

Confidence Intervals Two Sample Difference in Means Free Response

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Question 1

Qualification: AP Statistics

Areas: Confidence Intervals

Subtopics: Matched Pairs T Interval For A Difference In Means, Two Sample T Interval For Difference Of Means

Paper: Part-A / Series: 2004-Form-B / Difficulty: Somewhat Challenging / Question Number: 4

4. The principal at Crest Middle School, which enrolls only sixth-grade students and seventh-grade students, is interested in determining how much time students at that school spend on homework each night. The table below shows the mean and standard deviation of the amount of time spent on homework each night (in minutes) for a random sample of 20 sixth-grade students and a separate random sample of 20 seventh-grade students at this school.

	Mean	Standard Deviation
Sixth-grade students	27.3	10.8
Seventh-grade students	47.0	12.4

Based on dotplots of these data, it is not unreasonable to assume that the distribution of times for each grade were approximately normally distributed.

- (a) Estimate the difference in mean times spent on homework for all sixth- and seventh-grade students in this school using an interval. Be sure to interpret your interval.
- (b) An assistant principal reasoned that a much narrower confidence interval could be obtained if the students were paired based on their responses; for example, pairing the sixth-grade student and the seventh-grade student with the highest number of minutes spent on homework, the sixth-grade student and seventh-grade student with the next highest number of minutes spent on homework, and so on. Is the assistant principal correct in thinking that matching students in this way and then computing a matched-pairs confidence interval for the mean difference in time spent on homework is a better procedure than the one used in part (a) ? Explain why or why not.

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Question 2

Qualification: AP Statistics
Areas: Confidence Intervals
Subtopics: Interpreting a Confidence Interval, Two Sample T Interval For Difference Of Means
Paper: Part-B / Series: 2005 / Difficulty: Hard / Question Number: 6



6. Lead, found in some paints, is a neurotoxin that can be especially harmful to the developing brain and nervous system of children. Children frequently put their hands in their mouth after touching painted surfaces, and this is the most common type of exposure to lead.

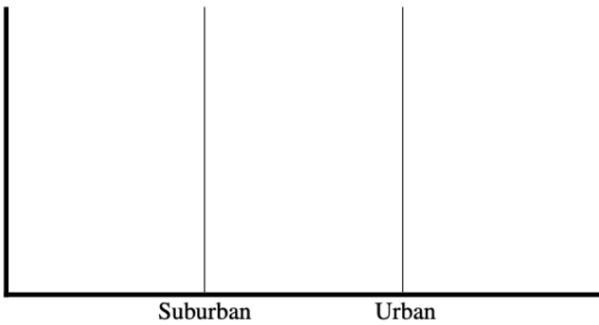
A study was conducted to investigate whether there were differences in children’s exposure to lead between suburban day-care centers and urban day-care centers in one large city. For this study, researchers used a random sample of 20 children in suburban day-care centers. Ten of these 20 children were randomly selected to play outside; the remaining 10 children played inside. All children had their hands wiped clean before beginning their assigned one-hour play period either outside or inside. After the play period ended, the amount of lead in micrograms (mcg) on each child’s dominant hand was recorded.

The mean amount of lead on the dominant hand for the children playing inside was 3.75 mcg, and the mean amount of lead for the children playing outside was 5.65 mcg. A 95 percent confidence interval for the difference in the mean amount of lead after one hour inside versus one hour outside was calculated to be $(-2.46, -1.34)$.

A random sample of 18 children in urban day-care centers in the same large city was selected. For this sample, the same process was used, including randomly assigning children to play inside or outside. The data for the amount (in mcg) of lead on each child’s dominant hand are shown in the table below.

Urban Day-Care Centers									
Inside	6	5	4	4	4.5	5	4.5	3	5
Outside	15	25	18	14	20	13	11	22	20

- (a) Use a 95 percent confidence interval to estimate the difference in the mean amount of lead on a child’s dominant hand after an hour of play inside versus an hour of play outside at urban day-care centers in this city. Be sure to interpret your interval.
- (b) On the figure below,
- Using the vertical axis for the mean amount of lead, plot the mean for the amounts of lead on the dominant hand of children who played inside at the suburban day-care center and then plot the mean for the amounts of lead on the dominant hand of children who played inside at the urban day-care center.
 - Connect these two points with a line segment.
 - Plot the two means (suburban and urban) for the children who played outside at the two types of day-care centers.
 - Connect these two points with a second line segment.



- (c) From the study, what conclusions can be drawn about the impact of setting (inside, outside), environment (suburban, urban), and the relationship between the two on the amount of lead on the dominant hand of children after play in this city? Justify your answer.



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Question 3

Qualification: AP Statistics

Areas: Confidence Intervals

Subtopics: Two Sample T Interval For Difference Of Means

Paper: Part-A / Series: 2006 / Difficulty: Medium / Question Number: 4

4. Patients with heart-attack symptoms arrive at an emergency room either by ambulance or self-transportation provided by themselves, family, or friends. When a patient arrives at the emergency room, the time of arrival is recorded. The time when the patient's diagnostic treatment begins is also recorded.

An administrator of a large hospital wanted to determine whether the mean wait time (time between arrival and diagnostic treatment) for patients with heart-attack symptoms differs according to the mode of transportation. A random sample of 150 patients with heart-attack symptoms who had reported to the emergency room was selected. For each patient, the mode of transportation and wait time were recorded. Summary statistics for each mode of transportation are shown in the table below.

Mode of Transportation	Sample Size	Mean Wait Time (in minutes)	Standard Deviation of Wait Times (in minutes)
Ambulance	77	6.04	4.30
Self	73	8.30	5.16

- (a) Use a 99 percent confidence interval to estimate the difference between the mean wait times for ambulance-transported patients and self-transported patients at this emergency room.
- (b) Based only on this confidence interval, do you think the difference in the mean wait times is statistically significant? Justify your answer.

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Question 4

Qualification: AP Statistics

Areas: Confidence Intervals

Subtopics: Interpreting a Confidence Interval, Constructing a Confidence Interval, Two Sample T Interval For Difference Of Means

Paper: Part-A / Series: 2009 / Difficulty: Medium / Question Number: 4

4. One of the two fire stations in a certain town responds to calls in the northern half of the town, and the other fire station responds to calls in the southern half of the town. One of the town council members believes that the two fire stations have different mean response times. Response time is measured by the difference between the time an emergency call comes into the fire station and the time the first fire truck arrives at the scene of the fire.

Data were collected to investigate whether the council member's belief is correct. A random sample of 50 calls selected from the northern fire station had a mean response time of 4.3 minutes with a standard deviation of 3.7 minutes. A random sample of 50 calls selected from the southern fire station had a mean response time of 5.3 minutes with a standard deviation of 3.2 minutes.

- (a) Construct and interpret a 95 percent confidence interval for the difference in mean response times between the two fire stations.
- (b) Does the confidence interval in part (a) support the council member's belief that the two fire stations have different mean response times? Explain.

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Question 5

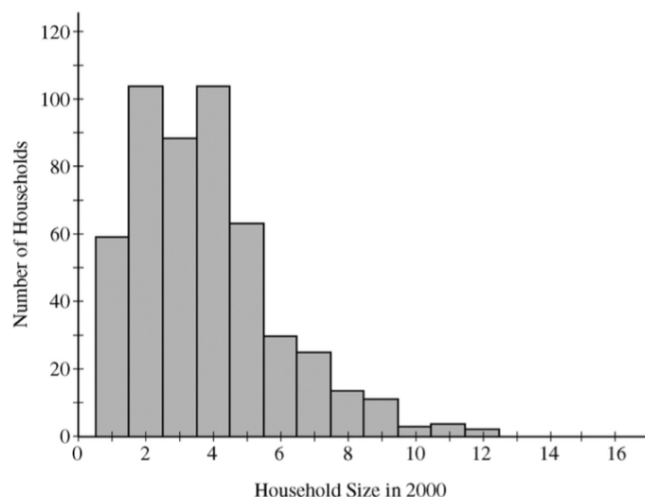
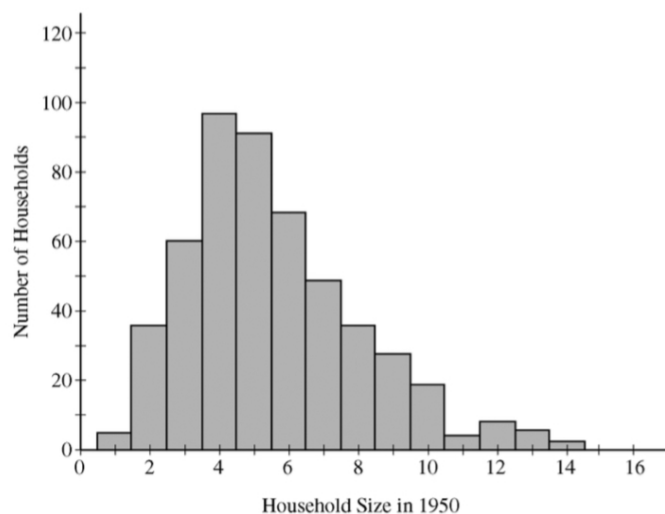
Qualification: AP Statistics

Areas: Data - One Variable, Confidence Intervals

Subtopics: Comparing Distributions, Histograms, Conditions for Interval , Two Sample T Interval For Difference Of Means

Paper: Part-A / Series: 2012 / Difficulty: Easy / Question Number: 3

3. Independent random samples of 500 households were taken from a large metropolitan area in the United States for the years 1950 and 2000. Histograms of household size (number of people in a household) for the years are shown below.



- (a) Compare the distributions of household size in the metropolitan area for the years 1950 and 2000.
- (b) A researcher wants to use these data to construct a confidence interval to estimate the change in mean household size in the metropolitan area from the year 1950 to the year 2000. State the conditions for using a two-sample t -procedure, and explain whether the conditions for inference are met.

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