statistics. Assume that the standard deviation is 40 minutes.

    A) Give a 95% confidence interval for the true mean time spent studying statistics each week by students in this class. (4pts)

B) Interpret the interval in terms of the problem. (2pts)

27. Assume that the distribution of the duration of human pregnancies can be described by is Normal with mean $\mu = 266$ and standard deviation $\sigma = 16$ days.

A) Suppose a pregnant woman is chosen at random from the population. What is the probability her pregnancy lasts more than 270 days? (4pts)

B) Suppose an obstetrician is providing prenatal care to 60 pregnant women. What is the sampling distribution of of the mean pregnancy duration for a random sample of $n = 60$ women? (3pts)

C) What is the probability that the mean duration of these 60 patients's pregnancies will be more than 270 days? (4pts)

D) Suppose the distribution of the duration of human pregnancies is later found to be skewed to the left. Which answer from part A), B), and C) is **most** affected by this new knowledge and why? (3pts)

28. In a study of the effects of nutrition on work efficiency, a random sample of 16 workers ate a special diet. In one part of the study, the blood sugar level of each sample worker was measured 2 hours after breakfast. The sample mean blood sugar level was $\bar{x} = 112.8$ mg. The researcher wants to see if this is convincing evidence ($\alpha = 0.05$) that the true mean blood sugar levels is greater than 110. She is willing to assume that $\sigma = 9.6$ mg and that the true population of blood sugar readings is normally distributed. Report hypotheses, value of test statistic, p-value, decision and conclusion. (12 pts.)