STAT 301 HW7 due Wed Oct 7

You may work with one partner on this assignment, submitting one report with both names, provided that both students contribute substantially to the work. Word-processed reports are preferred to hand-written ones. Please copy/paste relevant computer output into your report as appropriate.

Abolishing Pennies?
In June of 2004, the Harris organization asked a random sample of 2136 adult Americans: "Would you favor or oppose abolishing the penny so that the nickel would be the lowest-denomination coin?" It turned out that 41% responded in favor of abolishing the penny.

a) Is 41% a parameter or a statistic? Explain.

This is a statistic because it refers to the sample of 2136 adult Americans selected by the Harris organization.

b) Let π represent the parameter of interest in this study. Explain in words what π represents.

π represents the proportion of all adult Americans who favor abolishing the penny.

Suppose that I want to test whether the sample data provide strong evidence that the proportion of all adult Americans who favor abolishing the penny is less than .5.

c) State (using the symbol π) the appropriate null and alternative hypotheses.

H_0: $\pi = .5$ H_a: $\pi < .5$

d) Calculate the value of the *z*-test statistic (by hand). Also interpret what this value reveals.

$$z = \frac{\hat{p} - \pi_0}{\sqrt{\frac{\pi_0(1-\pi_0)}{n}}} = \frac{.41 - .5}{\sqrt{\frac{.5(1-.5)}{2136}}} \approx -8.319$$

e) Determine the p-value of this test.

The p-value is the probability that a standard normal distribution is less than -8.319, which is approximately zero.

f) Would you reject the null hypothesis at the $\alpha = .01$ significance level?

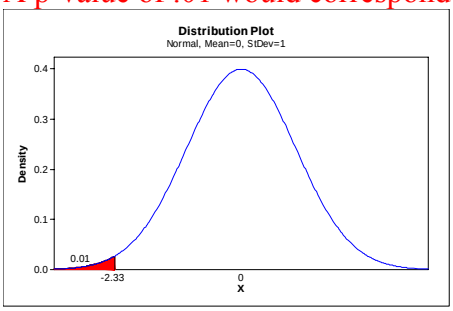
Yes, because the p-value is less than .01.

g) Summarize your conclusion about whether less than half of all adult Americans favor abolishing the penny.

The sample results provide extremely strong evidence that less than half of all adult Americans favor abolishing the penny.

h) In a random sample of 2136 adults, determine the largest value of the sample proportion that would have led to rejecting the null hypothesis at the $\alpha = .01$ significance level?

A p-value of .01 would correspond to a *z*-score of -2.33, as shown here:



Setting the test statistic $\dfrac{\hat{p}-.5}{\sqrt{\dfrac{.5(1-.5)}{2136}}}$ equal to -2.33 and solving for $\hat{p}$ gives

$\hat{p} = .5 - 2.33\sqrt{\dfrac{.5(1-.5)}{2136}} \approx 0.475$. We would reject the null hypothesis when we obtain a random sample of 2136 adults in which 47.5% or less favor abolishing the penny.