Question 1. The histogram of sample means from a large number of equally-sized random samples of size 50 will be shaped approximately like a:

(A) Normal (bell-shaped) curve.

(B) Triangle.

(C) Skewed histogram, with a long right tail.

(D) Semi-circle.

Question 2. A study of caffeine levels of farmers and doctors reported the following data:

	Farmers	Doctors
Sample Size	25	25
Sample Mean	13	10
Sample S.D.	4	3

The standard error of the difference between the two sample means is:

(A) $(\text{Sample Mean}_1 - \text{Sample Mean}_2)/\sqrt{\text{SD}_1 - \text{SD}_2} = (13 - 10)/\sqrt{4 - 3} = 3.0$

(B) $\sqrt{(\text{Sample Mean}_1)^2/\text{SD}_1 + (\text{Sample Mean}_2)^2/\text{SD}_2} = \sqrt{(\frac{13}{\sqrt{25}})^2 + (\frac{10}{\sqrt{25}})^2} = 3.28$

(C) $\sqrt{(\text{SEM}_1)^2 + (\text{SEM}_2)^2} = \sqrt{(\frac{4}{\sqrt{25}})^2 + (\frac{3}{\sqrt{25}})^2} = 1.0$

(D) The standard deviation of the data in the combined samples.

Question 3. A sudy of PSU students failed (p-value = .32) to find a difference in pulse rates between men and women. Which of the following is true?

(A) It is possible that they committed a Type 2 error

(B) The research hypothesis is supported

(C) It is possible that they committed a Type 1 error

(D) The null hypothesis is rejected

Question 4. In 1982, 490,000 subjects were asked about their drinking habits. Researchers tracked subjects' death rates until 1991, and found that adults who regularly had one alcoholic drink daily had a lower death rate than those who did not drink. Most of the subjects were middle-class, married, and college-educated. A news headline reporting the medical study as "Daily Drink Cuts Death!" is:

(A) Accurate; there is fundamentally solid anecdotal evidence that one drink daily increases life length and cuts death.

(B) Accurate; stratified random samples lead to randomized experiments, from which we cannot infer causation.

(C) Misleading; it implies that there is a causal connection between improved health and the habit of having one drink daily; however, causation cannot be deduced from an observational study.

(D) Misleading; we can never infer causation from randomized experiments.

Question 5. Suppose that 1%of the population has hepatitis. Suppose we have a test for the disease that has 80% sensitivity and 90% specificity. What is Pr(hepatitis given that the test is positive)?

(A) .14

(B) .075

(C) .80

(D) .01

Question 6. Which of the following is the correct completion of the following sentence? Removing an outlying point from a scatterplot ...

(A) ...can increase both the correlation coefficient and the slope of the regression line.

(B) ...can increase the correlation coefficient but not the slope of the regression line

(C) ...can increase the slope of the regression line but not the correlation coefficient.

(D) ...cannot increase either the correlation coefficient or the slope of the regression line.

Question 7. A simple random sample of 100 Penn State students were asked whether they have a tattoo, and 20% of them said yes. Based on this information, use the approximate Chapter 4 formula for margin of error—that is, $1/\sqrt{n}$—instead of the more exact formula found in Chapter 20 to create a 95% confidence interval for the true proportion of Penn State students who have tattoos.

(A) $20\% \pm 10\%$, or 10% to 30%.

(B) $10\% \pm 9.5\%$, or 0.5% to 19.5%.

(C) $95\% \pm 2\%$, or 93% to 97%.

(D) $20\% \pm 2\%$, or 18% to 22%.

(E) $95\% \pm 10\%$, or 85% to 105%.

Question 8. A sample of 28 temperature measurements in °F, all taken at 12:00 p.m., was collected in a coastal town in NC. A second sample of 28 temperature readings in a GA coastal town was also collected. Each GA measurement was recorded at the same time and date as the NC data value, and turned out to be exactly 5°F higher than the corresponding NC measurement. We calculate the standard deviation (S.D.) of the two data sets and conclude that:

(A) The two data sets have the same standard deviations.

(B) The S.D. of the NC data exceeds the S.D. of the GA data by 5°F.

(C) The S.D. of the GA data exceeds the S.D. of the NC data by 5°F.

(D) There is not enough information to determine the relationship between the two S.D.'s.

Question 9. The standard deviation of the histogram of a large number of sample means is, approximately:

(A) (population standard deviation)/$\sqrt{\text{sample size}}$.

(B) The true mean of the population.

(C) The area below the normal curve and between -2 and +2.

(D) The mean of a proportion of the population which is never sampled.

Question 10. As measured by the Stanford-Binet test, IQ scores are approximately normally distributed with mean 100 and standard deviation 16. A score of 108 on the Stanford-Binet test falls in the:

(A) 92nd percentile.

(B) 50th percentile.

(C) 69th percentile.

(D) 80th percentile.

Question 11. Suppose after viewing the results of a study you decide, on the basis of the reported p-value, to support the skeptic. Then

(A) You must have committed a Type 1 error

(B) It is impossible for you to have committed a Type 2 error

(C) It is impossible for you to have committed either a Type 1 or Type 2 error

(D) It is impossible for you to have committed a Type 1 error

Question 12. A *simple random sample* of ten subjects from a population is one in which:

(A) Any group of ten subjects has the same chance of being the selected sample.

(B) We record the data provided by the first ten subjects who respond to the survey.

(C) A simple way was found to choose ten subjects at random from the population.

(D) Most, but not all, groups of size ten have the same chance of being selected.

Question 13. If a *simple random sample* of 1,600 subjects is chosen then an approximate margin of error for making inferences about a percentage of the entire population is:

(A) Approximately zero because the sample size is so large.

(B) Very high, because the sample size is a tiny percentage of the population size.

(C) Impossible to calculate without knowing the percentage observed in the sample.

(D) $1/1,600$, or 0.06%.

(E) $1/\sqrt{1,600}$, or 2.5%.

Question 14. Suppose you hear a salesman on a television commercial say, "Would you pay sixty dollars for this product? We're now selling it for only \$19.99!" Which of the following is the salesman exploiting?

(A) The law of large numbers

(B) Anchoring

(C) The conjunction fallacy

(D) The law of small numbers

(E) Confusion of the inverse

Question 15. As measured by the Stanford-Binet test, IQ scores are approximately normally distributed with mean 100 and standard deviation 16. *Mensa* is an organization whose members have IQ scores in the top 2% of the population. To be admitted to Mensa, a person's Stanford-Binet IQ score is at least:

(A) $100 + (16 \times 0.98) = 115.68$.

(B) $100 - (16 \times 0.98) = 84.32$.

(C) $100 + (16 \times 2.05) = 132.80$.

(D) $100 - (16 \times 2.05) = 67.20$.

Question 16. Consider the scatterplot below.
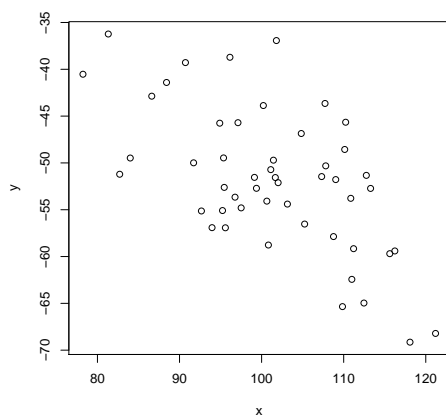
One of the numbers below is the correct correlation of the variables in the scatterplot. Which one is it?

(A) $-.61$

(B) -1

(C) 0

(D) 8

(E) $.52$

Question 17. All other things remaining constant, if the sample size increases by a factor of 25 then the standard error of the mean:

(A) Becomes five times as large.

(B) Becomes one twenty-fifth as large.

(C) Will remain unchanged.

(D) Becomes twenty-five times as large.

(E) Becomes one fifth as large.

Question 18. Given a sample mean of 103 and a standard error of the mean (SEM) of 1.5, what is the correct test statistic for the null hypothesis that the true population mean equals 100?

(A) $\frac{100-1.5}{103}$, or 0.956

(B) $\frac{103-1.5}{100}$, or 1.015

(C) $\frac{103-100}{1.5}$, or 2

(D) $\frac{100}{103-1.5}$, or 0.985

(E) $\frac{103}{100}$, or 1.03

Question 19. We want to test whether or not a particular coin is fair, where "fair" means that it comes up heads 50% of the time. We conduct an experiment in which we flip the coin 1000 times. Based on this experiment, we calculate a test statistic of 1.75. What is the p-value?

(A) 0.08

(B) 0.96

(C) 0.04

(D) 0.02

(E) 1.92

Question 20. Which of the following results in an increase in the power of a statistical test?

(A) lower p-value cutoff for rejecting the null hypothesis

(B) true population value closer to the null value

(C) larger sample size

Question 21. What does it mean to make sure that a statistical study is ecologically valid?

(A) Make sure that randomization is used in the selection of the sample.

(B) Make sure that the measurement environment is as realistic as possible.

(C) Make sure that a randomized experiment is conducted.

(D) Make sure that the study is single-blinded or double-blinded.

(E) Make sure that a placebo is part of the study.

Question 22. Suppose the probability that a child lives with his or her mother as the sole parent is .216, and the probability that a child lives with his or her father as sole parent is .031. Then the probability that a child either lives with both or with neither parent is:

(A) $1 - (.216 + .031) = .753$

(B) $1 - .031 = .969$

(C) $.216 + .031 = .247$

(D) $1 - .216 = .784$

(E) None of the above

Question 23. In a randomized experiment involving a drug intended to treat cancer, suppose that 200 cancer patients were divided into two groups of 100 each. The new drug was given to one group, while the control group receieved the traditional cancer treatment. Over the next five years, it was found that 25 of the patients receiving the experimental drug died, whereas 30 of those receiving the traditional treatment died. In this study, what are the odds of death for the control group?

(A) $\frac{30}{70}$

(B) $\frac{25}{75}$

(C) $\frac{25}{30}$

(D) $\frac{30}{100}$

(E) $\frac{25}{100}$

Question 24.
A study of caffeine levels of farmers and doctors reported the following data:

	Farmers	Doctors
Sample Size	25	25
Sample Mean	13	10
Sample S.D.	4	3

A 95% confidence interval for the difference in population mean caffeine levels (farmers' mean minus doctors' mean) is:

(A) $(13 - 10) \pm 1.64 \times$ (SE of the difference).

(B) $(4 - 3) \pm 2 \times$ (SE of the difference).

(C) $(13 - 10) \pm 2 \times$ (SE of the difference).

(D) $(4 - 3) \pm 2 \times$ (SE of the difference).

Question 25. Suppose you have to cross a train track on your commute. The probability that you will have to wait for a train is 1/5, or .20. If you don't have to wait, the commute takes 15 minutes, but if you have to wait, the commute takes 20 minutes. What is the expected value of the time it takes you to commute?

(A) $20 \times \frac{1}{5} + 15 \times \frac{4}{5}$, or 16 minutes

(B) $(20 + 15) \times \frac{1}{5}$, or 7 minutes

(C) $20 \times \frac{1}{5} + 15$, or 19 minutes

(D) $20 \times \frac{1}{5}$, or 4 minutes

(E) $\frac{15+20}{2}$, or 17.5 minutes

Question 26. All other things remaining constant, increasing the confidence coefficient causes the width of a confidence interval to:

(A) Remain unchanged.

(B) Increase for a while and then decrease.

(C) Decrease.

(D) Increase.

Question 27. If a particular dataset has a five-number summary given by 10, 20, 30, 40, 50, then the *interquartile range* is:

(A) $(10 + 20 + 30 + 40 + 50)/5 = 30$

(B) $40 - 20 = 20$

(C) $30 - 5 = 25$

(D) $50 - 10 = 40$

Question 28. Suppose you repeatedly toss a coin for which the probability of tossing heads is .3, or 30%. The probability that you do not toss heads on any of your first four tosses is:

(A) .7

(B) $.7 + .7 + .7 + .7 = 2.8$

(C) $1 - (.7)^4 = .76$

(D) $(.7)^4 = .24$

(E) None of the above

Question 29. As measured by the Stanford-Binet test, IQ scores are approximately normally distributed with mean 100 and standard deviation 16. A student who scores 108 on the Stanford-Binet test has a *standardized score* of:

(A) $(108 - 100)/16 = 0.50.$

(B) $(108 - 100)/\sqrt{100} = 0.80.$

(C) $(108 - 16)/100 = 0.92.$

(D) Cannot be calculated because we are given insufficient information.

Question 30. The reason that *randomized experiments* are different from *observational studies* is that *randomized experiments*

(A) require only small sample sizes.

(B) utilize a random sample from the population.

(C) allow the inference of causation.

(D) None of the above.

Question 31. For a sample of cities in the United States, suppose we measure the following two variables: $x =$ Total population and $y =$ Total number of houses. We would expect the correlation between x and y to be

(A) -1

(B) between -1 and 0

(C) 0

(D) between 0 and 1

(E) 1

Question 32. To test the effects of sleepiness on driving performance, twenty volunteers took a simulated driving test under each of three conditions: Well-rested, Sleepy, and Exhausted. The order in which each volunteer took the three tests was randomized, and an evaluator rated their driving accuracy without knowing the condition of the volunteer. This type of experiment is a:

(A) Retrospective observational study.

(B) Single-blind, block design experiment.

(C) Single-blind, matched-pair experiment.

(D) Double-blind, matched-pair experiment.

Question 33. When measured with extreme accuracy, the variable "height of a building" is:

(A) A discrete quantitative variable

(B) A nominal categorical variable

(C) A continuous quantitative variable

(D) An ordinal categorical variable

Question 34. The mean of a large number of sample proportions from equally-sized random samples will be approximately:

(A) The square root of: (true proportion) × (sample size)/(1 − true proportion).

(B) The area below the normal curve and between -1.96 and +1.96.

(C) The square root of: (true proportion) × (1 − true proportion)/(sample size).

(D) A proportion of the population which is never sampled.

(E) The true proportion of the population.

Question 35. A polling organization wishes to determine whether at least a majority of the voters in a particular city supports a proposed tax increase. They collect data from a representative sample of these voters, and the test statistic they calculate is 3.01. What is the p-value corresponding to this p-value?

(A) 0.9974

(B) 0.00065

(C) 0.9987

(D) 0.0013

(E) 0.0026

Question 36. In an example in the textbook, the correlation between wives' and husbands' heights, in millimeters, was 0.36. If heights are measured in inches then the correlation will:

(A) Increase, because 1 inch is longer than 1 millimeter.

(B) Become zero; for there is no correlation between the two variables.

(C) Be unchanged, because correlation does not depend on the units of measurement.

(D) Decrease, because 1 millimeter is shorter than 1 inch.

(E) None of the above.

Question 37. A sample of 28 temperature measurements in °F, all taken at 12:00 p.m., was collected in a coastal town in NC. The data are given in the following stemplot:

Stemplot of Temperature Readings

```
3   2
5   5
6   0 1 2 4 4 8
7   3 5 5 6 8 8 9 9
8   0 0 2 3 4 5 8
9   0 2 3 5 8
```

For the data given in this stemplot, the five-number summary is:

(A) 32, 66, 78, 84, 98

(B) 32, 66, 78.5, 84.5, 98

(C) 55, 66, 78.5, 84.5, 95

(D) 32, 68, 79, 88, 98

Question 38. A dataset contains yearly measurements since 1960 of the divorce rate (per 100,000 population) in the United States and the yearly number of people (per 100,000 population) sent to prison for drug offenses in the United States. We observe a strong correlation of .67. Each of the following statements is true EXCEPT

(A) Higher divorce rates are associated with higher rates of drug lockups.

(B) Higher divorce rates lead to higher rates of drug lockups.

(C) A positive correlation between divorce rates and drug lockups exists.

(D) Years with higher divorce rates have tended to be years with higher lockup rates.

Question 39. A radio advertiser wishes to choose a sample of size 100 from a population of 5000 listeners. He divides the population into five separate groups and then selects a simple random sample from each group. This method of sampling is called:

(A) Simple random sampling.

(B) Systematic random sampling.

(C) Stratified random sampling.

(D) Volunteer sampling.

Question 40. A *confidence interval* for a population proportion is a range of numbers which:

(A) Is certain to contain the population proportion.

(B) Has a 90% probability of containing the population proportion.

(C) Is a plausible range of values for the population proportion.

(D) Increases in width as the sample size increases.

Question 41. A researcher asks 1,600 randomly chosen doctors whether or not they take aspirin regularly. She also asks them to estimate the number of headaches they have had in the past six months, and compares the number of headaches reported by those who take aspirin regularly to the number of headaches reported by those who do not take aspirin regularly. In this study, the number of headaches is a:

(A) Response variable.

(B) Explanatory variable.

(C) Confounding variable.

(D) None of the above.

Question 42. In a study of PSU students' awareness of world issues, a television crew sampled students sitting in the Hub at 12:00 p.m. (noon). This survey is an example of:

(A) A haphazard (or convenience) sample, because the Hub is a convenient place to find students.

(B) A simple random sample, because it is simple to find students at the Hub in a random manner.

(C) A volunteer response sample because, to be seen on the evening news, students will eagerly volunteer their responses.

(D) A stratified random sample, because students are stratified by gender and they are found at the Hub in a random manner.

Question 43. A researcher asks 1,600 randomly chosen doctors whether or not they take aspirin regularly. She also asks them to estimate the number of headaches they have had in the past six months, and compares the number of headaches reported by those who take aspirin regularly to the number of headaches reported by those who do not take aspirin regularly. This type of study design is a:

(A) Retrospective observational study.

(B) Randomized experiment.

(C) Prospective study.

(D) Census.

Question 44.

	No Ticket	Ticket	Total
Female	52	25	77
Male	17	19	36
Total	69	44	113

The data show clearly that males received traffic tickets at a higher rate than females. From these census data we conclude that the events "Female" and "Ticket" are:

(A) Mutually exclusive

(B) Neither mutually exclusive nor independent

(C) Independent

(D) Both mutually exclusive and independent

Question 45. It has been observed that participants in a statistical experiment sometimes respond differently than they otherwise would because they know that they are in an experiment. This phenomenon is called the:

(A) Confounding effect.

(B) Placebo effect.

(C) Interacting effect.

(D) Hawthorne effect.

Question 46. We have discussed some of the work of Daniel Kahneman and Amos Tversky in class. What is the subject of this work?

(A) Pioneering work on linear regression, including a famous study of "regression to the mean"

(B) The largest clinical trial in U.S. history, used to determine that a vaccine for polio is effective

(C) The misuse of correlation coefficients, especially as they are often used to imply causation

(D) The psychology of statistics, including the representativeness heuristic

(E) An experiment at the Hawthorne electric company in Illinois suggesting that people perform differently than normal when they are being observed in an experiment.

Question 47. In a random sample of 400 PSU graduates, 64% stated that they prefer root beer (over birch beer). Therefore, a 90% confidence interval for the proportion of all PSU graduates who prefer root beer is:

(A) $0.64 \pm 1.64 \times \sqrt{.64 \times .36/400}$

(B) $0.64 \pm 1.64 \times \sqrt{.64/400}$

(C) $0.64 \pm 2 \times \sqrt{.64 \times .36/400}$

(D) $0.64 \pm 2 \times \sqrt{.64/400}$

Question 48. In a study of car ownership in Pennsylvania, the variable "Brand of car owned" is:

(A) A discrete quantitative variable

(B) A nominal categorical variable

(C) A continuous quantitative variable

(D) An ordinal categorical variable

Question 49. Suppose you make the following bet with a friend who is also in this section of STAT 100: If we have a quiz at the end of class on Friday, Nov. 1, then you will pay her \$3. On the other hand, if we do not have a quiz that day, then she will pay you \$3. What is the expected amount of money that you will win as a result of this bet? If you will lose money, your answer should be negative. (Hint: The calculations are easy. Also, the question of whether we have a quiz on Nov. 1 will be decided the same way it is decided at the end of every class.)

(A) \$0

(B) $-\$2$

(C) \$2

(D) $-\$1$

(E) \$1

Question 50. Consider the research hypothesis: Working at least 5 hours per day at a computer contributes to deterioration of eyesight. The null hypothesis is:

(A) working at least 5 hours per day contributes to the deterioration of eyesight

(B) working at least 5 hours per day does not affect your eyesight

(C) working at least 5 hours per day improves your eyesight

(D) cannot determine the null hypothesis

Question 51. In a randomized experiment involving a new vitamin supplement intended to reduce the chances of catching a cold, suppose that subjects were randomly divided into two groups of 100 each. Over the course of an entire winter, 13 of the subjects receiving the supplement got colds and 24 of those not receiving the supplement got colds. In this study, what is the risk for the treatment group?

(A) $\frac{24}{100}$

(B) $\frac{24}{76}$

(C) $\frac{13}{87}$

(D) $\frac{13}{24}$

(E) $\frac{13}{100}$

Question 52. For any data set, the *standard deviation* is:

(A) The average of the sample mean and quartiles.

(B) The average of the deviations.

(C) A measure of the spread or variability of the data.

(D) A measure of central tendency.

Question 53. A student claims that, for any data set of size two or more, the standard error of the mean (SEM) is smaller than the sample standard deviation. This claim is:

(A) Always true.

(B) Always false.

(C) Not always true; it depends on the actual numbers in the sample.

(D) Not always false; it depends on the sample size.

Question 54. Suppose that we asked a sample of Penn State students whether they watch more than 10 hours of television per week. In order to compare the percentage of women who said yes to the percentage of men who said yes, we ran a chi-squared analysis and obtained a chi-squared statistic of 4.37. What conclusion may be drawn from this statistic?

(A) There is a statistically significant difference between men and women on this question.

(B) There is a practically significant difference between men and women on this question.

(C) There is not a statistically significant difference between men and women on this question.

(D) There is no way to draw any conclusion about statistical or practical significance without seeing the actual data.

Question 55. In any large data set, the proportion of data falling at or below Q_3, the third quartile, is:

(A) 75%

(B) 25%

(C) 99.7%

(D) Dependent on the sample drawn from the population.

(E) 68%

Question 56. In a study to determine if putting newborn babies in an incubator contributed to claustrophobia in adult life, the researchers found a p-value of .023. This study supports:

(A) neither the skeptic nor the research advocate

(B) both the skeptic and the research advocate

(C) the skeptic

(D) the research advocate

Question 57. Suppose we find the following relationship between the calorie content of a fast food sandwich and its weight (in ounces) based on a sample of 15 sandwiches:

$$\text{calories} = 41 + (56 \times \text{weight})$$

We also find that the correlation between calories and weight is 0.92. What is the expected increase in the response variable for every increase of one in the explanatory variable?

(A) $\frac{1}{0.92}$ calories

(B) 0.92 calories

(C) 56 calories

(D) 41 calories

(E) $\frac{1}{56}$ calories

Question 58. In 1982, 490,000 subjects were asked about their drinking habits. Researchers tracked subjects' death rates until 1991, and found that adults who regularly had one alcoholic drink daily had a lower death rate than those who did not drink. Most of the subjects were middle-class, married, and college-educated. This experiment was:

(A) Based on a stratified random sample; subjects were stratified randomly into overlapping groups according to whether or not they had one drink daily.

(B) A randomized experiment; subjects were assigned in a randomized manner to have one alcoholic drink each day.

(C) An observational study; it would not be ethical for the researchers to randomly assign subjects to drink alcohol or not.

(D) Accurate; there is fundamentally solid anecdotal evidence that people's health will improve if they have one drink daily.

Question 59. A certain test for hepatitis has a sensitivity of 90%. What does this mean?

(A) 90% of individuals who do not have hepatitis will test negative.

(B) 90% of individuals who have hepatitis will test negative.

(C) 90% of individuals who do not have hepatitis will test positive.

(D) 90% of individuals who have hepatitis will test positive.

Question 60. Suppose that you work for an automobile insurance company. The company charges each of its policyholders a \$300 annual premium. To each policyholder who files a legitimate claim after an accident, the company pays a lump sum of \$2500. You know from past experience that 5% of your policyholders file legitimate claims each year. What is the insurance company's expected profit for each policyholder?

(A) \$2800 × 0.05 + \$300 × 0.95, or \$425

(B) \$300 × 0.95, or \$285

(C) −\$2500 × 0.05, or −\$125

(D) \$2500 × 0.05, or \$125

(E) −\$2200 × 0.05 + \$300 × 0.95, or \$175

Question 61.   In a study of caffeine levels of farmers and doctors, suppose that a 95% confidence interval for the difference in the means does *not* contain the value zero. We may infer that the population means of farmers' and doctors' caffeine levels:

(A) Are equal to each other; we are 95% confident that they are equal.

(B) Are significantly different from each other.

(C) Have no relationship to each other; we have insufficient evidence to make an inference about their relative location.

(D) Are close to each other; there is no significant difference between them.

Question 62.   To test the effects of sleepiness on driving performance, twenty volunteers took a simulated driving test under each of three conditions: Well-rested, Sleepy, and Exhausted. The order in which each volunteer took the three tests was randomized, and an evaluator rated their driving accuracy without knowing the condition of the volunteer. The explanatory variable is:

(A) The evaluator's rating of the driver's condition.

(B) The condition of sleepiness.

(C) The evaluator's rating of driving accuracy.

(D) The order in which the volunteers took the tests.

Question 63.   In a journal article describing a new rating of hangover severity, a Bonferroni correction is said to have been applied. What does this tell us about the article?

(A) The power of the hypothesis test is too low.

(B) The sample measurements have been reweighted to correct for a bias in the selection of the sample.

(C) The sample size is too small.

(D) More than one hypothesis test is carried out.

Question 64.   All other things remaining constant, if the population size quadruples from 10 million to 40 million then the width of a confidence interval will:

(A) Increase and then decrease.

(B) Increase by a factor of two.

(C) Remain unchanged.

(D) Decrease by half.

Question 65.   Suppose a door prize winner is selected at random from all the people attending an Italian electrical engineering conference. Your roommate believes that the winner is more likely to be a black-haired male than a male in general. Your roommate has committed

(A) no fallacy at all; it is well-known that men with black hair have more fun.

(B) the anchoring fallacy.

**(C)** the gambler's fallacy.

(D) the conjunction fallacy.

Question 66. In a study of the relationship between handspan (in centemeters) and height (in inches) it was found that the correlation is about .80 and the regression equation is

$$\text{handspan} = -3 + 0.35 \text{ height}$$

What is the predicted handspan for someone 5 feet tall?

(A) 3 centimeters

(B) 60 centimeters

(C) 18 centimeters

(D) 22.2 centimeters

Question 67.

Histogram of CD ownership, Stat 100.2 S04
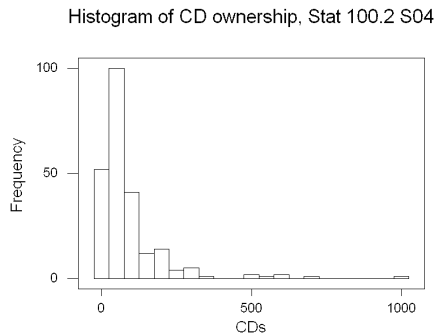
Which of the following is true about the sample depicted in the histogram above?

(A) The mean is larger than the median.

(B) The mean is smaller than the median.

(C) The mean is equal to the median.

(D) It is impossible to tell from this histogram alone whether the mean is larger than, smaller than, or equal to the median.

Question 68. A random sample of students was asked the following question: "Are your parents divorced or separated?" The data are given below.

	Div/sep?		
	No	Yes	All
Female	99	34	133
Male	77	24	101
All	176	58	234

What is the expected count (assuming the skeptic is correct) corresponding to the 99 in the upper left?

(A) 99

(B) $\frac{176 \times 133}{234}$, or 100.03

(C) $\frac{99}{234}$, or .42

(D) $\frac{77 \times 34}{234}$, or 11.19

(E) $\frac{99}{133}$, or .74

Question 69. A statistical study considers the question of whether the presence of plants in an office might lead to fewer sick days. In this study, the null hypothesis is:

(A) The presence of sick people in an office leads to fewer plants.

(B) The presence of plants in an office does not lead to fewer sick days.

(C) Insufficient information is given to allow us to determine the null hypothesis.

(D) The presence of plants in an office leads to fewer sick days.

Question 70. A researcher repeatedly collects random samples of size 1,600 and computes a 95% confidence interval for the population mean using each sample. Over the long run, the proportion of confidence intervals which will fail to capture the population mean is:

(A) 95%

(B) 5%

(C) $1/\sqrt{1,600}$, or 1/40, 2.5%

(D) None of the above.

Question 71. In a randomized experiment involving a drug intended to treat cancer, suppose that 200 cancer patients were divided into two groups of 100 each. The new drug was given to one group, while the control group receieved the traditional cancer treatment. Over the next five years, it was found that 25 of the patients receiving the experimental drug died, whereas 30 of those receiving the traditional treatment died. In this sample, what is the conditional probability of death, given that one receives the new experimental drug?

(A) $\frac{25}{100}$

(B) $\frac{30}{70}$

(C) $\frac{25}{30}$

(D) $\frac{25}{75}$

(E) $\frac{30}{100}$

Question 72. As measured by the Stanford-Binet test, IQ scores are approximately normally distributed with mean 100 and standard deviation 16. Because of the Empirical Rule (68-95-99.7 Rule), we can conclude that approximately 68% of all IQ scores will fall between:

(A) 32 and 168.

(B) 0 and 200.

(C) 68 and 132.

(D) 84 and 116.

Question 73. Suppose that in a particular sample, we find that 80% of female college students use cell phones while 75% of male college students use cell phones. Which of the following is true?

(A) This difference between males and females is less likely to be statistically significant if the sample is larger.

(B) This difference between males and females is more likely to be practically significant if the sample is larger.

(C) This difference between males and females is more likely to be statistically significant if the sample is larger.

(D) This difference between males and females is less likely to be practically significant if the sample is larger.

Question 74. An experiment was conducted to see if adding Quaker State motor oil to Coppertone suntan lotion enhances tanning. A Type 1 error is to

(A) claim QS does not enhance tanning

(B) claim QS enhances tanning

(C) claim QS does not enhance tanning when it does

(D) claim QS enhances tanning when it does not

Question 75. All other things remaining constant, if the sample size decreases then the standard error of the sample mean (SEM)

(A) increases, levels off, and then increases again.

(B) will remain unchanged.

(C) increases.

(D) decreases and then increases.

(E) decreases.

Question 76. Why would we use a Bonferroni correction when running multiple tests?

(A) The Bonferroni procedure attempts to correct for the presence of potentially confounding variables so that causation is more likely in the event that we reject the null hypothesis.

(B) Whenever multiple p-values are calculated, we must correct for the problem of high correlation among these p-values.

(C) Rare events are more likely to occur in repeated tests, so we must adjust the p-value cutoff for rejecting the null hypothesis.

(D) It is not possible to compare multiple p-values with each other unless we use a correction such as the Bonferroni correction.

Question 77. Suppose that 1% of the population has hepatitis. Suppose we have a test for the disease that has 80% sensitivity and 90% specificity. What is the probability of a false negative for someone with the disease?

(A) .99

(B) .20

(C) .10

(D) .01

Question 78. A confidence interval for a population mean is given as "Sample mean $\pm$ 2.33$\times$SEM." The corresponding level of confidence is:

(A) 98%

(B) 95%

(C) 64%

(D) 99%

Question 79. The mean of a large number of sample means from equally-sized random samples will be approximately:

(A) The mean of a proportion of the population which is never sampled.

(B) (population standard deviation)/$\sqrt{\text{sample size}}$.

(C) The true mean of the population.

(D) The area below the normal curve and between -1.96 and +1.96.

Question 80. A p-value is a probability that is computed under what assumption?

(A) The alternative hypothesis is true

(B) The null hypothesis is true

(C) A type 1 error has been committed

(D) A type 2 error has been committed

Question 81. To obtain a margin of error of 1% we need a sample of size:

(A) 100

(B) 1,000

(C) 10,000

(D) 100,000

Question 82. It has been observed that participants in a statistical experiment sometimes respond positively to a placebo, a substance which has no active ingredients. This phenomenon is called the:

(A) Confounding effect.

(B) Hawthorne effect.

(C) Placebo effect.

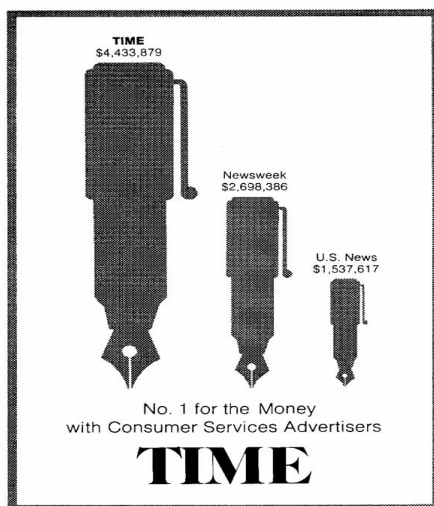**(D)** Interacting effect.

Question 83.

Figure 6. An attractive but misleading bar graph. [Copyright © 1971 by

What is the biggest flaw of the graph above?

(A) The sizes of the pens are misleading because there is no pen representing zero dollars for the sake of comparison.

(B) The pens are correctly scaled according to *area*, but the resulting *heights* make the differences look much larger than they really are.

(C) The pens are correctly scaled according to *height*, but the resulting *areas* make the differences look much larger than they really are.

(D) The use of pens is distracting and hides the informational content of the graph.

Question 84. To investigate whether spinning a coin on a table results in a different probability of heads than 0.50, we conduct an experiment in which we spin a coin 250 times and record the number of times it comes to rest heads-side-up. We observe 100 heads, which gives a proportion of 100/250, or 0.40. Which of the following is the correct test statistic?

(A) $\dfrac{-0.10}{\sqrt{\frac{0.50 \times 0.50}{250}}}$, or -3.16

(B) $\dfrac{-0.10}{\sqrt{0.50^2 + 0.40^2}}$, or -0.16

(C) $\dfrac{-0.10}{\sqrt{\frac{0.5^2}{250} + \frac{0.4^2}{250}}}$, or -2.47

(D) $\dfrac{-0.10}{(0.4/\sqrt{250})}$, or -3.95

(E) $\dfrac{-0.10}{\sqrt{\frac{0.40 \times 0.60}{250}}}$, or -3.23

Question 85. In a study of farmers' caffeine levels, a random sample of 25 farmers yielded a sample mean of 22 and a sample standard deviation (S.D.) of 4. Therefore, the standard error of the mean (SEM) is:

(A) $22/\sqrt{25}$

(B) $4/\sqrt{25}$

(C) $4 \times \sqrt{25}$

(D) $22 \times \sqrt{25}$

Question 86. A fair die if rolled repeatedly until the first six appears. What is the probability that the first six appears on the fourth roll?

(A) $\frac{5}{6} \times \frac{5}{6} \times \frac{5}{6} \times \frac{1}{6} = .0965$

(B) $\frac{4}{6} = .6667$

(C) $(\frac{5}{6})^6 = .3349$

(D) $3 \times \frac{5}{6} \times \frac{1}{6} = .4167$

Question 87. A random sample of 25 farmers was examined in a study of caffeine levels. From the data collected, a 95% confidence interval for the population mean caffeine level was calculated to be 21.5 to 23.0. We can conclude that:

(A) None of the above.

(B) If we repeatedly sample the entire population then, about 95% of the time, the population mean will fall between 21.5 and 23.0.

(C) 95% of all farmers have caffeine levels between 21.5 and 23.0.

(D) For any random sample of 25 farmers, the resulting sample mean will always fall between 21.5 and 23.0.

(E) If we repeatedly collect random samples of size 25 and calculate the corresponding confidence intervals then, over the long run, 95% of these intervals will capture the population mean and 5% will fail to capture the population mean.

Question 88. All other things remaining constant, if the sample size increases by a factor of nine then the confidence interval for the population mean will:

(A) Become nine times as wide.

(B) Triple in width.

(C) Become one-ninth as wide.

(D) Become one-third as wide.

Question 89. To calculate a 99% confidence interval for a population proportion, we use:

(A) Sample proportion $\pm$ 2.33× S.D.

(B) Sample proportion $\pm$ 2.576× S.D.

(C) Sample proportion $\pm$ 2× S.D.

(D) Sample proportion $\pm$ 1.64× S.D.

Question 90. A random sample of students was asked the following question: "Do you have a tattoo?" The data are given below.

	Tattoo? No	Yes	All
Female	210	62	272
Male	170	30	200
All	380	92	472

Chi-Sq = 0.368 + 1.522 +
         0.502 + 2.070 = 4.462

Based on these data, is this a <u>practically</u> significant result?

(A) Because the chi-squared statistic is greater than 3.84, the result is not practically significant.

(B) Because the chi-squared statistic is greater than 3.84, the result is practically significant.

(C) This chi-squared statistic gives us no information about practical significance.

Question 91. In a particular coastal city in the Northeast, is has been shown that when the monthly number of ice cream cones sold increases, the number of drowning deaths also increases. However, this is not a causal relationship, and it turns out that both ice cream cone sales and drowning deaths are related to the outside temperature: The warmer months bring many more people to the beach and also encourage people to buy ice cream.

In this example, temperature is called

(A) a Hawthorne effect.

(B) a discrete variable.

(C) a standardized score.

(D) a placebo.

(E) a confounding variable.

Question 92. The standard deviation of the histogram of a large number of sample proportions is, approximately:

(A) The square root of: (true proportion) × (sample size)/(1 − true proportion).

(B) The square root of: (true proportion) × (1 − true proportion)/(sample size).

(C) A proportion of the population which is never sampled.

(D) The area below the normal curve and between -1.96 and +1.96.

(E) The true proportion of the population.

Question 93. It is *known* that in the presidential elections of 1992, 56% of all eligible adults actually voted. If we collect a large number of simple random samples each of size 1,600 adults then, about 95% of the time, the sample proportion of adults who voted will fall between:

(A) $.56 \pm 2 \times \sqrt{.56(1 - .56)/1600}$, or 0.536 and 0.584.

(B) $.56 \pm 3 \times \sqrt{.56(1 - .56)/1600}$, or 0.524 and 0.596.

(C) $.56 \pm 1 \times \sqrt{.56(1 - .56)/1600}$, or 0.548 and 0.572.

(D) $.56 \pm 4 \times \sqrt{.56(1 - .56)/1600}$, or 0.512 and 0.608.

Question 94. The variables x (temperature in °C) and y (temperature in °F) are related by the formula $y = 32 + 1.8x$. Therefore the correlation between x and y will be:

(A) 1.8, because if x increases by 1°C then y increases by 1.8°F.

(B) 0, because if $x = 0$ then $y = 32$.

(C) -1, because if x decreases then y decreases.

(D) 1, because the variables have a deterministic, linear, increasing relationship.

(E) 32, because if $y = 32$ then $x = 0$.

Question 95. Suppose an observational study finds that people who use public transportation to get to work have weaker knowledge of current affairs overall than those who drive to work, but that this relationship is reversed for well-educated people. Which of the following variables is an interacting variable in this context?

(A) Level of education

(B) Knowledge of current affairs

(C) Use of public transportation

(D) Distance from home to work

Question 96. In a hypothetical sample of 14 different sandwiches from a popular fast-food restaurant in which we measure both the number of calories and the weight (in ounces) for each sandwich, it is found that the correlation is 0.83 and the regression equation is

$$\text{calories} = -10 + 60 \times \text{weight}$$

What is the predicted calorie content for a sandwich that weighs 8 ounces?

(A) $-10 + 60 \times 8$, or 470 calories

(B) $60 \times 8 \times .83$, or 398.4 calories

(C) 8 calories

(D) $.83 \times (-10 + 60)$, or 41.5 calories

**(E)** $60 + .83$, or 60.83 calories

Question 97.
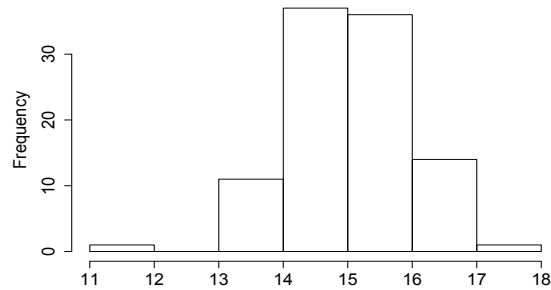
Choose the best estimate for the standard deviation of the sample depicted in the histogram above:

(A) 7

(B) 15

(C) 1

(D) 5

(E) 0.25

Question 98. We wish to use data from our STAT 100 class to try to learn whether Penn State students who have used marijuana have a lower mean grade point average (GPA) than those who have not used marijuana. Which of the following statements is correct?

(A) The alternative hypothesis is two-sided.

(B) The null hypothesis is two-sided.

(C) The null hypothesis is one-sided.

(D) The alternative hypothesis is one-sided.

Question 99.
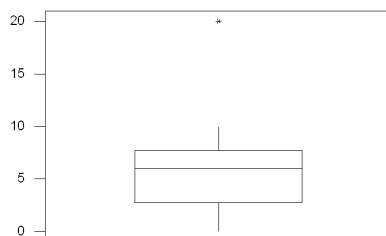
Refer to the boxplot above. Which of the following values is found in the sample and is considered an outlier?

(A) 20

(B) 10

(C) 6

(D) 3

(E) 0

Question 100. What is the interquartile range (IQR) of the sample depicted in the previous problem?

(A) 20 minus 0, or 20

(B) 20 minus 6, or 14

(C) 8 minus 3, or 5

(D) 10 minus 0, or 10

(E) 6 minus 6, or 0

Hypothetical research question, asked of a random sample of students: Do you own a pet? (Data and related output below.)

```
    Rows:  Gender        Columns:  Pet

            no      yes      All
   Female   26      50        76
   Male     17      18        35
   All      43      68       111

  Chi-sq = 0.40 +  0.25 +
           0.87 +  xxxx = 2.08
```

Question 101. In the debate between the research advocate and the skeptic, who wins in this case involving the pet question above?

(A) Neither

(B) Skeptic

(C) Both

(D) Research advocate

Question 102. In the table above about the pet data, the expected number corresponding to 18 is about:

(A) 17

(B) 68

(C) 111

(D) 21

(E) 14

Question 103. If all the counts in the table above about the pet data were multipled by 10, the chi-squared value would

(A) change to .208

(B) change to 20.8

(C) change to 208

(D) stay the same

Question 104. The following table presents experts' and students' rankings of the risks of eight activities. (Hint: Sketch the scatterplot of these rankings with the experts' rankings on the horizontal axis.)

The Eight Greatest Risks

Activity or Technology	Experts' Rank (x)	Students' Rank (y)
Motor Vehicles	1	5
Smoking	2	3
Alcoholic Beverages	3	7
Handguns	4	4
Surgery	5	11
Motorcycles	6	6
X-rays	7	17
Pesticides	8	2

If "Pesticides" were deleted from the data above, then we would expect that:

(A) The correlation will increase and the slope will decrease.

(B) The correlation and the slope of the regression line both will remain unchanged.

(C) The correlation and the slope of the regression line both will increase.

(D) The correlation and the slope of the regression line both will decrease.

(E) None of the above.

Question 105. The technology "Nuclear Power" was ranked 1 by the students and 20 by the experts. If "Nuclear Power" were to be added to the list in the previous question, we would expect that:

(A) The correlation and the slope of the regression line both will remain unchanged.

(B) The correlation and the slope of the regression line both will decrease.

(C) The correlation will increase and the slope will decrease.

(D) The correlation and the slope of the regression line both will increase.

(E) None of the above.