E Chapter 9 Exercises

Construct and interpret each specified confidence interval.

1. Two math teachers each believe that their own very large class is doing better than the other class. The teachers decide to determine whose class is doing better by looking at scores from a recent exam. A random sample of 40 scores from Class A yields a mean exam score of 88.5. Assume that the population standard deviation of the exam scores for Class A is 5.7. A random sample of 37 scores from Class B yields a mean exam score of 85.3. Assume that the population standard deviation of the exam scores for Class B is 6.2. Construct and interpret a 95% confidence interval for the true difference between the mean exam scores for Classes A and B.

2. Insurance companies assert that more accidents are caused by people who talk on the phone while driving than by people who do not. Cellular phone companies dispute this assertion. Independent studies were done by an insurance company and a cell phone company. The results are in the following table. Construct and interpret a 95% confidence interval for the true difference between the proportions of accidents occurring while the driver was talking on the phone for the populations from which the samples were drawn for the two studies.

Number of Accidents

	Driver on Phone	Driver Not on Phone
Cell Phone Company Study	44	50
Insurance Company Study	71	63

3. To determine how well a new drug reduces a fever, 10 adults running a fever in a hospital agree to take the new drug instead of the traditional treatment. Their temperatures are taken before the drug is administered and 30 minutes after taking the drug. The results are shown in the following table. Construct and interpret a 99% confidence interval for the mean change in temperatures of patients after taking this new drug.

Patient Temperatures (in °F)

First Temperature	100.1	101.3	102.1	102.7	101.9	100.8	103.1	102.5	103.5	101.7
Second Temperature	98.9	99.1	99.2	99.0	98.7	98.6	99.4	99.2	100.1	99.2

4. Voters in a dry county (meaning no alcohol is sold in the county) will soon decide whether the county should remain dry. Local businesspeople fear that more people in the food industry than in the general population favor the sale of alcohol. A survey of local restaurant and convenience store owners is conducted, as well as a survey of the general population. The results of the surveys are shown in the following table. Construct and interpret a 90% confidence interval for the true difference between the population proportions of the food industry owners and the general population who favor the sale of alcohol.

Results of Survey

	Food Industry	General Population
Favor Alcohol Sale	54	32
Oppose Alcohol Sale	19	20

5. Does an apple a day keep the doctor away? To test this theory, a pediatrician asks 12 children to be a part of a study. With parental consent, the number of doctor's visits from the previous six months is recorded for each child. The children are then asked to eat an apple each day for the next six months, after which the number of doctor's visits for that time period is again recorded for each child. Use the following table to construct and interpret a 95% confidence interval for the true mean change in the number of doctor's visits during a six-month period for children who eat an apple a day for six months.

Number of Doctor's Visits												
Without Apples	2	1	2	2	3	0	4	1	2	1	2	0
With Apples	1	1	0	2	2	1	1	2	0	0	2	1

6. Who makes better grades, students who live on-campus or off-campus? To answer this question, suppose you survey both types of students on your campus, asking each to confidentially give you their GPAs. For the 28 on-campus students surveyed, you calculate their mean GPA to be 3.15 with a standard deviation of 0.76 points. For the 26 off-campus students surveyed, you calculate their mean GPA to be 3.32 with a standard deviation of 0.68 points. Assuming that both population distributions are approximately normal and the population variances are equal, construct and interpret a 90% confidence interval for the true difference between the mean GPAs of students who live on-campus and off-campus.

7. A popular magazine is conducting a study in order to rank each state according to the overall health of its citizens. One measure that is used is the mean number of times each citizen exercises per week. For the 85 people surveyed in State A, the mean exercise rate was 1.9 times per week. For the 91 people surveyed in State B, the mean exercise rate was 2.3 times per week. Assume that the population standard deviations of the citizens' exercise rates are 0.5 times per week for State A and 1.1 times per week for State B. Construct and interpret a 95% confidence interval for the true difference between the mean exercise rates for these two states.

8. A research firm is hired by a snack food company to determine where it should focus its resources for a new advertising campaign. Specifically, it is interested in comparing the snack food preferences of adults and children. To do this, 100 adults and 100 children are surveyed. Among the adults, 62% say that they prefer salty over sweet snack food. Among the children, 54% say that they prefer salty over sweet snack food. Construct and interpret a 95% confidence interval for the true difference between the population proportions of adults and children who prefer salty over sweet snack food.

9. Comparing results on standardized tests is a very common way to evaluate programs within certain university settings. The Board of Trustees of State Institutions for Higher Learning (IHL) in one state often evaluates programs based on how students perform on these tests. Suppose that in 2018, the land grant university reported that a random sample of 101 students who took the GRE had a mean verbal score of 464.3. Also in 2018, the State University reported that a random sample of 216 students who took the GRE had a mean verbal score of 455.8. Assume that the population standard deviations of students' GRE verbal scores are 5.1 for the land grant university and 7.4 for the State University. Construct and interpret a 90% confidence interval for the true difference between the population means of students' GRE verbal scores for the land grant university and the State University.

10. A television station is interested in the number of televisions that the average family has in its home. The station executives performed a survey in two different areas of town to see if there was a difference by area. After surveying 20 homes in Area A, they found that the mean number of televisions found in each home was 2.4 with a standard deviation of 0.5. In Area B, they found that after sampling 15 homes, the mean number of televisions was 1.9 with a standard deviation of 0.7. Assume that both population distributions are approximately normal and the population variances are not the same. Construct and interpret a 90% confidence interval to estimate the true difference between the mean numbers of TVs per home in the two areas.

11. One petroleum company claims that using its engine-cleaning product will improve a car's gas mileage. It was added to six cars, and here are the before and after gas mileages (in miles per gallon). Construct and interpret a 95% confidence interval for the true mean improvement in gas mileage for cars that use the engine-cleaning product.

Gas Mileage (in Miles per Gallon)

Without Engine Cleaner	29	48	43	35	21	19
With Engine Cleaner	31	50	46	43	29	20

12. Have you ever noticed that air currents can speed up air travel in certain directions? With this in mind, a businessperson wants to determine how much faster the return trip from Dallas to Atlanta is than the initial trip from Atlanta to Dallas. He records the times for his next seven flights to and from Dallas and obtains the following data. Assuming that both population distributions are approximately normal and the variances of the two populations are not the same, construct and interpret a 90% confidence interval for the true difference between the mean times for flights from Atlanta to Dallas and flights from Dallas to Atlanta. (**Hint:** Convert all times to minutes.)

Flight Times

Atlanta to Dallas	Dallas to Atlanta
1 h 49 min	1 h 32 min
1 h 51 min	1 h 23 min
2 h 03 min	1 h 38 min
1 h 47 min	1 h 26 min
1 h 53 min	1 h 30 min
2 h 01 min	1 h 19 min
1 h 45 min	1 h 28 min

13. A coach wants to compare the consistency of the two best batters on his baseball team. The coach considers the number of times per game that each player gets on base. For a sample of 15 games, John's sample variance is 4.389 and Mark's sample variance is 3.981. Assume that the population distributions of the numbers of times per game that the players get on base are both approximately normal. Construct and interpret a 95% confidence interval for the ratio of the population variances for the two different batters.

14. To ensure that the braking time of a client's car meets the manufacturer's specifications, a mechanic decides to compare the consistency of its braking distances to a car that is known to meet the manufacturer's specifications. The mechanic measures the braking distance, in feet, of the client's car 12 times and calculates a sample variance of 313.6. He then measures the braking distance of the control car 12 times and calculates a sample variance of 304.8. Assume that the population distributions of the braking distances are approximately normal for both cars. Construct and interpret a 99% confidence interval for the ratio of the population variances for the two different cars.

15. A professor decides to compare the variance in the annual salaries of associate professors with the variance in the annual salaries of full professors. A sample of 15 associate professors reveals a sample variance of 609,961. A sample of 14 full professors reveals a sample variance of 674,041. Construct and interpret a 90% confidence interval for the ratio of the population variances for the different ranks of professors.