Exam 2a   Statistics 216   Fall 2004

Name ———————————————————————— Section ——————————

In each of the following multiple choice questions choose the **single best** answer. Each
multiple choice question is worth 4 points.

*The weight of potato chips in a medium-size bag is stated on the package to be 10 ounces. The
amount that the packaging machine puts in these bags is believed to be normally distributed
with a mean of 10.2 ounces and standard deviation 0.12 ounces. Use this information to
answer questions 1 and 2.*

1. What is the probability a randomly chosen bag will be underweight, i.e. weigh less
   than 10 ounces?

   A) 0.25

   B) 0.0475

   C) 0.9525

   D) 0.5

2. What is the probability that the sample mean weight of 4 randomly chosen bags is
   below 10 ounces?

   A) 0.9525

   B) 0.0475

   C) 0.0004

   D) 0.9996

3. The probability model below describes the number of repair calls that an appliance
   repair shop may receive during an hour.

Repair Calls	0	1	2	3
Probability	0.1	0.3	0.4	0.2

   The mean number of calls per hour is

   A) 1.7

   B) 1.5

   C) 2

   D) 1.33

4. Carbon monoxide emissions for a certain kind of car varies from car to car according to a normal distribution with mean $\mu = 2.9$ grams/mile and standard deviation $\sigma = 0.4$ grams/mile. A simple random sample of $n = 8$ cars is taken. The sampling distribution of the sample mean is

    A) $N(2.9, 0.4)$

    B) $N(1.03, 0.14)$

    C) $N(2.9, 0.14)$

    D) $N(2.9, 0.05)$

5. A large SRS $(n = 200)$ will be taken from a population with a mean of $\mu = 10$ and standard deviation $\sigma = 8$. The population is not normally distributed. Which of the following is a true statement.

    A) The approximate probability the sample mean will be less than 11 can be found because of the Central Limit Theorem.

    B) The approximate probability the sample mean will be less than 11 can be found because of the Law of Large Numbers.

    C) The approximate probability the sample mean will be less than 11 cannot be found because the margin of error will be too large.

    D) The approximate probability the sample mean will be less than 11 cannot be found because the sample mean is biased when the population is not normal.

6. A 95% confidence interval for a population mean is $(1, 6)$. The margin of error is

    A) 1.96

    B) 2.5

    C) 3.5

    D) 5

7. A television station is interested in predicting whether or not voters in its listening area are in favor of federal funding for abortions. It asks its viewers to phone in and indicate whether they are in favor of this or opposed to this. Of the 2241 viewers who phoned in, 1574 (70.2%) were opposed to federal funding for abortions. The number 70.2% is

    A) a statistic.

    B) a parameter.

    C) a sample.

    D) a population.

8. Livestock are given a special feed supplement to see if it will promote weight gain. The researchers report that the 77 cows studied gained an average of 56 pounds and that a 95% confidence interval for the mean weight gain this supplement produces is (45, 67). Which of the following is a correct interpretation of these results?

   A) 95% of the cows studied gained between 45 and 67 pounds.

   B) We are 95% confident a cow fed this supplement will gain between 45 and 67 pounds.

   C) The true mean weight gain of cows fed this supplement will be between 45 and 67 pounds 95% of the time.

   D) We are 95% confident the true mean weight gain of cows fed this supplement will lie between 45 and 67 pounds.

9. Other things being equal which of the following P-values provides the strongest evidence against the null hypothesis?

   A) 0.001

   B) 0.03

   C) 0.45

   D) 0.77

10. Which of the following will *not* result in a decrease in the width of a confidence interval?

    A) An increase of the sample size.

    B) A decrease in the level of confidence.

    C) A decrease in the P-value.

    D) A decrease in σ.

11. A doctor monitoring the level of phosphorus in the blood of a dialysis patient took a SRS of 6 measurements and recorded a sample mean of $\bar{x} = 5.4$ milligrams of phosphorus per deciliter of blood (mg/dl). Assuming the level of phosphorus varies normally with standard deviation $\sigma = 0.9$ mg/dl, give a 90% confidence interval for the mean blood phosphorus level.

    A) 5.4 ± 1.48

    B) 5.4 ± 0.9

    C) 5.4 ± 0.6

    D) 5.4 ± 0.37

12. The null and alternative hypotheses of a test are $H_0 : \mu = 10$ vs. $H_a : \mu \neq 10$. The value of the test statistic is $z = 1.18$. The P-value is

   A) 0.238

   B) 0.119

   C) 0.881

   D) 0.05

13. Antonio makes a measurement in a chemistry laboratory and records the results in his lab report. The standard deviation of students' lab measurements is $\sigma = 10$ milligrams. How many measurements must Antonio make so that the standard deviation of $\bar{x}$ equals 5?

   A) 2

   B) 1

   C) 3

   D) 4

14. One of the following statements is not a valid null hypothesis. Which one?

   A) In a sample of students, the mean pulse rate for men is equal to the mean pulse rate for women.

   B) The true mean weight of all newborn boys is the same as the true mean weight of all newborn girls.

   C) The proportion of all cars in California that are white is equal to the proportion of all cars in Maine that are white.

   D) The mean weight of all Canadian geese is the same as the mean weight of all Canadian warblers.

15. You have taken a simple random sample and constructed a 95% confidence interval for a population mean μ. The probability the interval contains μ is

   A) 0.50

   B) 0.05

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

   D) 95%

16. During an angiogram, heart problems can be examined via a small tube threaded into the heart from a vein in the patient's leg. It is important that the company who manufactures the catheter maintain a diameter of 2.00 mm. A quality control specialist makes several measurements to test $H_0 : \mu = 2.00$ vs. $H_a : \mu \neq 2.00$. She computes a P-value of 0.01. Which interpretation below is correct?

   A) The probability $\mu = 2.00$ is 0.01.

   B) The probability $\mu \neq 2.00$ is 0.01.

   C) The probability the quality control specialist conducted the study properly is 0.99.

   D) The probability of the quality control specialist observing the results she did (or something more extreme) if $\mu = 2.00$ is 0.01.

In each of the following True/False questions (17-21) circle the best answer. Each True/False question is worth 2 points.

17. **TRUE**   **FALSE**
    Valid probabilities are always between 0 and 1, inclusive.

18. **TRUE**   **FALSE**
    An event and its complement are independent.

19. **TRUE**   **FALSE**
    Two events A and B are independent if the probability B occurs stays the same regardless of whether or not A occurs.

20. **TRUE**   **FALSE**
    The α-level should be determined prior to data collection.

21. **TRUE**   **FALSE**
    A small P-value is evidence the sample or experiment was properly designed.

    Show your work and fill in the blank: questions 22-25.

22. A coin is tossed 4 times and the number of tails is recorded. What is the sample space? (2pts)

23. The table below shows the probabilities of the political affiliation and position on the death penalty of American voters. Note that one value is missing.

	Death Penalty	
	Favor	Oppose
Republican	0.26	0.04
Democrat	0.12	0.24
Other	0.24	?

A) What is the missing value? (1pt)

B) What is the probability that a randomly chosen person is a Republican who opposes the death penalty? (2pts)

C) What is the probability that a randomly chosen person is a Republican? (2pts)

D) What is the probability a randomly chosen person is not a Republican? (1pts)

24. The figure below shows histograms of 4 sampling distributions of statistics intended to estimate the parameter of **50**. Label each distribution relative to the others as high or low bias and high or low variability. (8 pts)
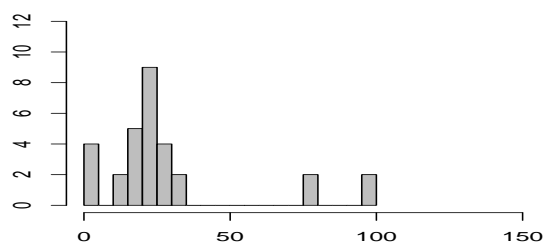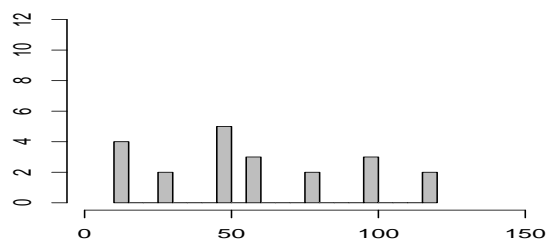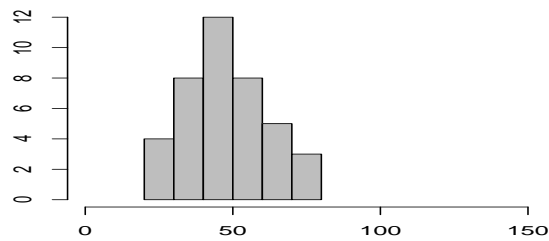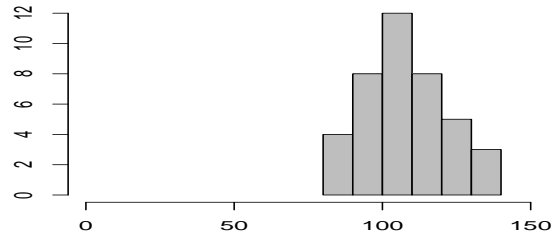
Histogram A _____ bias; _____ variability

Histogram B _____ bias; _____ variability

Histogram C _____ bias; _____ variability

Histogram D _____ bias; _____ variability

25. An agronomist examines the cellulose content of a variety of alfalfa hay. Suppose the cellulose content in the population has standard deviation $\sigma = 8$ milligrams per gram (mg/g). A previous study claimed that the mean cellulose content was $\mu = 140$ mg/g. The agronomist believes the mean is higher than that and will conduct a test of significance to see if there is evidence for his belief. A SRS of 15 cuttings has mean cellulose content $\bar{x} = 145$ mg/g. Show work on B and C to receive full credit.

A) State the appropriate null and alternative hypotheses. (2pts)

B) Compute the value of the test statistic. (2pts)

C) Find the P-value of the test. (2pts)

D) Assuming an α-level of 0.05 do you reject or fail to reject H_0? You must justify your answer for full credit. (2pts)

E) Draw a conclusion in terms of the problem. (2pts)