Unit 5 Progress Check: FRQ

1. Show all your work. Indicate clearly the methods you use, because you will be scored on the correctness of your methods as well as on the accuracy and completeness of your results and explanations.

Researchers are studying two populations of sea turtles. In population D, 30 percent of the turtles have a shell length greater than 2 feet. In population E, 20 percent of the turtles have a shell length greater than 2 feet. From a random sample of 40 turtles selected from D, 15 had a shell length greater than 2 feet. From a random sample of 60 turtles selected from E, 11 had a shell length greater than 2 feet. Let $\hat{p}_D$ represent the sample proportion for D, and let $\hat{p}_E$ represent the sample proportion for E.

(a) What is the value of the difference $\hat{p}_D - \hat{p}_E$? Show your work.

(b) What are the mean and standard deviation of the sampling distribution of the difference in sample proportions $\hat{p}_D - \hat{p}_E$? Show your work and label each value.

(c) Can it be assumed that the sampling distribution of the difference of the sample proportions $\hat{p}_D - \hat{p}_E$ is approximately normal? Justify your answer.

(d) Consider your answer in part (a). What is the probability that $\hat{p}_D - \hat{p}_E$ is greater than the value found in part (a)? Show your work.

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2. Show all your work. Indicate clearly the methods you use, because you will be scored on the correctness of your methods as well as on the accuracy and completeness of your results and explanations.

The following histogram shows the distribution of house values in a certain city. The mean of the distribution is $403,000 and the standard deviation is $278,000.
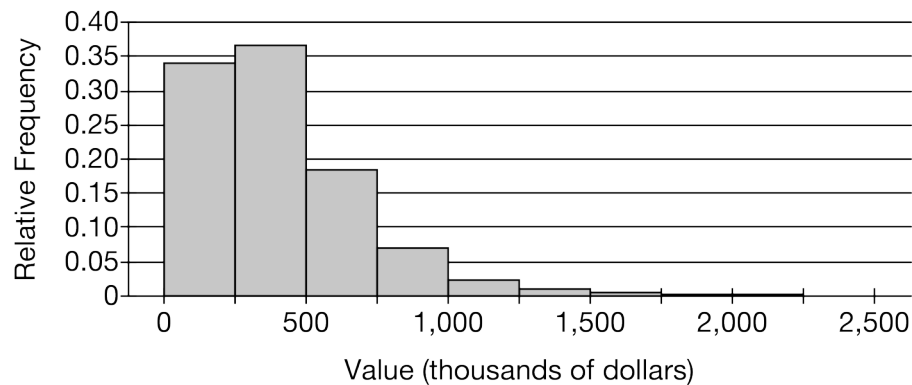

(a) Suppose one house from the city will be selected at random. Use the histogram to estimate the probability that the selected house is valued at less than $500,000. Show your work.

(b) Suppose a random sample of 40 houses are selected from the city. Estimate the probability that the mean value of the 40 houses is less than $500,000. Show your work.

To estimate a population mean μ, the sample mean $\bar{x}$ is often used as an estimator. However, a different estimator is called the sample midrange, given by the formula $\dfrac{\text{sample minimum} + \text{sample maximum}}{2}$.

(c) The following table shows the values, in thousands of dollars, of 40 randomly selected houses in the city.

34	38	95	110	137	140	155	155	169	207
209	217	274	314	314	323	343	347	349	363
369	373	388	389	397	416	448	450	483	487
488	516	571	595	600	738	762	769	863	1,084

(i) Calculate the sample midrange for the data.

(ii) Explain why the sample midrange might be preferred to the sample mean as an estimator of the population mean.

(d) To investigate the sampling distribution of the sample midrange, a simulation is performed in which 100 random samples of size $n = 40$ were selected from the population of house values. For each sample, the sample midrange was calculated and recorded on the following dotplot. The mean of the distribution of sample midranges is $617,000 with standard deviation $136,000.

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Sample Midrange (thousands of dollars)
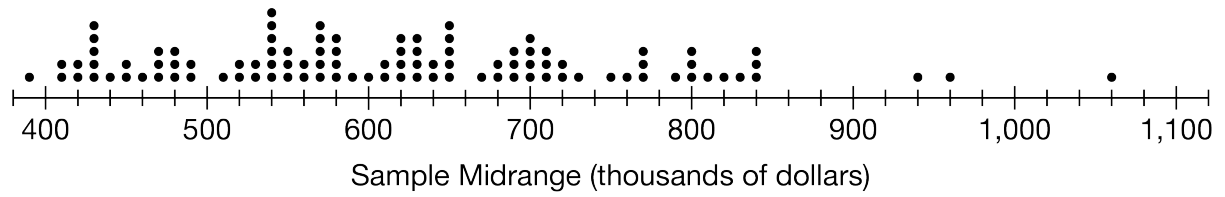
Based on the results of the simulation, explain why the sample mean might be preferred to the sample midrange as an estimator of the population mean.