This instrument is intended to measure your attitudes towards statistics and your concepts knowledge after taking this course.

Your participation is voluntary. After you enter your name below, you may opt out of answering the remaining questions. Your name will still be included in the list sent to your instructor.

After this first page, there are three sections to the instrument: an attitude survey, a concepts post-test, and some demographic questions. The three sections combined should take you approximately 35 minutes. Thank you for your participation!

* 1. What is your first name?

* 2. What is your last name?

* 3. Please confirm that your instructor is _____

- ◯ Yes, my instructor is _____
- ◯ No, my instructor is not _____ (Note: You should probably be taking a different survey!)

* 4. In what month were you born?
(This will be used to assist in verifying your name)

- ◯ January
- ◯ February
- ◯ March
- ◯ April
- ◯ May
- ◯ June
- ◯ July
- ◯ August
- ◯ September
- ◯ October
- ◯ November
- ◯ December

* 5. Do you choose to participate?

- ◯ I will participate. The following pages will take you to the remainder of the questions.
- ◯ I decline to participate (your name will still be provided to your instructor if they are offering course credit for your involvement in this survey).

Attitudes

Attitudes: The following questions ask about your attitudes towards statistics. Each item has 7 possible responses. The responses range from strongly disagree to strongly agree. If you have no opinion, then choose "Neutral."

6. Please read each statement. Mark the one response that most clearly represents your degree of agreement or disagreement with that statement. Try not to think too deeply about each response. Record your answer and move quickly to the next item. Please respond to all of the statements.

			Very Strongly Disagree	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Very Strongly Agree
6	a	I completed all of my statistics assignments.	effort						
7	b	I worked hard in my statistics course.	effort						
8	c	I liked statistics.	affect						
9	D	I felt insecure when I had to do statistics problems.	AFFECT						
10	E	I had trouble understanding statistics because of how I think.	COMPETENCE						
11	f	Statistics formulas were easy to understand.	difficulty						
12	G	Statistics was worthless.	VALUE						
13	H	Statistics was a complicated subject.	DIFFICULTY						
14	i	Statistics should be a required part of my professional training.	value						
15	j	Statistical skills will make me more employable.	value						

7. Please read each statement. Mark the one response that most clearly represents your degree of agreement or disagreement with that statement. Try not to think too deeply about each response. Record your answer and move quickly to the next item. Please respond to all of the statements.

			Very Strongly Disagree	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Very Strongly Agree
16	a	I had no idea of what was going on in this statistics course.	○	○	○	○	○	○	○
		COMPETENCE							
17	b	I am interested in being able to communicate statistical information to others.	○	○	○	○	○	○	○
		interest							
18	c	Statistics is not useful to the typical professional.	○	○	○	○	○	○	○
		VALUE							
19	d	I studied hard for every statistics test.	○	○	○	○	○	○	○
		effort							
20	e	I got frustrated going over statistics tests in class.	○	○	○	○	○	○	○
		AFFECT							
21	f	Statistical thinking is not applicable in my life outside my job.	○	○	○	○	○	○	○
		VALUE							
22	g	I use statistics in my everyday life.	○	○	○	○	○	○	○
		value							
23	h	I was under stress during statistics class.	○	○	○	○	○	○	○
		AFFECT							
24	i	I enjoyed taking statistics courses.	○	○	○	○	○	○	○
		affect							
25	j	I am interested in using statistics.	○	○	○	○	○	○	○
		interest							

8. Please read each statement. Mark the one response that most clearly represents your degree of agreement or disagreement with that statement. Try not to think too deeply about each response. Record your answer and move quickly to the next item. Please respond to all of the statements.

		Very Strongly Disagree	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Very Strongly Agree
26 8a VALUE	Statistics conclusions are rarely presented in everyday life.	○	○	○	○	○	○	○
27 8b difficulty	Statistics is a subject quickly learned by most people.	○	○	○	○	○	○	○
28 8c interest	I am interested in understanding statistical information.	○	○	○	○	○	○	○
29 8d DIFFICULTY	Learning statistics requires a great deal of discipline.	○	○	○	○	○	○	○
30 8e VALUE	I have no application for statistics in my profession.	○	○	○	○	○	○	○
31 8f COMPETENCE	I made a lot of math errors in statistics.	○	○	○	○	○	○	○
32 8g effort	I attended every statistics class session.	○	○	○	○	○	○	○
33 8h AFFECT	I was scared by statistics.	○	○	○	○	○	○	○
34 8i interest	I am interested in learning statistics.	○	○	○	○	○	○	○
35 8j DIFFICULTY	Statistics involves massive computations.	○	○	○	○	○	○	○

9. Please read each statement. Mark the one response that most clearly represents your degree of agreement or disagreement with that statement. Try not to think too deeply about each response. Record your answer and move quickly to the next item. Please respond to all of the statements.

		Very Strongly Disagree	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Very Strongly Agree
36	I learned statistics.	competence						
37	I understood statistics equations.	competence						
38	Statistics is irrelevant in my life.	VALUE						
39	Statistics is highly technical.	DIFFICULTY						
40	I found it difficult to understand statistical concepts.	COMPETENCE						
41	Most people have to learn a new way of thinking to do statistics.	DIFFICULTY						

Please note that the labels for each scale for the following questions change from item to item.

10. How well have you done in mathematics courses you have taken in the past?

Very Poorly	Poorly	Below Average	Average	Above Average	Well	Very Well

11. How good at mathematics are you?

Very Poor	Poor	Below Average	Average	Above Average	Good	Very Good

12. In the field in which you hope to be employed when you finish school, how much will you use statistics?

Not At All	Very Little	Less Than Average	Average	Greater Than Average	Large Amount	Great Deal

13. How confident are you that you mastered introductory statistics material?

Not at All Confident	Very Little Confidence	Little Confidence	Some Confidence	Fairly Confident	Confident	Very Confident

14. Why did you take this course?

Choose all that apply:

- [ ] It sounded interesting
- [ ] For a general education requirement
- [ ] For my major

15. If the choice had been yours, how likely is it that you would have chosen to take any course in statistics?

Not at All Likely	Unlikely	Fairly Unlikely	Average	Likely	Fairly Likely	Very Likely
○	○	○	○	○	○	○

You have now completed the attitudes portion of the post-test.

Concepts

Concepts: The following questions ask a series of questions related to your conceptual understanding of statistics. You should try your best, but don't take a lot of time deliberating your answers. Going with your gut instinct is probably best.

16. A large university surveyed a sample of their students currently living in dormitories to estimate the proportions of all students who prefer single rooms, double rooms, or multiple (more than two people) rooms in the dormitories on campus.

Which of the following should be considered before deciding whether the results from this sample can be generalized to all students at this university currently living in dormitories? (check all that apply)

- [ ] whether or not the sample was randomly selected
- [ ] the size of the sample compared to the number of students living in dormitories at the university
- [ ] whether the university surveyed at least 100 students
- [ ] the percentage of students contacted who responded

data collection

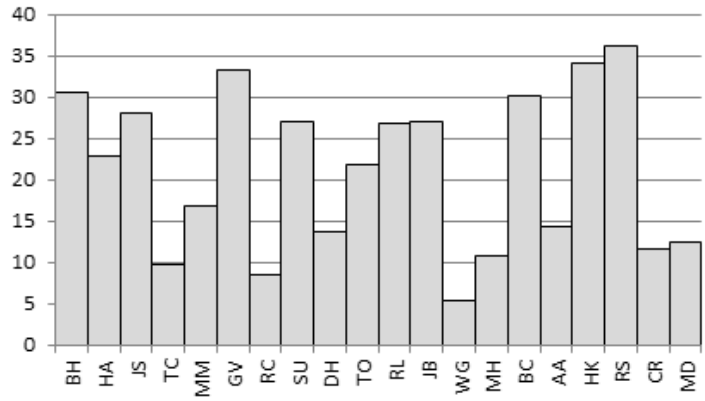
correct: 1 and 4

Concepts

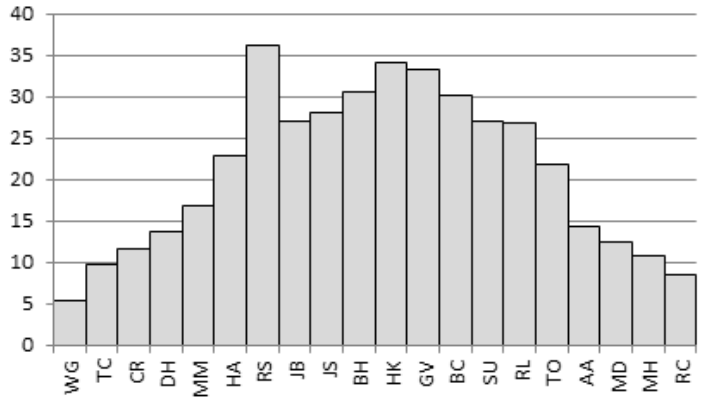
Use the following information to answer the question below. A teacher kept track of the time it took her students to complete a particular exam (in minutes). These times (along with the students' initials) are recorded in the table below.

Student	Time	Student	Time	Student	Time
BH	31	SU	27	BC	30
HA	23	DH	14	AA	14
JS	28	TO	22	HK	34
TC	10	RL	27	RS	36
MM	17	JB	27	CR	12
GV	33	WG	5	MD	13
RC	9	MH	11		

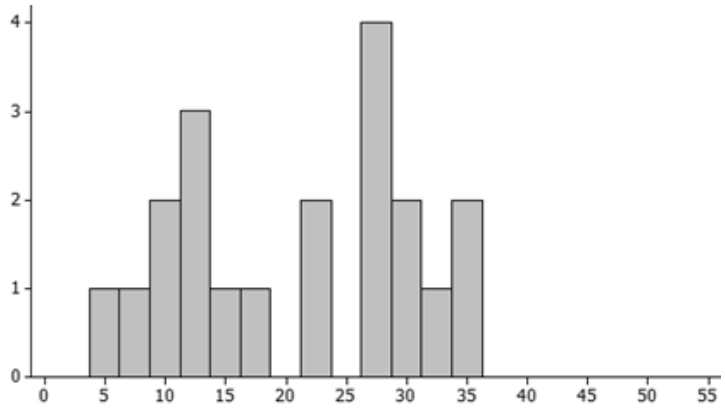
Graph A



Graph B

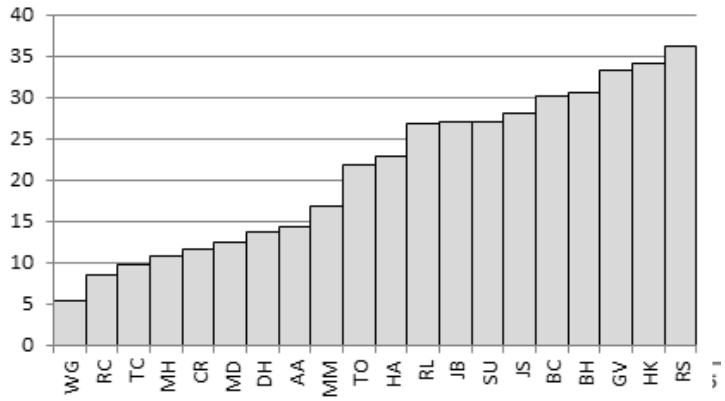


Graph C



correct

Graph D



17. Which of the graphs shown above is the most appropriate display of the distribution of times, in that the graph allows the teacher to describe the shape, center, and variability of the completion times?

- Graph A
- Graph B
- Graph C correct
- Graph D

descriptive statistics

Concepts

Use the following information to answer the next three questions A high school statistics class wants to estimate the average cookie weight of a generic brand of chocolate chip cookies. They collect a random sample of 50 cookies from the manufacturing process and obtain the weight (in grams) for each cookie. Based on their data, the 95% confidence interval for the average weight per cookie is 25.65 to 26.35 grams.

For each of the following three statements, indicate whether it is a valid or invalid conclusion.

18. We can infer with 95% confidence that a randomly selected cookie manufactured for this generic brand will weigh between 25.65 to 26.35 grams.

- ◯ Valid
- ◯ Invalid correct

confidence intervals

19. We can infer with 95% confidence that mean weight of all cookies manufactured for this generic brand is between 25.65 and 26.35 grams.

- ◯ Valid correct
- ◯ Invalid

confidence intervals

20. We can infer with 95% confidence that the average weight for 50 cookies randomly selected from those manufactured for this generic brand will be between 25.65 and 26.35 grams.

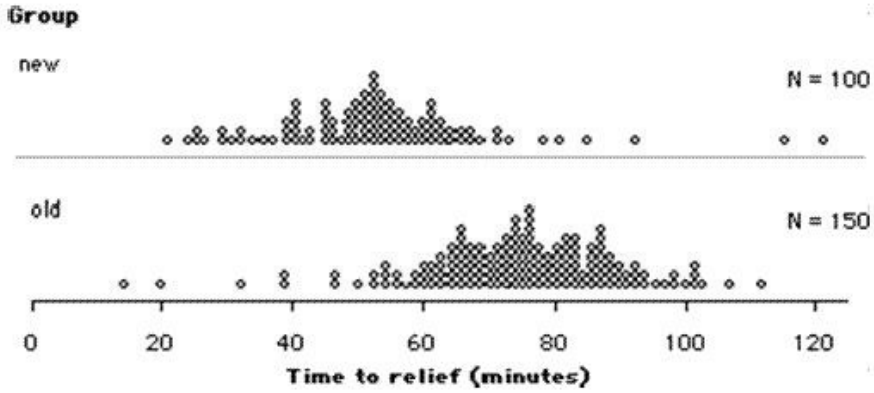
- ◯ Valid
- ◯ Invalid correct

confidence intervals

Concepts

Use the following information to answer the next two questions.

Two hundred fifty people who frequently suffer from headaches agreed to participate in a study. One hundred of these people were randomly assigned to receive a new headache medication when they had a headache, and the other 150 people received the old headache medication. The time until the patient reported that they no longer had a headache was recorded. The results are shown below:



descriptive statistics

21. Which of the following is the most valid conclusion for these data?

- The new medication may be preferable. People taking the new medication tended to feel relief about 20 minutes sooner, on average, than those taking the old medication. correct
- Neither medication is preferable. The number of patients in the two groups is not the same so there is no fair way to compare the two medications.
- The old medication works better. Two people who took the old medication felt relief in less than 20 minutes, compared to none who took the new medication. Also, the worst result - near 120 minutes - was with the new medication.

22. Suppose the study finds a statistically significant tendency for faster relief with the new medication. From this study, can we conclude that the new medicine causes faster relief among individuals like those in this study?

- Yes, because this was a randomized experiment and statistically significant correct
- Yes, because both sample sizes are above 50
- No, because the difference was probably due to random chance alone
- No, because the sample sizes were too small

scope of conclusions

Use the following scenario to answer the next two questions.A researcher in environmental science conducted a study to investigate the impact of a particular herbicide on the level of a certain enzyme in fish. He randomly assigned 60 healthy fish to either a treatment group exposed to the herbicide or to a control group that was not exposed to the herbicide. At the end of the study, the researcher calculated that the average level of the enzyme was higher for the fish that were exposed to the herbicide than for the fish that were not exposed. But when he conducted a test of significance, he found that this difference was not statistically significant.

For each of the following statements, indicate whether it is a valid or invalid conclusion.

23. It is plausible that the herbicide does have an impact on the enzyme level but the sample size may have been too small to detect the difference?

- Valid correct
- Invalid

significance

24. We have strong evidence that the herbicide does not have an impact on the enzyme level.

- Valid
- Invalid correct

significance

Concepts

25. Researchers surveyed 1,000 randomly selected adults in the U.S. A statistically significant, strong positive association was found between income level and the number of containers of recycling they typically collect in a week. Please select the best interpretation of this result.

scope of conclusions

Select one:

- We **can** conclude that earning more money causes more recycling among U.S. adults because the association is statistically significant.
- We **cannot** conclude that earning more money causes more recycling among U.S. adults because this type of study does not allow us to infer causation. correct
- We **cannot** conclude that earning more money causes more recycling among U.S. adults because the sample is too small to draw any conclusions about the association between income level and amount of recycling for adults in the U.S.

26. The United States has over 310 million residents. Suppose that you want to estimate the proportion of Americans who ate breakfast this morning to within a margin-of-error of 3 percentage points with 95% confidence. About how many people would you need to randomly sample? (Assume all selected will respond to the survey.) Choose the best answer from the following choices.

- 30
- 1500 correct
- 300,000
- 10,000,000

confidence

27. A graduate student is designing a research study. She is hoping to show that the results of an experiment are statistically significant. What type of p-value would she want to obtain?

significance

Select one:

- The magnitude of a p-value has no impact on statistical significance.
- A large p-value
- A small p-value correct

Concepts

Use the following scenario to the answer the next four questions.A research article reports the results of a new drug test. The drug is hypothesized to decrease vision loss in people with macular degeneration more effectively than the current treatment. The article reports a p-value of 0.04 in the analysis section.

Indicate whether the following interpretations are valid or invalid interpretations of this p-value.

28. We conclude that the new drug is not effective because there is only a .04 probability that the drug is more effective than the current treatment.

- ◯ Valid
- ◯ Invalid correct

significance

29. We conclude that the new drug is effective because results like they found, or results even more favorable to the new drug, would only happen 4% of the time if the drug was not effective.

- ◯ Valid correct
- ◯ Invalid

significance

30. We conclude that the new drug is effective because there is only a 4% chance that it's not.

- ◯ Valid
- ◯ Invalid correct

significance

31. We conclude that the new drug is not effective because the difference in the proportion of macular degeneration patients with vision loss between the two treatments is only 0.04.

- ◯ Valid
- ◯ Invalid correct

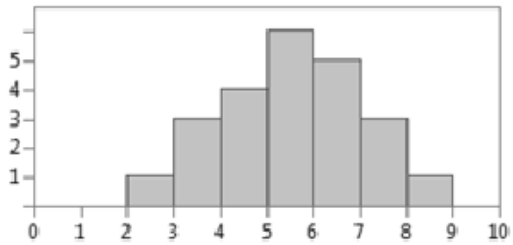
significance

Concepts

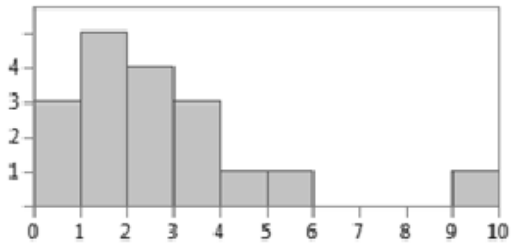
Use the following information to answer the next two questions.

Four histograms are displayed below. Match the description to the appropriate histogram.

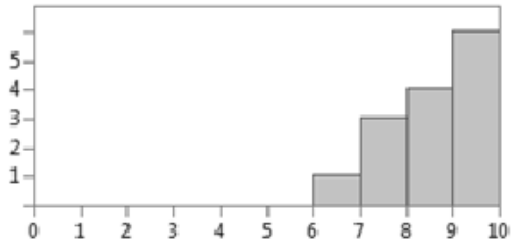
A



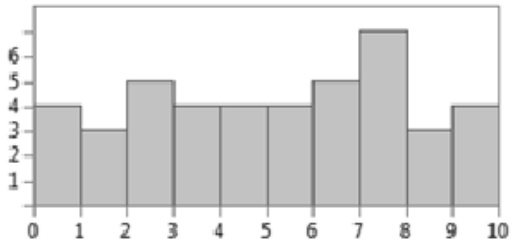
B



C



D



32. A distribution for the second to last digit of phone numbers sampled from students in a class (i.e., for the phone number 968-9667, the second to last digit is 6) is best represented by:

- Histogram A
- Histogram B
- Histogram C
- Histogram D correct

descriptive statistics

33. A distribution for a set of scores on a ten-point quiz where the quiz was very easy - and most students did well - is best represented by:

- Histogram A
- Histogram B
- Histogram C correct
- Histogram D

descriptive statistics

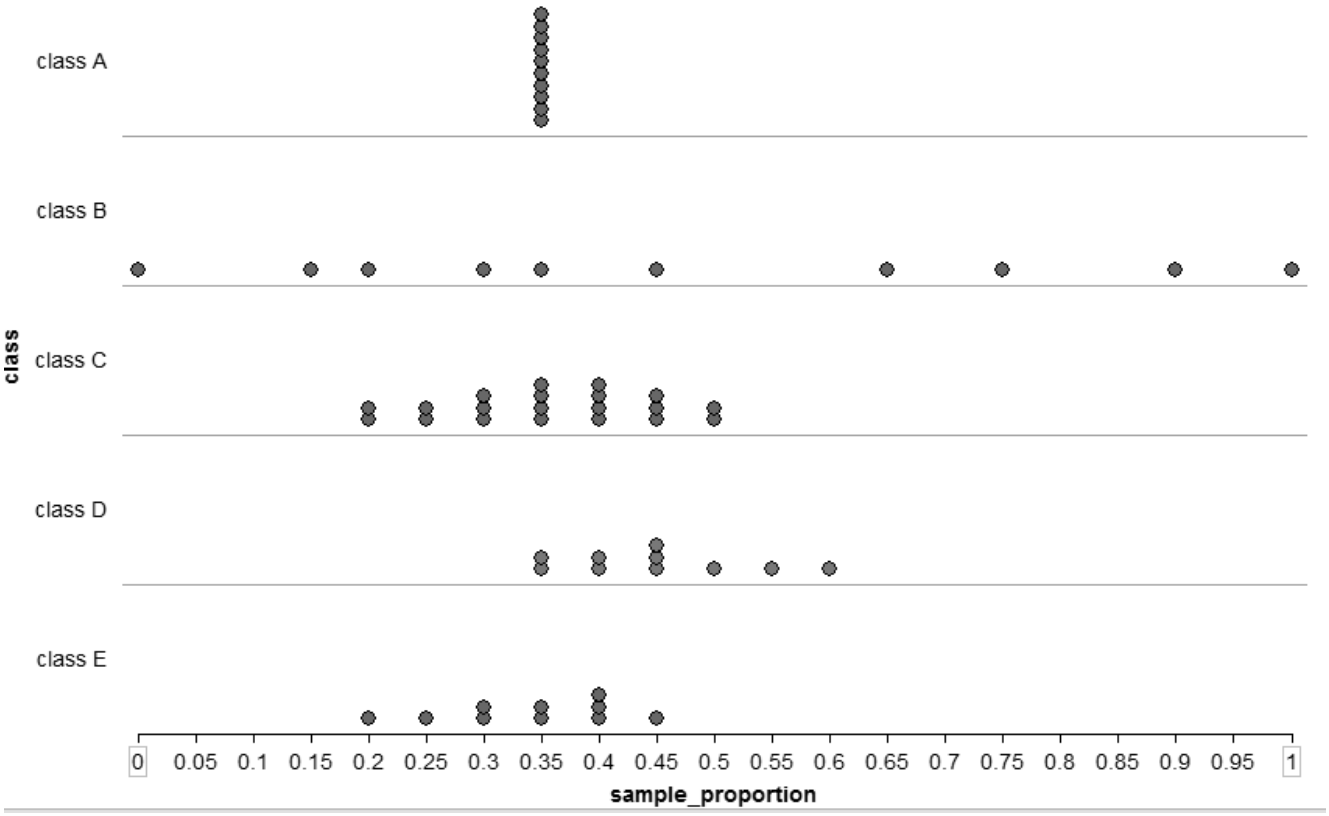
Concepts

34. Suppose at a large university, 15% of the students are left-handed. Sam plans to take a random sample of 100 students and ask whether or not the student is left-handed. Kerry plans to ask a random sample of 50 students whether or not the student is left-handed. Who, Sam or Kerry, is more likely to find more than 25% of their sample is left-handed?

- ○ Sam because a larger sample is more likely to have more left-handed students.
- ○ Kerry because a smaller sample is more likely to have more left-handed students.
- ○ Kerry because there is more variability in the sample proportions among smaller samples. correct
- ○ Sam because there is more variability in the sample proportions among larger samples.
- ○ Both have the same chance because both are planning to select a random sample from a population in which 15% are left-handed.

simulation

Imagine you have a barrel that contains thousands of candies with different colors, produced from a certain manufacturing process. We know that the manufacturing process produces yellow candies 35% of the time. Ten students each take a random sample of 20 candies from the barrel, and each student records the proportion of yellow candies in his or her sample.



35. Which of the dotplots above is the most plausible for the results for these ten students?

- Class A
- Class B
- Class C
- Class D
- Class E correct

simulation

The following table is based on records of accidents compiled by a State Highway Safety and Motor Vehicles Office. The Motor Vehicle Office wants to decide whether drivers are less likely to have a fatal accident if they are wearing a seat belt than if they are not wearing a seat belt.

Safety equipment in use	Nonfatal injury	Fatal injury	Row Total
Seat belt	412,368	510	412,878
No seat belt	162,527	1,601	164,128
Column total	574,895	2,111	577,006

36. Which of the following comparisons is most appropriate for supporting this conclusion?

Select one:

- Compare the ratios 510/412,878 and 1,601/164,128 correct
- Compare the ratios 510/577,006 and 1,601/577,006
- Compare the ratios 412,368/412,878 and 510/412,878
- Compare the numbers 510 and 1,601

descriptive statistics

Concepts

Use the following information to answer the three questions below.A student claims she can be blindfolded and still distinguish between the tastes of Coke and Pepsi by a single sip alone. Her friends allow her to sip a sample of each soft drink and then to repeat that process 10 times, randomly deciding which one she tastes first. She correctly identifies which soda is which eight times out of the ten tries. She claims that this proves that she can reliably tell the difference between the two soft drinks. You want to determine the probability that someone would get at least eight right out of ten tries if they really couldn't tell the difference between the two sodas.

For each of the three statements below, check whether it is a valid or invalid method to provide an accurate estimate of this probability.

37. Have the student repeat this experiment many times and calculate the proportion of times she correctly distinguishes between the brands.

- ◯ Valid
- ◯ Invalid correct

simulation

38. Simulate this process a large number of times on the computer with a 50% chance of guessing the correct soft drink on each try, and calculate the proportion of times there are eight or more correct guesses out of ten trials.

- ◯ Valid correct
- ◯ Invalid

simulation

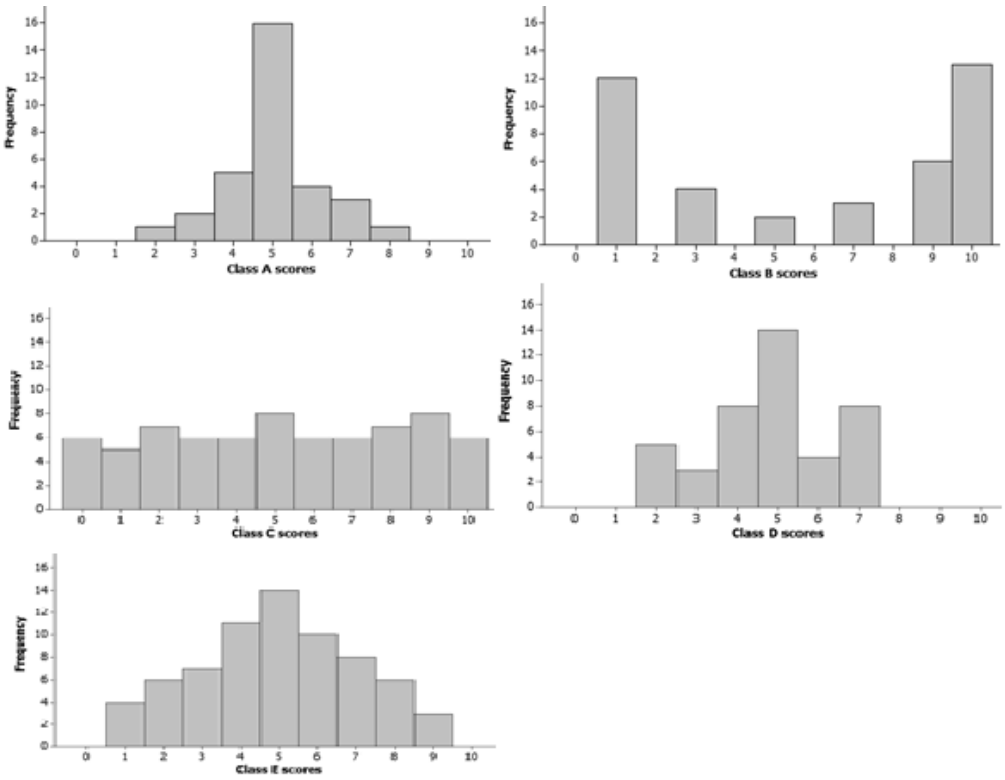
39. Repeat this experiment with a very large sample of people and calculate the percentage of people who make eight correct guesses out of ten tries.

- ◯ Valid
- ◯ Invalid correct

simulation

Concepts

The next two questions refer to the following situation: Five histograms are presented below. Each histogram displays test scores on a scale of 0 to 10 for one of five different statistics classes.



40. Which of the classes has the<u>least</u> variability (as measured by standard deviation) of scores?

- Class A correct
- Class B
- Class C
- Class D
- Class E

descriptive statistics

41. Which of the classes has the<u>greatest</u> variability (as measured by the standard deviation) in scores?

- Class A
- Class B correct
- Class C
- Class D
- Class E

descriptive statistics

42. A recent research study randomly divided participants into two groups: One group was given Vitamin E to take daily and the other group received only a placebo pill containing no Vitamin E. The research study followed the participants for eight years to see which participants developed a particular type of cancer during that time period. What is the primary purpose of the use of random assignment for making inferences based on this study?

data collection

Select one:

- A. So that the participants in the study are likely to be representative of the larger population.
- B. So that the groups are expected to be similar in all respects except for the use of Vitamin E. correct
- Both A. and B. are primary purposes of random assignment.

43. When manufactured, pennies need a beveled edge (slightly angled) to help pop them out of the press. For this reason, it has been conjectured that spinning a penny on its edge is more likely to land with the tail side up than with the head side up. Suppose you investigate by spinning a penny 15 times (put it on its edge and flick it to spin on its own) and that you find that the penny lands with the tail side up 13 times. You determine that if a spun penny is equally likely to land tails or heads, then the probability of 13 or more tails in 15 coin spins is 0.004. What does this analysis tell you about whether this penny is more likely to land tails than heads if spun a large number of times?

significance

- Getting 13 tails in 15 spins likely happened just by chance and therefore this penny has a 50-50 chance to land tails when spun a large number of times.
- There is strong evidence that this coin is more likely to land tails than heads if spun a large number of times. correct
- These results prove that this penny is more likely to land tails than heads when spun a large number of times.
- Nothing, spinning the penny only 15 times does not produce conclusive evidence either way.

44. For which outcome would you be more convinced that this coin is more likely to land tails when spun?
Select one:

significance

- 13 tails in 15 coin spins
- 130 tails in 150 coin spins correct
- They are equally convincing because 13/15 = 130/150

Concepts

45. Suppose that a random sample of 41 state college students is asked to measure the length of their right foot in centimeters. A 95% confidence interval for the mean foot length for students at this university turns out to be (21.709, 25.091). Based on this interval, what can we say about the claim that the mean foot length for students at this school is 25 cm?

signifiance

confidence

- We have convincing evidence that the mean foot length at this school is not 25cm because 25 is near the right-hand endpoint of the interval.
- We don't have evidence that the mean foot length at this school differs from 25cm because 25 is inside the confidence interval. correct
- We have evidence that the mean foot length at this school is 25cm because 25 is inside the confidence interval.
- We can't make any statements about the claim based on the confidence interval, we would need the p-value.

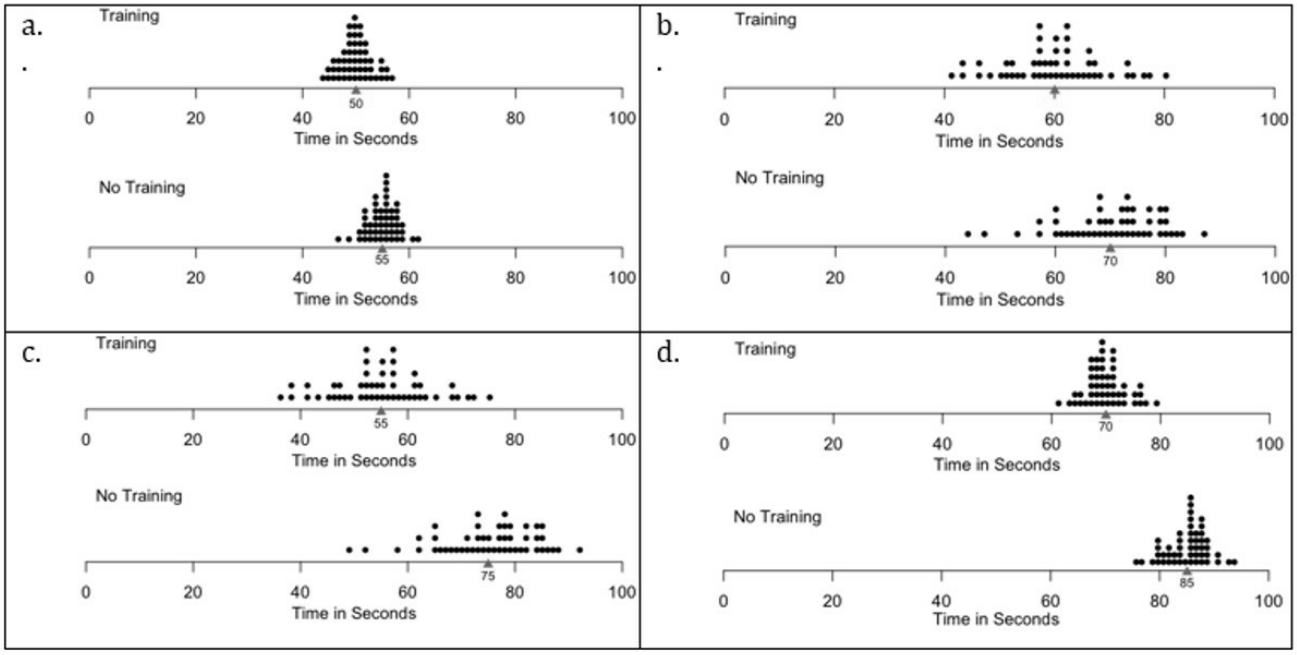
46. Suppose your teacher believes the confidence interval found in the previous question is too wide. She wants to know what could have been done to produce a narrower confidence interval and therefore a more precise estimate of the mean foot length for students at this university.

confidence

For each suggestion below, answer True, False or Can't Tell for whether this change would produce a narrower confidence interval.

	Yes	No	Can't Tell
Increase the sample size to 150	X		
Increase the confidence level to 99%		X	

Use the following information to answer the question below. There are 100 students at a summer camp that trains athletes to run a particular track race. To see whether adding weight training to the program can increase their speed, 50 athletes are randomly assigned to receive an additional weight-training program (the Training group) while the other 50 athletes do not receive the weight-training program (the No Training group). At the end of camp, all of the athletes from both groups run the same race and their times (in seconds) are recorded. Below are four pairs of hypothetical dotplots of their race times at the end of the study. A red triangle marks the mean for each dotplot and the value of the mean is printed below the triangle.



47. Which pair of dotplots provides the strongest statistical evidence that the Training group ran faster (smaller times), on average, than the No Training group?

hmmm, not great wording

- ○ Pair A
- ○ Pair B
- ○ Pair C
- ○ Pair D correct

significance

You have now completed the concepts portion of the post-test.

Demographics

48. Are you female or male?

- ○ Female
- ○ Male

49. What is your age (years)? Enter a single numeric value (e.g., 19)

50. Are you a first-generation college student?

- ◯ Yes
- ◯ No
- ◯ Not Applicable - I am a high school student

51. What is your race or origin? Choose **ALL** applicable categories.

- ☐ **White**: German, Irish, Lebanese, Egyptian, etc.
- ☐ **Black, African American, or Negro** : African American, Haitian, Nigerian, etc.
- ☐ **Hispanic, Latino or Spanish origin** : Mexican, Mexican American, Puerto Rican, Cuban, Argentinean, Dominican, Salvadoran, Spaniard, etc.
- ☐ **American Indian or Alaska Native**: Navajo, Mayan, Tlingit, etc.
- ☐ **Asian**: Asian Indian, Chinese, Pilipino, Japanese, Korean, Vietnamese, Hmong Laotian, Thai, Pakistani, Cambodian, etc.
- ☐ **Native Hawaiian or Other Pacific Islander** : Native Hawaiian, Guamanian, Samoan, Fijian, etc.
- ☐ **Some other race or origin**: Provide race(s) or origin(s) below

52. What is the most recent Statistics course you have taken, prior to this class?

- ◯ High School non-AP Stats
- ◯ High School AP Stats
- ◯ 1 other College Stats course
- ◯ More than 1 other College Stats course
- ◯ No other Stats course in High School or College

53. How would you best classify your status as a student?

- ◯ High school student
- ◯ Freshman in college
- ◯ Sophomore in college
- ◯ Junior in college
- ◯ Senior in college
- ◯ Fifth or more year in college
- ◯ Non-traditional/part-time student in college
- ◯ Graduate student

54. If you are in college, how would you best describe your primary field of interest/study?

- ◯ Social sciences (including, but not limited to, psychology, sociology, kinesiology, athletic trainer, social work, political science, communication, accounting, business, economics, education, women's studies, criminal justice, etc.)
- ◯ Natural and applied sciences (including, but not limited to, biology, chemistry, physics, engineering, mathematics, statistics, agriculture, computer sciences, nursing, environmental studies, pre-med, etc.)
- ◯ Arts and humanities (including, but not limited to, art, music, photography, philosophy, theology, religion, classics, languages, english, dance, history, theater, etc.)
- ◯ Undeclared/Undecided
- ◯ I am not in college
- ◯ Other (please specify)

55. What is your current grade point average (GPA) on a 4 point scale (4.0 is max)? Please estimate if you don't know; give only one single numeric response. If you do not yet have a grade point average, please enter 99.

56. We would like to know what score you received on the MATH portion of the ACT or SAT.

- ◯ I will provide my SAT Math score
- ◯ I will provide my ACT Math score
- ◯ I have not taken the ACT or the SAT / prefer not to answer

57. My SAT Math score was (should be a number between 200 and 800)

58. My ACT Math score was (should be a number between 1 and 36)

59. What grade do you anticipate receiving in this course?

- ◯ A+
- ◯ A
- ◯ A-
- ◯ B+
- ◯ B
- ◯ B-
- ◯ C+
- ◯ C
- ◯ C-
- ◯ D+
- ◯ D
- ◯ D-
- ◯ F

You've reached the end of the post-test. When you click "done" below you will submit your final answers.