Unit 6 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.

A recent survey collected information on television viewing habits from a random sample of 1,000 people in the United States. Of those sampled, 37 percent indicated that their favorite sport to watch on television was American football.

(a) Construct and interpret a 95 percent confidence interval for the proportion of all people in the United States who would indicate that their favorite sport to watch on television is American football.

(b) Based on your answer to part (a), is it reasonable to believe that 33 percent is the actual percent of people in the United States whose favorite sport to watch on television is American football? Justify your answer.

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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.

A fair die, with its faces numbered from 1 to 6, is one in which each number is equally likely to land face up when the die is rolled. On a fair die, the probability that the number 6 will land face up is $\frac{1}{6}$. A group of students wanted to investigate a claim about manipulating a fair die so that it favors one outcome. The claim states that if a fair die is put into an oven and baked at $200\,^\circ\mathrm{F}$ for 10 minutes, the inside of the die will begin to melt. When the die cools, the inside will be solid again, but with more weight toward the bottom. This shift in weight will cause the face that was up when the die cooled to land up more often that the other faces.

The students obtained a fair die and baked it according to the preceding directions. The die cooled with the number 6 face up. After the die cooled, they rolled the die 200 times, and the number 6 landed face up 43 times. Let p represent the population proportion of times the number 6 will land face up on the baked die if the die could be rolled an infinite number of times.

(a) Clarke, one of the students, constructed a 95 percent confidence interval for p as 0.215 ± 0.057. Does the interval provide convincing statistical evidence that the number 6 will land face up more often on the baked die than on a fair die? Explain your reasoning.

(b) Aurelia, another student, suggested they conduct a significance test to investigate the claim. She tested the hypotheses $\mathrm{H}_0 : p = \frac{1}{6}$ versus $\mathrm{H}_\mathrm{a} : p > \frac{1}{6}$ at the significance level of $\alpha = 0.05$. She obtained a test statistic of 1.83 with a p-value of 0.033. Do the results of the significance test agree with the results of Clarke's confidence interval in part (a)? Explain your reasoning.

(c) Two standard normal curves are shown below, one for the confidence interval calculated in part (a) and one for the significance test conducted in part (b).

(i) For the confidence interval curve, label the critical values for the 95% confidence level and shade the area that represents values in the outer 5%.

(ii) For the significance test curve, label the critical value for the 5% significance level and shade the area representing the values of z that would lead to a rejection of the null hypothesis in part (b).

Confidence Interval   Hypothesis Test
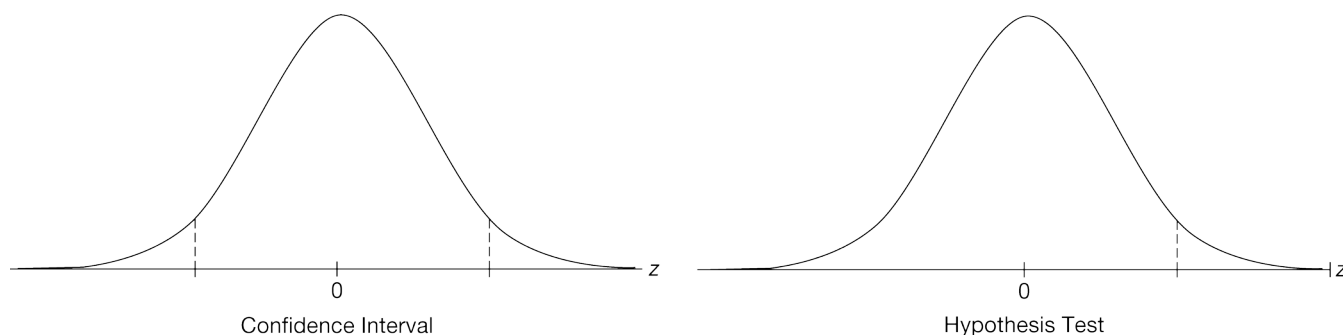
(d) Joachim, a third student, noted that the confidence interval in part (a) gives plausible values of the parameter as an interval between two values. He suggested that they develop a one-sided confidence interval because they were only concerned with whether the number 6 was landing face up more often than expected, not less often. The one sided-interval will determine a value L such that all plausible values of p are greater than L. The formula for L is

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$$L = \hat{p} + z^* \sqrt{\frac{\hat{p}(1-\hat{p})}{n}}.$$

(i) Determine the values of z^* needed to create the one-sided 95 percent confidence interval. Then calculate the value of L.

(ii) Do the results of Joachim's one-sided confidence interval agree with results of Aurelia's significance test in part (b)? Explain your reasoning.