

AP Stats POW #13

Answer each question as thoroughly as possible.

1. At an archaeological site that was an ancient swamp, the bones from 20 brontosaurus skeletons have been unearthed. The bones do not show any sign of disease or malformation. It is thought that these animals wandered into a deep area of the swamp and became trapped in the swamp bottom. The 20 left femur bones (thigh bones) were located and 4 of these left femur are to be randomly selected without replacement for DNA testing to determine gender.
 - a. Let X be the number out of the 4 selected left femurs that are from males. Based on how these bones were sampled, explain why the probability distribution of X is not binomial.
 - b. Suppose that the group of 20 brontosaurus whose remains were found in the swamp had been made up of 10 males and 10 females. What is the probability that all 4 in the sample to be tested are male?
 - c. The DNA testing revealed that all 4 femurs tested were from males. Based on this result and your answer from part (b), do you think that males and females were equally represented in the group of 20 brontosaurus stuck in the swamp? Explain.
 - d. Is it reasonable to generalize your conclusion in part (c) pertaining to the group of 20 brontosaurus to the population of all brontosaurus? Explain why or why not.
2. 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 the 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, and so on. Is the assistant principal correct in thinking that matching students in this way and then computing a matched-pair 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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3. A large company has two shifts - a day shift and a night shift. Parts produced by the two shifts must meet the same specifications. The manager of the company believes that there is a difference in the proportion of parts produced within specifications by the two shifts. To investigate this belief, random samples of parts that were produced on each of these shifts were selected. For the day shift, 188 of its 200 selected parts met specifications. For the night shift, 180 of its 200 selected parts met specifications.
 - a. Use a 96% confidence interval to estimate the difference in the proportions of parts produced within specifications by the two shifts.

 - b. Based only on this confidence interval, do you think that the difference in the proportions of parts produced within specifications by the two shifts is significantly different from 0? Justify your answer.