



AP Statistics 2000 Student Samples

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2. Anthropologists have discovered a prehistoric cave dwelling that contains a large number of adult human footprints. To study the size of the adults who used the cave dwelling, they randomly selected 20 of the footprints from the population of all footprints in the cave and measured the length of those footprints. Some statistics resulting from this random sample are as follows.

Sample size	20	Minimum	15.2 cm	> 3.5
Mean	24.8 cm	First quartile	18.7 cm	> 2.8
Standard deviation	7.5 cm	Median	21.5 cm	> 8.5
		Third quartile	30.0 cm	> 7.0
		Maximum	37.0 cm	

The anthropologists would like to construct a 95 percent confidence interval for the mean foot length of the adults who used the cave dwelling.

- (a) What assumptions are necessary in order for this confidence interval to be appropriate?

- It is necessary to assume that foot lengths of the adults who used the cave dwelling are normally distributed.
- It is necessary to assume that the footprints were left by random individuals. In other words, the confidence interval is not appropriate if most of the footprints in the cave were left by the same individual, with only a few by other individuals.

- (b) Discuss whether each of the assumptions listed in your response to (a) appears to be satisfied in this situation.

At least one of the above assumptions seems not to be satisfied. If the foot lengths of these adults is normally distributed and the sample of footprints represents each adult who lived in the cave about uniformly, then the foot lengths in the sample should be approximately normally distributed. In this case, the data should be approximately symmetric about the mean/median. This does not seem to be the case. The difference in foot length between the second and third quartiles is 8.5 cm — more than the difference between the minimum and second quartile. The vastly asymmetric spread of data implies that one of the assumptions is wrong.

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I would guess that the record of the assumptions in (a) is most likely not correct. I would suggest that the anthropologists use foot length and other distinguishing characteristics of footprints to identify sets of footprints created by the same adult. They could then average the foot length of each of the adults. Although not perfect, this method would yield a more valid confidence interval.

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The 20 footprints are randomly selected. The footprints all come from adults. It is equally likely for a female adult footprint to be chosen as it is for a male footprint to be chosen. The same adult's footprint isn't chosen more than once. The distribution of foot lengths of prehistoric adults is distributed approximately normally. All footprints came from adults using the cave dwelling.

- (b) Discuss whether each of the assumptions listed in your response to (a) appears to be satisfied in this situation.

The 20 footprints were selected randomly, but it wasn't made sure that all the footprints were made by adults who used the cave dwelling. It wasn't made sure that the footprint of the same person wasn't selected more than once. It doesn't appear that the footprints were distributed normally since the mean is greater than the median, indicating a skewed right distribution. It wasn't made sure that females' and males' footprints had an equally likely chance of being chosen.

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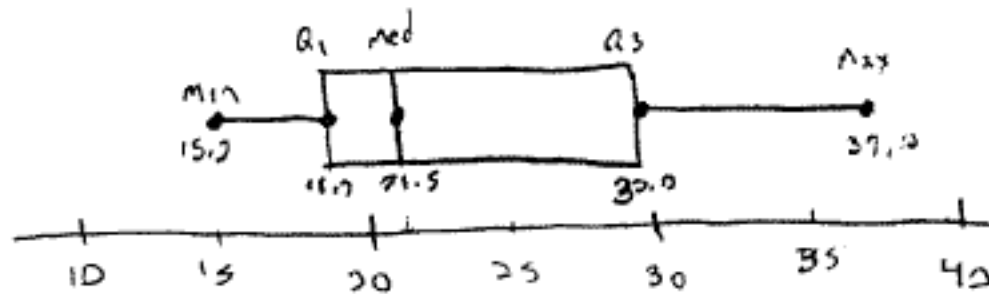
The anthropologists would like to construct a 95 percent confidence interval for the mean foot length of the adults who used the cave dwelling.

- (a) What assumptions are necessary in order for this confidence interval to be appropriate?

The distribution of the population of foot lengths of adults who used the cave dwelling must be normal.

That many of the foot prints did not come from the same person. Or that one person made more foot prints than the others.

- (b) Discuss whether each of the assumptions listed in your response to (a) appears to be satisfied in this situation.



Based on the boxplot constructed above the distribution of the sample of foot lengths of the adults who used the cave dwelling, does not appear to be normal. It appears as though it is skewed to the right.

Maybe the smaller people spent most of their time in the cave and there for made more foot prints since distribution is skewed to the right. The bigger people with bigger feet could have been out hunting or building and there for would have made fewer footprints.

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