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Assignment 3

Due: Friday October 9, 2020 11:59 PM (Atlantic Daylight Time)

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After you have completed the assignment, please save, scan, or take photos of your work and upload your files to the questions below. Crowdmark accepts PDF, JPG, and PNG file formats.

Q1 (4 points)

One random sample of 100 human genes from the human genome (Example 4.1) was found to have a median length of 2150 nucleotides. Specify whether each of the following statements is true or false.

- (a) The median gene length of all human genes is 2150 nucleotides.
- (b) The median gene length of all human genes is estimated to be 2150 nucleotides.
- (c) The sample median has a sampling distribution with a standard error.
- (d) A random sample of 200 genes would likely to yield an estimate of the median closer to the population median than a random sample of 100 genes.

Q2 (10 points)

Amorphophallus johnsonii is a plant growing in West Africa, and it is better known as a "corpse flower". Its common name comes from the fact that when it flowers, it gives off a "powerful aroma of rotting fish and faeces" (Beath 1996). The flower smells this way because their principal pollinators are carrion beetles, who are attracted to such a smell. Beath (1996) observed the number of carrion beetles that arrive per night to flowers of this species. The data are as follows:

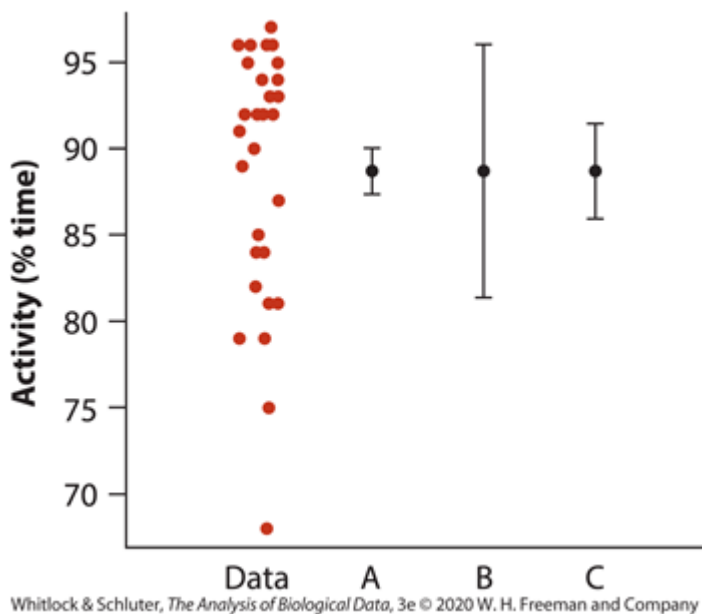
51, 45, 61, 76, 11, 117, 7, 132, 52, 149

- (a) What is the mean of beetles per flower?
- (b) What is the standard deviation of beetles per flower?
- (c) What is the standard error of the mean?

- (d) Give an approximate 95% confidence interval of the mean. Provide the lower and upper limits.
- (e) Is it correct to say "there is a 95% chance that the population mean number of beetles per flower is within the the calculated 95% confidence interval from the sample data"?
- (f) Interpret the 95% confidence level through a hypothetical scenario that a large number of samples could be collected.
- (g) If you had been given 100 data points instead of 10, would you expect the mean to be greater, less than, or about the same as the mean of this sample?
- (h) If you had been given 100 data points instead of 10, would you expect the standard deviation to be greater, less than, or about the same as the standard deviation of this sample?
- (i) If you had been given 100 data points instead of 10, would you expect the standard error to be greater, less than, or about the same as the standard error of this sample?
- (j) If you had been given 100 data points instead of 10, would you expect the 95% confidence interval to be wider, narrower, or about the same as the 95% confidence interval from this sample?

Q3 (3 points)

In the graph below:



- (a) Which of the error bars, A, B or C, indicates the standard deviation?
- (b) Which of the error bars indicates the standard error of the mean?
- (c) Which of the error bars indicates a 95% confidence interval for the mean?

Q4 (6 points)

Imagine that a collection of 1600 pea plants from one of Mendel's experiments had 900 that were tall plants with green pods, 300 that were tall with yellow pods, 300 that were short with green

pods, and 100 that were short with yellow pods.

- (a). Are "tall" and "green pods" mutually exclusive traits for this collection of plants? Why?
- (b) Are "tall" and "green pods" independent traits for this collection of plants? Why?
- (c) A plant is randomly selected from this collection of 1600 plants. What is the probability that it is tall or it has green pods?

Q5 (4 points)

A seed randomly blows around a complex habitat. It may land on any of three different soil types: a high-quality soil that gives a 0.8 chance of seed survival, a medium-quality soil that gives a 0.3 chance of survival, and a low-quality soil that gives only a 0.1 chance of survival. These three soil types (high, medium, and low) are present in the habitat in proportions 40:40:20, respectively. The probability that a seed lands on a particular soil type is proportional to the frequency of that type in the habitat.

- (a) What is the probability of survival of the seed, assuming that it lands?
- (b) Assume that the seed has a 0.2 chance of dying before it lands in the habitat. What is the overall probability of survival?