# EXAM QUESTIONS

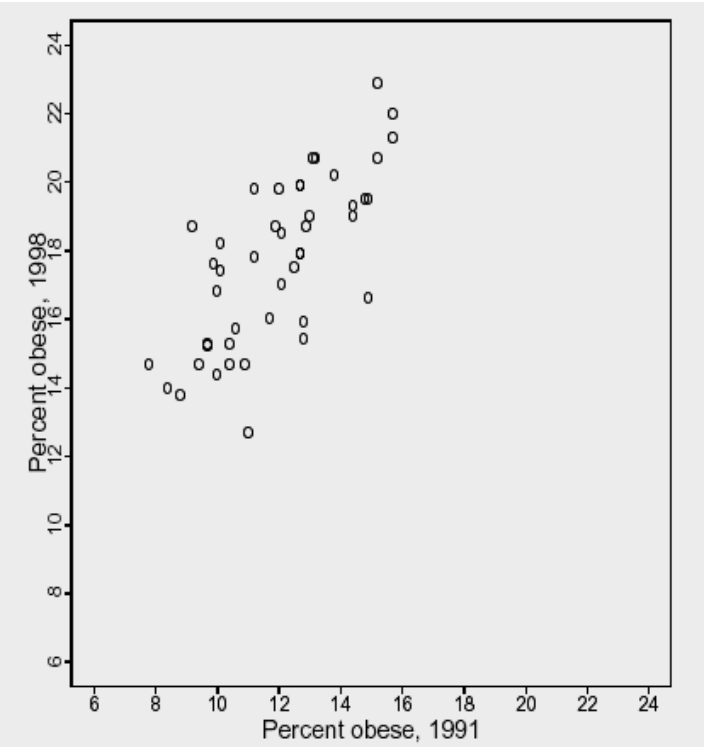
The *Journal of the American Medical Association* recently published an article titled "The Spread of the Obesity Epidemic in the United States." Here is a plot of the percent of adults who are obese in each of the 45 states that participated in a large study. The data are in percents and tenths of a percent. For example, 19.5% of Indiana adults are obese.
**The next eight questions** concern this study of obesity.

| | |
|---|---|
| 12 | 7 |
| 13 | 8 |
| 14 | 047777 |
| 15 | 233479 |
| 16 | 068 |
| 17 | 0456899 |
| 18 | 25777 |
| 19 | 003558899 |
| 20 | 2777 |
| 21 | 3 |
| 22 | 09 |

1. This type of graph is called a
(a) boxplot
(b) histogram
(c) line graph
(d) scatterplot
(e) stemplot

2. The median percent of obese adults in these 45 states is:
(a) 17.69% (b) 17.8% (c) 17.85% (d) 17.9% (e) 23%

Here is a graph of the percent of adults in each state who were obese in 1991 and the percent who were obese in 1998:




3. This type of graph is called a
(a) boxplot
(b) histogram
(c) line graph
(d) scatterplot
(e) stemplot

4. Which of these is a reasonable value of the correlation $r$ for the data in this graph?
(a) $r = 0$ (b) $r = 0.3$ (c) $r = 0.7$
(d) $r = 0.95$ (e) $r = 1$

5. Arizona had the lowest percent obese in 1998, 12.7%. About what percent of Arizona adults were obese in 1991?
(a) 7.8% (b) 9.0% (c) 11.0%
(d) 12.7% (e) 14.7%

6. The least-squares regression line for predicting 1998 percent obese from 1991 percent obese is $y = 7.4 + 0.86x$. In 1991, 14.8% of Indiana adults were obese. Based on this information, what percent would you predict to be obese in 1998?
(a) 5.3% (b) 7.5% (c) 12.7% (d) 19.5% (e) 20.1%

7. The 11 states in the Midwest have these percents of obese adults:
19.5 19.5 17.9 20.7 17.9 15.7 19.3 19.8 18.7 15.4 17.5
The mean and standard deviation of these values are about:
(a) 18.35 and 18.7
(b) 18.35 and 19.5
(c) 18.7 and 1.68
(d) 18.35 and 1.68
(e) 18.35 and 2.00

8. Indiana has 19.5% obese adults. Where does Indiana stand in the distribution for the 11 Midwest states?
(a) Below the median.
(b) Exactly at the median.
(c) Above the median but below the third quartile
(d) Exactly at the third quartile.
(e) Above the third quartile.

9. A table of random numbers is used to select 25 students from a large class to rate a CD by the group Wilco. The ratings that these students give are used to estimate the ratings that would be given if the entire class were asked to rate the CD. The average of the ratings of the 25 students in the sample is
(a) a convenience sample
(b) a census
(c) an unbiased estimate of the class rating
(d) a biased estimate of the class rating
(e) the population

10. You read that drinking moderate amounts of alcohol may reduce the risk of heart disease. To be convinced this is true, you would like to have data from
(a) a random sample of people with heart disease that asked about their drinking habits.
(b) a random sample of people with different drinking habits, followed for several years to compare their future heart disease.
(c) a comparison of heart disease rates in countries where people drink lots of wine with countries where people drink little.
(d) a randomized comparative experiment in which some people drink moderately and others do not drink at all.
(e) methods (b), (c), and (d) are equally effective.

11. When a sample survey asks people about use of illegal drugs, some people who use drugs will deny that they do because they fear that the information will be given to the police or employers.
(a) This is a sampling error that causes bias.
(b) This is a sampling error that increases variability.
(c) This is a nonsampling error that causes bias.
(d) This is a nonsampling error that increases variability.
(e) This is a nonsampling error that increases both bias and variability.

12. You take an SRS of size 100 from the 48,300 students at Ohio State University. You then take an SRS of size 100 from the 8,500,000 adults in the state of Ohio. The margin of error in a 95% confidence statement for the Ohio State student sample is
(a) the same as for the sample of Ohio adults because both are samples of size 100.
(b) smaller than for the sample of Ohio adults because the population is much larger.
(c) larger than for the sample of Ohio adults because the population is much larger.
(d) either larger or smaller than for the sample of Ohio adults because it changes at random when we take a sample.
(e) either larger or smaller than for the sample of Ohio adults, depending on what confounding variables are present.

A 2008 Gallup Poll asked 1010 randomly chosen adults to rate the "honesty and ethical standards" of 21 occupations. Nurses were at the top, with 84% of the poll respondents rating them "very high" or "high." Lobbyists were at the bottom with just 5% "very high" or "high" ratings. **The next two questions** concern this poll.

14. The population for this poll is
(a) all adults.
(b) the 1010 respondents.
(c) people in 21 occupations.
(d) nurses and lobbyists.
(e) honesty and ethical standards.

15. The numbers 84% and 5% in the report on the poll results are
(a) parameters because they describe a population.
(b) parameters because they describe a sample.
(c) statistics because they describe a population.
(d) statistics because they describe a sample.
(e) neither statistics nor parameters.

16. When we take a census, we collect data from
(a) a stratified random sample
(b) every individual selected in a simple random sample
(c) every individual in the population
(d) a voluntary response sample
(e) a convenience sample

17. Which of the following is correct
(a) parameters describe sample characteristics
(b) parameters describe population characteristics
(c) the population is a subset of the sample
(d) statistics must be based on a simple random sample
(e) parameter and statistic are two names for the same thing

18. Divide undergraduate students at State Tech into two groups: those who live in university housing and those who do not. Take a random sample from each group. This is an example of
(a) multistage sampling
(b) stratified random sampling
(c) clustered sampling
(d) simple random sampling
(e) systematic random sampling

19. The correlation between two variables $x$ and $y$ is -0.6. If we used a regression line to predict $y$ using $x$, what percent of the variation in $y$ would be explained?
(a) 20% (b) 36% (c) -36% (d) 60% (e) -60%

20. For a 95% confidence interval, a larger sample size will generally give
(a) a least-squares line
(b) a larger margin of error
(c) less bias
(d) higher correlation
(e) a smaller margin of error

21. Fifty percent of the observations will be at or above the
(a) maximum
(b) standard deviation
(c) mean
(d) median
(e) first quartile

23. Which correlation indicates a strong negative straight line relationship?
(a) 0.5 (b) -1.5 (c) -0.5 (d) -0.9 (e) 0.9

A college football team wins 8 games and loses 3 during its season. The margins of victory in the 8 wins are (in points scored):

11 14 12 16 25 45 1 49

**The next three questions** are based on these data.

25. What were the mean and median margins of victory in these eight games?
(a) mean = 20.5, median = 21.6
(b) mean = 21.6, median = 20.5
(c) mean = 15, median = 21.6
(d) mean = 21.6, median = 15
(e) Can't tell without knowing the results of the three losses.

26. The relationship between the mean and median margin of victory is typical of distributions which, like this one, are
(a) nearly symmetric.
(b) skewed to the left.
(c) skewed to the right.
(d) all positive.
(e) football-shaped.

27. Suppose the "margins of victory" in the team's three losses were also reported, as negative numbers; for example, the "margin of victory" in a 42 to 17 was -25. What effect would including these three negative numbers, in addition to the eight positive numbers, have on the mean and median?
(a) Both the mean and the median would be smaller.
(b) The mean would be smaller, but the median would stay the same.
(c) The median would be smaller, but the mean would stay the same.
(d) Both the mean and the median would stay the same.
(e) Can't tell without knowing the results of all three losses.

28. A high correlation between two variables does not always mean that changes in one cause changes in the other. The best way to get good evidence that cause-and-effect is present is to
(a) arrange the data in a two-way table.
(b) carry out a randomized comparative experiment.
(c) make a histogram and look for outliers.
(d) make a scatterplot and look for a strong association.
(e) select a simple random sample from the population of interest.

Here are the attendance figures for the lectures in a large class. **The next three questions** are based on these data.

| Date | Attendance | Date | Attendance |
|---|---|---|---|
| 08/26 | 398 | 10/16 | 306 |
| 08/28 | 389 | 10/21 | 303 |
| 09/02 | 359 | 10/24 | 285 |
| 09/04 | 373 | 10/28 | 290 |
| 09/09 | 370 | 10/31 | 298 |
| 09/11 | 351 | 11/04 | 278 |
| 09/16 | 341 | 11/11 | 275 |
| 09/18 | 317 | 11/13 | 270 |
| 09/23 | 321 | 11/18 | 269 |
| 09/30 | 318 | 11/21 | 255 |
| 10/02 | 309 | 11/25 | 211 |
| 10/07 | 317 | 12/02 | 262 |
| 10/09 | 265 | 12/04 | 259 |

29. To show the evolution of attendance during the semester, what type of graph should you draw?
(a) boxplot
(b) histogram
(c) line graph
(d) scatterplot
(e) stemplot

30. 74% of the 398 students who attended the August 26 lecture said they knew how to "go to a computer lab and get on the World Wide Web." If these 398 were a simple random sample drawn from the entire student population, what would a 95% confidence interval be for the percent of all students who could do likewise?
(a) 74% ± 0.05%
(b) 74% ± 2%
(c) 74% ± 3%
(d) 74% ± 4%
(e) 74% ± 0.04%

31. In which of these cases would the confidence interval be wider than the one in the previous question?
(a) If the confidence level were 90% instead of 95%.
(b) If the sample size were 498 instead of 398.
(c) If the entire student population were larger.
(d) Both (a) and (b).
(e) None of the above.

A news report says, "New research suggests that an active social life may increase resistance to respiratory infections. In a recent study, 300 healthy volunteers were given nasal sprays of cold virus, then quarantined for five days. The volunteers were asked about relationships with spouse, children, friends, neighbors, and coworkers. Those who had only one to three types of relationships were four times as likely to get a cold as those with six or more types. The most significant factor for resisting the cold virus seemed to be the diversity rather than the sheer quantity of social contacts." **The next two questions** concern this report.

32. How would you categorize this study?
(a) An experiment with the nasal spray as the treatment.
(b) An observational study with the various possible "social networks" as the treatments.
(c) An experiment with the various possible "social networks" as the treatments.
(d) A randomized, controlled clinical trial.
(e) A voluntary response study.

33. Why do these results fall short of demonstrating that by broadening our social networks we can increase our resistance to respiratory infections? (Pick the best answer.)
(a) Volunteers were used.
(b) We're not told the age of the volunteers.
(c) We're not told what day of the week they got the nasal spray.
(d) Maybe the subjects lied about their relationships.
(e) Some other variables, associated with the breadth of one's social network, may be the real causes of higher resistance to colds.

34. According to the FBI Uniform Crime Report, the robbery rate in the United States is 202 per 100,000 people. At that rate, how many robberies would there be in a state the size of Indiana (5.8 million people)?
(a) about 1,200
(b) about 12,000
(c) about 120,000

(d) about 1,200,000
(e) impossible to say

35. The difference between an experiment and an observational study is
(a) Observational studies don't have explanatory and response variables.
(b) Experiments don't have placebos.
(c) An experiment imposes treatments on subjects, while an observational study measures variables of interest without attempting to influence responses.
(d) Experiments are double-blind, while observational studies are only single-blind.
(e) All of the above.

37. A magazine article on preventing cancer says, "Eating one serving of tofu a week may cut your risk of breast cancer 15 percent, recent research suggests." If the data comes from an observational study, then
(a) the results must be false.
(b) the results must be true.
(c) there may be lurking variables.
(d) perhaps those who chose to eat more tofu are, for some reason, less susceptible to breast cancer than those who didn't.
(e) Both (c) and (d) are true.

**The next three questions** concern a baseball team that had the following record for the season:

| | Home Games | Away Games |
|---|---|---|
| Won | 45 | 25 |
| Lost | 35 | 55 |

38. What percent of their games did the team win for the season?
(a) 28.125% (b) 31.25% (c) 43.75% (d) 56.25% (e) 64.29%

39. What percent of their home games did the team win?
(a) 28.125% (b) 31.25% (c) 43.75% (d) 56.25% (e) 64.29%

40. The two previous questions lead to this conclusion about the relationship between where the team played and how well it did:
(a) The team is more likely to win when it plays at home.
(b) The team is less likely to win when it plays at home.
(c) There is a positive association between where the team played and whether it won or lost.
(d) Both (a) and (c).
(e) Both (b) and (c).

42. You are planning an experiment to determine the effect of the brand of gasoline and the weight of a car on gas mileage measured in miles per gallon. You will use a single test car, adding weights so that its total weight is 3000, 3500, or 4000 pounds. The car will drive on a test track at each weight using each of Amoco, Marathon, and Speedway gasoline. The response variable in your experiment is
(a) the weight of the car.
(b) the brand of gasoline.
(c) Both (a) and (b) are response variables.
(d) gas mileage in miles per gallon.
(e) random.

44. In the gas mileage experiment of the previous two questions,
(a) gasoline brand is a categorical variable and weight is a quantitative variable.
(b) gasoline brand and weight are both categorical variables.
(c) gasoline brand and weight are both quantitative variables.
(d) gasoline brand is a quantitative variable and weight is a categorical variable.
(e) gasoline brand and car model are categorical variables and weight is a quantitative variable.

45. A sample of credit card holders charged, on the average, about 300 more this year, without an annual fee, than they did last year with one. Unfortunately we don't know whether the increase is due to not having an annual fee or to better economic conditions this year than last. This is an example of
(a) bias due to involuntary response.
(b) measurement error.
(c) the placebo effect.
(d) sampling error.
(e) confounding.

48. Scores on the Scholastic Assessment Test are reported on a scale that yields a normal distribution with mean 500 and standard deviation 100. The percent of scores above 500 on the SAT is
(a) 99.7% (b) 95% (c) 68% (d) 50% (e) 34%

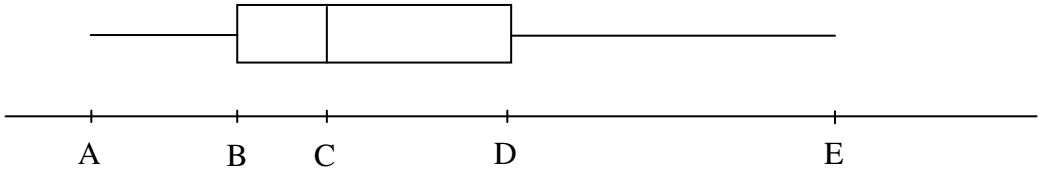
49. Scores on the Scholastic Assessment Test are reported on a scale that yields a normal distribution with mean 500 and standard deviation 100. Julie scores 600 on the SAT. Her standard score is
(a) $z = -1$ (b) $z = 0$ (c) $z = 1$ (d) $z = 6$ (e) $z = 100$

50. In any normal distribution, the percent of observations falling between standard score $z = 0$ and standard score $z = 2$ is about
(a) 95% (b) 81.5% (c) 61% (d) 50% (e) 47.5%

51. George has an average bowling score of 180 and bowls in a league where the average for all bowlers is 150 and the standard deviation is 20. Bill has an average bowling score of 190 and bowls in a league where the average is 160 and the standard deviation is 15. Who ranks higher in his own league, George or Bill ?
(a) Bill, because his 190 is higher than George's 180.
(b) Bill, because his standard score is higher than George's.
(c) George, because his standard score is higher than Bill's.
(d) Bill and George have the same rank in their leagues, because they are both 30 pins above the mean.
(e) Bill and George have the same rank in their leagues, because their standard scores are equal.

52. Scores of adults on the Wechsler Adult Intelligence Scale (a common "IQ" test) follow a normal distribution. The middle 95% of scores on this test range from 70 to 130. What is the standard deviation of the test scores?
(a) 30 points (b) 15 points (c) 10 points (d) 7.5 points (e) 5 points

53. A set of measurements has this boxplot:




Which point on this boxplot is the first quartile of the distribution?
(a) A (b) B (c) C (d) D (e) E

A multiple choice exam offers 5 choices for each question. Jason just guesses the answers, so he has probability 1/5 of getting any one answer right. **The next five questions** concern Jason.

56. Jason's guess on any one question gives no information about his guess on any other question. The statistical term for this is
(a) absence of bias (b) absence of confounding
(c) law of large numbers (d) independence
(e) expected value

57. You want to simulate whether Jason's answers to 10 questions are right or wrong. One correct way to do this is:
(a) One digit from the random digit table simulates one answer, with 5 = right and all other digits = wrong. Ten digits from the table simulate 10 answers.
(b) One digit from the random digit table simulates one answer, with 0 or 1 = right and all other digits = wrong. Ten digits from the table simulate 10 answers.
(c) One digit from the random digit table simulates one answer, with odd = right and even = wrong. Ten digits from the table simulate 10 answers.
(d) Two digits from the random digit table simulate one answer, with 00 to 20 = right and 21 to 99 = wrong. Ten pairs of digits simulate 10 answers.

(e) Two digits from the random digit table simulate one answer, with 00 to 05 = right and 06 to 99 = wrong. Ten pairs of digits simulate 10 answers.

58. Here is part of the table of random digits:

14459 26066 14201 88371 65103 62253 50490 61181

Use your chosen method from the previous question to simulate Jason's answers to 10 multiple choice questions. The number he gets right is

(a) none (b) one (c) two (d) three (e) four

59. One of your math major friends tells you that the assignment of probabilities to the number of questions Jason gets right out of 10 is (rounded to three decimal places):

| Number right | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Probability | .108 | .268 | .302 | .201 | .088 | .026 | .006 | .001 | .000 | .000 | .000 |

What is the probability that Jason will get no more than two of the 10 questions right?

(a) 0.302 (b) 0.322 (c) 0.376 (d) 0.678 (e) 0.698

60. What is the expected number of right answers Jason will get?

(a) 4 (b) 3 (c) 2 (d) 1

(e) Can't tell from the information given.

65. A sportswriter wants to know how strongly Lafayette residents support the local minor league baseball team, the Lafayette Leopards. She stands outside the stadium before a game and interviews the first 20 people who enter the stadium. The intended *population* for this survey is

(a) all residents of Lafayette. (b) all Leopard fans.

(c) all people attending the game the day the survey was conducted.

(d) the 20 people who gave the sportswriter their opinion.

(e) all American adults.

66. The *sample* for the survey in the previous question is

(a) all residents of Lafayette. (b) all Leopard fans.

(c) all people attending the game the day the survey was conducted.

(d) the 20 people who gave the sportswriter their opinion.

(e) the sportswriter.

67. The newspaper asks you to comment on their survey of local opinion, described in the previous two questions. You say

(a) This is a simple random sample. It gives very accurate results.

(b) This is a simple random sample. The results are not biased, but the sample is so small that variation will be high.

(c) This is a census, because all fans had a chance to be asked. It gives very accurate results.

(d) The sampling method is biased. It will almost certainly overestimate the level of support among all Lafayette residents.

(e) The sampling method is biased. It will almost certainly underestimate the level of support among all Lafayette residents.

68. A *stratified random sample* is a sample in which

(a) every member of the population has the same chance of being selected.

(b) every member of the population has a known chance of being selected.
(c) the population is first divided into groups of similar individuals, then a separate simple random sample is selected from each group and combined to form the full sample.
(d) every possible sample of the same size has the same chance of being selected.
(e) we choose the final sample in several stages, for example, first states, then counties in those states, then households in those counties.

70. The Gallup Poll in the previous question contacted people by dialing telephone numbers at random. A possible source of *nonsampling error* in this poll is
(a) some people chosen for the sample refused to answer questions.
(b) people without telephones could not be in the sample.
(c) some people never answered the phone in several calls.
(d) Both (a) and (c).
(e) All of (a), (b), and (c).

71. Can pleasant aromas help people work more efficiently? Researchers did this study to find out. Twenty-two students worked a paper and pencil maze six times. On three tries, they wore a mask with floral scents. On the other three tries they wore a mask with no scent. The six tries were done in random order and each used a different maze. The researchers found that the subjects took less time to complete the maze when wearing the scented mask. This study is
(a) an experiment.
(b) an observational study.
(c) a sample survey.
(d) a census.
(e) a time series.

The table below gives the age in weeks of 6 laboratory mice and the best time (in three trials) for each of the mice to finish a maze.

| Mouse age (wks) | 10 | 15 | 16 | 18 | 20 | 20 |
|---|---|---|---|---|---|---|
| Finish time (sec) | 38 | 30 | 32 | 24 | 23 | 20 |

The regression equation for Finish time ($x$) *vs.* Age ($y$) is $y = 55.9 - 1.7x$, and $r^2 = 0.918$

**The next four questions** concern these data.

73. What is the predicted finish time for a mouse who is 16 weeks old?
(a) 32 (b) 28.7 (c) 22.9 (d) 16 (e) 1.5

74. What is the correlation coefficient for the relationship between finish time and age?
(a) –0.958 (b) –0.918 (c) –0.843 (d) 0.918 (e) 0.958

75. Why would it be risky to use this equation to predict the finish time for a 25-week-old mouse?
(a) Mice rarely live that long.
(b) We would be using the regression equation well beyond the range of the data.
(c) None of the mice in our experiment are 25 weeks old.
(d) The sample is too small to make such predictions.
(e) The correlation coefficient is too small to make such predictions.

76. The residual for the 20-week-old mouse who took 23 seconds to finish the maze is
(a) –1.1 (b) 1.1 (c) 3 (d) 16.8 (e) 21.9

A psychologist thinks that listening to Mozart helps people think. She gives subjects a set of puzzles, and measures how many they solve in 5 minutes while listening to Mozart. From data on many people, the psychologist gets this probability model:

| Puzzles solved | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| Probability | 0.2 | 0.4 | 0.3 | 0.1 |

**The next three questions** concern this model.

80. The probability that a subject solves more than one puzzle is
(a) 0.2 (b) 0.8 (c) 2.3 (d) 1
(e) unknown -- not enough information.

81. The expected number of puzzles that a subject solves is
(a) 0.575 (b) 1 (c) 2.3 (d) 2.5
(e) varies from repetition to repetition.

85. In statistical language, "95% confidence" means that
(a) we used a margin of error that covers 95% of the entire population.
(b) we used simulation to get our result, so we know it is not exactly correct.
(c) we used a method that gives correct answers with probability 0.95.
(d) our margin of error is ±95%.
(e) the sampling distribution has only probability 0.95, rather than probability 1.

86. Which of the values below is impossible for the descriptive measure in question?
(a) $r = 1.25$
(b) $\bar{x} = -0.2$
(c) $s = 3.4$
(d) Both (a) and (b).
(e) Both (a) and (c).

87. You measure both the calories and the amount of salt in each of 33 brands of hot dogs. The correlation between these variables is $r = 0.49$. This shows that
(a) hot dogs with more calories tend to have less salt.
(b) calories and salt in hot dogs are not related at all.
(c) the mean amount of salt is less than the mean number of calories.
(d) the mean amount of salt is greater than the mean number of calories.
(e) hot dogs with more salt tend to also have more calories.

90. You want to make a graph to display the distribution of the salaries of the 1700 professors at a large university. The best choice is
(a) a boxplot. (b) a histogram. (c) a line graph. (d) a pie chart. (e) a stemplot.

A study of drug addicts in Amsterdam recorded how often each addict had recently injected drugs and whether or not the addict was infected with HIV, the virus that causes AIDS. Here is a two-way table of the numbers of addicts in each condition:

| | | HIV Yes | HIV No |
|---|---|---|---|
| Inject? | Daily | 32 | 45 |
| | Less than daily | 20 | 18 |
| | No | 18 | 23 |

**The next six questions** concern the data in this table.

91. How many addicts did the study gather data from?
(a) 156 (b) 86 (c) 77 (d) 70 (e) Can't tell from the table.

92. About what percent of addicts who inject daily are infected with HIV?
(a) 20.5%. (b) 41.6%. (c) 44.9%. (d) 45.7%. (e) 49.3%.

93. From the data in the two-way table, about what is the value of the correlation between whether or not an addict is infected with HIV and how often he or she injects drugs?
(a) Small but positive, say $r = 0.2$.
(b) Quite large and positive, say $r = 0.8$.
(c) Very small, close to $r = 0$.
(d) Small but negative, say $r = -0.2$.
(e) $r$ makes no sense for these data.

94. If an addict from this study is chosen at random, what is the probability that he is infected with HIV, given that he injects daily?
(a) 0.42 (b) 0.45 (c) 0.49 (d) 0.52 (e) 0.55

95. If we test the null hypothesis that there is no association between HIV infection and frequency of injection, the expected count for the cell "HIV Yes" and "Daily" is
(a) 32 (b) 34.6 (c) 42.4 (d) 45 (e) 70

96. The chi-square distribution for the statistic in the test in the previous problem has how many degrees of freedom?
(a) 1 (b) 2 (c) 3 (d) 4 (e) 6

97. Until the scale was changed in 1995, SAT scores were based on a scale set many years ago. For math scores, the mean under the old scale in the 1990s was about 470 and the standard deviation was about 110. What is the standard score of someone who scored 500 on the old SAT?
(a) $z = 0.27$ (b) $z = -0.27$ (c) $z = 30$ (d) $z = -30$ (e) $z = 0$

98. The change in scales makes it hard to compare scores on the 1994 math SAT (mean 470, standard deviation 110) and the 1996 math SAT (mean 500, standard deviation 100). Jane took the SAT in 1994 and scored 500. Her sister Colleen took the SAT in 1996 and scored 520. Who did better on the exam, and how can you tell?
(a) Colleen -- she scored 20 points higher than Jane.
(b) Colleen -- her standard score is higher than Jane's.
(c) Jane -- her standard score is higher than Colleen's.

(d) Jane -- the standard deviation was bigger in 1994.
(e) Can't tell from the information given.

The *New York Times* conducted a poll on women's issues in June of 1989. **The next seven questions** concern this poll.

99. The poll conducted telephone interviews with 1497 adults. These 1497 people make up the
(a) population.
(b) sampling frame.
(c) sample.
(d) response variable.
(e) experimental treatment.

101. One question asked was: "Many women have better jobs and more opportunities than they did 20 years ago. Do you think women have had to give up too much in the process, or not?" Of the 1025 women who were asked, 492 said "Yes." Take these 1025 women to be an SRS of all adult women. Which of these is a correct 95% confidence interval for the proportion of all adult women who would say "Yes" to this statement?
(a) $0.48 \pm 0.031$
(b) $0.48 \pm 0.000487$
(c) $0.48 \pm 0.0156$
(d) $0.492 \pm 0.031$
(e) $0.492 \pm 0.0156$

102. The poll questioned 1025 women and 472 men. The design of the sample choose separate samples of men and women and planned to interview more women than men. This is a
(a) systematic random sample.
(b) completely randomized design.
(c) stratified random sample.
(d) simple random sample.
(e) matched pairs design

103. The 472 men were also asked the question described in problem 101 above, and 212 of them said "Yes." The margin of error for a 95% confidence interval for men would be
(a) larger than for women, because fewer men were asked.
(b) smaller than for women, because fewer men were asked.
(c) larger than for women, because fewer men said "Yes."
(d) smaller than for women, because fewer men said "Yes."
(e) the same as for women.

105. The *Times* gave 95% confidence intervals. The term "95% confidence" means
(a) If we took many samples, the confidence interval would cover the true population result in 95% of them.
(b) The sampling frame lists 95% of all American adults.
(c) 95% of those interviewed said "Yes" to the question asked.
(d) The confidence interval covers 95% of all responses in the population.
(e) Whatever bias is inherent in the sample, it can cause no more than a 5% change in the result.

106. As part of regular medical checkups, a study asked all 101,000 members of a medical insurance program to described their coffee drinking. The researchers then compared those who drank coffee with those who did not. Drinking 4 or more cups of coffee a day appeared to increase the risk of a heart attack by 40%.
(a) This study is an experiment because it has an explanatory variable and a response variable.
(b) This study is not an experiment because people choose whether to drink coffee or not.
(c) This study is an experiment because it compares two groups.
(d) This study is not an experiment because it was not double-blind.
(e) This study is an experiment because it has a control group: those who did not drink coffee.

107. The response variable in the study described in the previous problem is
(a) 101,000 members of a medical insurance program.
(b) how much coffee a person drinks.
(c) whether or not a person had a heart attack.
(d) regular medical checkups.
(e) 40%.

The quality control department of a firm that manufactures a special part for automobiles tests randomly-selected parts at the end of the production process for defects. Suppose that 0.5% (that's ½ percent) of the finished parts are defective. The testing process correctly identifies defective parts 99% of the time, and incorrectly identifies good parts as defective 2% of the time. **The next three questions** address this situation.

117. What is the probability that a randomly-selected part is identified as defective (that is, fails the test)?
(a) 0.0001 (b) 0.005 (c) 0.010 (d) 0.020 (e) 0.025

118. Given that a part is *not* defective, what is the probability that it fails the quality-control test?
(a) 0.0001 (b) 0.005 (c) 0.010 (d) 0.020 (e) 0.025

119. Given that a part fails the quality-control test, what is the probability that it is *not* defective?
(a) 0.005 (b) 0.020 (c) 0.181 (d) 0.199 (e) 0.801

131. You choose an SRS of 2000 women over 18 years of age from the New York City metropolitan area; 623 of them are single. A 95% confidence interval for the proportion of all adult women in the New York area who are single is (approximately)
(a) $0.31 \pm 0.03$
(b) $0.62 \pm 0.03$
(c) $0.31 \pm 0.02$
(d) $0.62 \pm 0.02$
(e) $0.20 \pm 0.03$

You suspect your friend's six-sided die is "loaded" so that higher rolls happen more often than they should. You roll the die 60 times and get the following results:

| Roll | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| Frequency | 7 | 9 | 8 | 10 | 13 | 13 |

You plan to perform a chi-square goodness-of-fit test to determine if the die is fair. **The next three questions** concern this test.

132. What is the null hypothesis for this test?

(a) $p_1 = \frac{7}{60}; p_2 = \frac{9}{60}; p_3 = \frac{8}{60}; p_4 = \frac{10}{60}; p_5 = \frac{13}{60}; p_6 = \frac{13}{60}$

(b) $p_1 = p_2 = p_2 = p_3 = p_4 = p_5 = p_6 = \frac{1}{6}$

(c) $p_1 \neq p_2 \neq p_2 \neq p_3 \neq p_4 \neq p_5 \neq p_6 \neq \frac{1}{6}$

(d) The is no association between value of roll and roll frequency.

(e) The is an association between value of roll and roll frequency.

133. The amount that the frequency of roll "4" contributes to the chi-square statistic is:

(a) –4 (b) –0.4 (c) 0 (d) 0.4 (e) 0.5

134. The chi-square statistics for these data is 3.2. Which of the following statements is the best conclusion to draw?

(a) Reject $H_0$ at the $\alpha = .05$ level: there is no evidence that the die is unfair.

(b) Reject $H_0$ at the $\alpha = .05$ level: there is evidence that the die is unfair.

(c) Fail to reject $H_0$ at the $\alpha = .05$ level: there is no evidence that the die is unfair.

(d) Fail to reject $H_0$ at the $\alpha = .05$ level: there is evidence that the die is unfair.

(e) We can't draw dependable conclusions because the conditions required for this procedure have not been met.

Choose an adult woman at random. Let the random variable X = the number of children the chosen women has had. **The next three questions concern these data.**

| Number of children | 0 | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| Probability | 0.41 | 0.18 | 0.21 | 0.13 | 0.05 | 0.02 |

135. The probability that a randomly chosen woman has had 3 or more children is

(a) 0.59 (b) 0.87 (c) 0.13 (d) 0.20 (e) 0.07

136. What is the expected value of the number of children a randomly chosen woman has had?

(a) 0.59 (b) 1.0 (c) 1.29 (d) 2.0 (e) 2.5

137. Given that the randomly chosen women has had at least one child, what is the probability that she has had 3 children?

(a) 0.07 (b) 0.13 (c) 0.20 (d) 0.22 (e) 0.33

140. Students who study German in high school tend to score higher on tests of English grammar than students who do not study German. Which is true:
(a) This shows that studying German improves your knowledge of English grammar.
(b) Students who choose to study German are probably already good at grammar, so we can't conclude anything about cause and effect.
(c) This makes no sense because you can't compute the correlation between studying German and English grammar test scores.
(d) There is a positive correlation between whether or not a student studied German and the student's English grammar test score.
(e) both (b) and (d).

141. You are planning a survey of Pennsylvania households. Among other items, you will ask whether they ate turkey on Thanksgiving day. You will give a 95% confidence interval for the proportion $p$ who ate turkey. If you take an SRS of 2000 households, the margin of error in your confidence interval will be
(a) twice as large as for an SRS of 500 households.
(b) one-half as large as for an SRS of 500 households.
(c) four times as large as for an SRS of 500 households.
(d) one-fourth as large as for an SRS of 500 households.
(e) the same size as for an SRS of 500 households.

144. You gather data on the number of hours of television watched per week and the grade point average of juniors majoring in the School of Liberal arts. You expect that TV watching will help explain grades. In a scatterplot of your data,
(a) hours of TV should be on the horizontal axis.
(b) grade index should be on the horizontal axis.
(c) it makes no difference which is horizontal.
(d) a scatterplot is not an appropriate type of graph for these data, use a dot plot.
(e) a scatterplot is not an appropriate type of graph for these data, use a box plot.

145. The plot of the data in the preceding question shows that students who watch more TV tend to have lower grade indexes. You calculate the correlation $r$ between hours of TV and grade index. A plausible value is
(a) $r = -1.2$ (b) $r = -1$ (c) $r = -0.4$ (d) $r = 0$ (e) $r = 0.4$

146. There is a strong straight-line relationship between the outdoor temperature and the amount of energy used to heat a house. Lower temperatures require more energy to keep the house warm. Knowing this, a reasonable value for the correlation coefficient between temperature and home energy consumption is:
(a) $r = 1$ (b) $r = 0.8$ (c) $r = 0$ (d) $r = -0.8$ (e) $r = -1$

147. If an SRS of size $n = 1500$ has sample proportion $\hat{p} = 0.55$ approving of the president, a 95% confidence interval for the proportion $p$ of all adults who approve is
(a) $0.55 \pm 0.00017$
(b) $0.55 \pm 0.00032$
(c) $0.55 \pm 0.013$
(d) $0.55 \pm 0.025$

(e) $0.55 \pm 0.030$

148. A study observes 200 men who run regularly and 200 men who choose not to run. A personality test shows that the runners are more optimistic and outgoing. Does this prove that running causes a change in personality?
(a) Yes – the personality is the response variable.
(b) No – the more optimistic men may have chosen to run, so there is confounding.
(c) Yes –this is an experiment, so it establishes causation.
(d) No – the sample size is too small to establish causation.
(e) No – it's a case of the placebo effect.

149. Which of the following pairs of variables is most likely to show a negative correlation?
(a) a person's income and her years of education.
(b) a car's top speed and its gas mileage (miles per gallon).
(c) a student's grade point average and his SAT score.
(d) a person's height and his or her income.
(e) a person's age and his or her shoe size.

Below is a table of persons aged 18 to 21 years by school enrollment status and sex, collected by the Current Population Survey. **The next four questions** refer to this table.

Number of Persons (thousands)

| | Female | Male |
|---|---|---|
| High school drop-outs | 965 | 1122 |
| Enrolled in high school | 355 | 695 |
| HS graduate, not in college | 2865 | 2540 |
| HS graduate, in college | 3068 | 2659 |
| Total | 7253 | 7016 |

150. How many persons age 18 to 21 are there?
(a) 14,269 (b) 1,426,900 (c) 5,727,000 (d) 14,269,000 (e) 12,181,000

151. The percent of men age 18 to 21 who are high school drop outs is
(a)13.3% (b) 15.5% (c) 16.0% (d) 7.9% (e) 53.8%

152. On the whole, these data suggest that
(a) young men are getting less education than young women.
(b) young men are getting more education than young women.
(c) almost all high school graduates go on to college.
(d) high school graduates are mainly men.
(e) most college students are male.

153. If a person is selected at random, what is the probability that she is female, given that she is a high school dropout?
(a) 0.08 (b) 0.15 (c) 0.16 (d) 0.46 (e) 0.54

A medical researcher collects health data on many women in each of several countries. One of the variables measured for each woman in the study is her weight in pounds. The following list gives a **modified version of the five-number summary** for the weights of women in each of several countries. The modification is that first and last numbers for each country are the **deciles** (that is, the 10th and 90th percentiles) instead of the maximum and minimum.. **The next three questions** refer to this information.

Country A : 100, 110, 120, 160, 200
Country B : 113, 135, 151, 185, 240
Country C : 84, 96, 110, 124, 136
Country D : 100, 143, 182, 191, 200
Country E: 112, 120, 128, 140, 150

155. In one of these countries the weights of women are approximately normally distributed, Which country is it?
(a) Country A (b) Country B (c) Country C (d) Country D (e) Country E

156. In one of the five countries, the mean weight of women is less than the median weight. Which country is it most likely to be?
(a) Country A (b) Country B (c) Country C (d) Country D (e) Country E

157. About what fraction of Country A women weigh between 110 and 200 pounds?
(a) 50% (b) 65% (c) 75% (d) 85% (e) 95%

Suppose that the distribution of MATH SAT scores from your state this year is normally distributed with mean 480 and standard deviation 100 for Males, and mean 440 and standard deviation 120 for Females. **The next three questions** make use of the above information.

160. If a person who scores 780 or higher on MATH SAT can be considered a genius, the proportion of geniuses among male SAT takers in this state is about
(a) 30% (b) 15% (c) 3% (d) 1.5% (e) 0.15%

161. Mary took the MATH SAT and scored 680. She did better than about _____ % of female students taking the test.
(a) 99.9 (b) 99 (c) 97.5 (d) 97 (e) 95

162. How well did Mary's score of 680 rate in terms of the scores of male students? Mary did better than about _____% of male students taking the test.
(a) 99.9 (b) 99 (c) 97.5 (d) 97 (e) 95

A recent survey by censusatschool.org.uk found that the mean time it takes students in Canada to travel to school is 20.3 minutes with a standard deviation of 15.4 minutes. The distribution is skewed to the right. **The next two questions** refer to this information.

164. Which of the following best describes the sampling distribution of means for samples of size 80 from this population?
(a) Mean 20.3; Standard deviation 15.4; shape unknown
(b) Mean 20.3; Standard deviation 15.4; shape approximately normal

(c) Mean unknown; Standard deviation 15.4; shape unknown
(d) Mean 20.3; Standard deviation 1.72; shape unknown
(e) Mean 20.3; Standard deviation 1.72; shape approximately normal

165. The probability that the mean of one sample of size 80 from this population is greater than 20 minutes is
(a) 0.41 (b) 0.43 (c) 0.47 (d) 0.51 (e) 0.57

A 40-year-old high school teacher who takes great pride in his youthful appearance asks the 75 students in his classes to guess his age. He assumes that his 75 students are a simple random sample of all high school students with respect to their estimates of his age. The mean guess is 38.8 years with a standard deviation of 3.3 years. **The next three questions** concern this situation.

166. The 95% confidence interval for the students' age guesses is
(a) $38.8 \pm 0.75$
(b) $38.8 \pm 0.62$
(c) $38.8 \pm 0.38$
(d) $38.8 \pm 0.11$
(e) $38.8 \pm 0.09$

167. The teacher wants to perform a test of significance to see if the students underestimate his age. The null and alternative hypotheses are:
(a) $H_0 : \mu < 40;\ H_a : \mu = 40$
(b) $H_0 : \mu \neq 40;\ H_a : \mu = 40$
(c) $H_0 : \mu = 40;\ H_a : \mu \pm 40$
(d) $H_0 : \mu = 40;\ H_a : \mu < 40$
(e) $H_0 : \mu = 40;\ H_a : \mu > 40$

168. The test statistic for this sample is $t = -3.15$. Which of the following best describes the P-value?
(a) $p < 0.001$
(b) $0.001 < p < 0.005$
(c) $0.005 < p < 0.01$
(d) $0.01 < p < 0.05$
(e) $p > 0.05$

169. A polling organization ask 350 voters if they plan to vote for a certain mayoral candidate and performs a test of significance on the resulting sample proportion. They null hypothesis is $H_0$: $p = 0.5$ and the alternative is $H_a$: $p > 0.5$. The resulting P-value is 0.027. Which of the following is an appropriate conclusion?
(a) Reject $H_o$ at the $\alpha = .05$ level: the majority of voters plan to vote for the candidate.
(b) Reject $H_o$ at the $\alpha = .05$ level: the majority of voters do not plan to vote for the candidate.
(c) Fail to reject $H_o$ at the $\alpha = .05$ level: the majority of voters plan to vote for the candidate.

(d) Fail to reject $H_o$ at the $\alpha = .05$ level: the majority of voters do not plan to vote for the candidate.
(e) The sample size is too small to draw conclusions from this test.

A December 2007 Gallup Poll reported that 43% of Americans use the internet for an hour or more each day. You suspect that a higher proportion of students at your school use the internet that much. To find out, you take a simple random sample of 60 students and find that 35 of them use the internet for an hour or more each day. (Assume your school has enough students so that this is a small sample relative to the size of the population). You plan to perform a significance test to address the question "Is the proportion of students at my school who use the internet an hour or more daily higher than the national proportion in 2007?" **The next three questions** address this procedure.

170. The null and alternative hypotheses for this test are
(a) $H_0 : p = 0.583;\ H_a : p > 0.583$
(b) $H_0 : p = 0.583;\ H_a : p < 0.583$
(c) $H_0 : p = 0.5;\ H_a : p > 0.5$
(d) $H_0 : p = 0.43;\ H_a : p < 0.43$
(e) $H_0 : p = 0.43;\ H_a : p > 0.43$

171. Which of the following best describes the sampling distribution of proportions for this test?
(a) Mean = 0.583; Standard deviation = 0.064; shape approximately normal
(b) Mean = 0.583; Standard deviation = 0.064; shape unknown
(c) Mean = 0.5; Standard deviation = 0.064; shape approximately normal
(d) Mean = 0.43; Standard deviation = 0.064; shape approximately normal
(e) Mean = 0.43; Standard deviation = 0.064; shape unknown

172. The test statistic, P-value, and appropriate conclusion ($\alpha = .01$) for this test are:
(a) $z = 2.39$; P-value = 0.008; reject $H_o$
(b) $z = 2.39$; P-value = 0.008; fail to reject $H_o$
(c) $t = 2.39$; P-value = 0.0103; reject $H_o$
(d) $t = 2.39$; P-value = 0.0103; fail to reject $H_o$
(e) no conclusion can be drawn, because the shape of the sampling distribution is unknown.

173. The reason we use a *t*-distribution instead of a normal distribution when most inference procedures involving means is:
(a) According to the central limit theorem, the sampling distribution of means for sufficient large samples has a *t*-distribution, not a normal distribution.
(b) Since we don't know the population mean, we are estimating it with the sample mean, which increases the variability of our estimate.
(c) Since we don't know the population standard deviation, we estimate it with the sample standard deviation, which increases the variability of our estimate.
(d) Both (a) and (c)
(e) All of (a), (b), and (c).