STAT 301 HW4 due Tues Jan 18

You may work with one other person on this assignment, submitting one report with both names, provided that both of you contribute substantially to the work.

Cola Discrimination?

A teacher doubted whether his students could distinguish between two different brands of cola soft drink (say, Coke and Pepsi). He presented each of his 48 students with three cups of cola. Two contained the same brand, and the third contained the other brand. Each student was asked to identify the cup containing cola that differed from the other two cups.

Let π represent the probability that a student can correctly identify the "odd" brand. The hypotheses to be tested are H_0: $\pi = 1/3$ vs. H_a: $\pi > 1/3$.

a) Describe (in words) what Type I error means in this situation.

b) Describe (in words) what Type II error means in this situation.

c) Describe (in words) what power means in this situation.

For the remaining questions, you may use either the Power Simulation applet for an approximate answer or R/Minitab for an exact answer. (Include screen captures of applet results or R/Minitab output with your answers.)

d) Determine the rejection region for this test, using the $\alpha = .05$ significance level.

e) Calculate the power of this test, using the $\alpha = .05$ significance level, when the success probability is actually $\pi = .5$. Also be sure to write this probability as Pr(X ___ *k*), where you indicate the appropriate probability distribution of X, and you will in the blank with the appropriate inequality, and you indicate the appropriate value of *k*.)

f) How would the power change if the success probability were larger? Explain why this makes sense intuitively. Then calculate the power when $\pi = 2/3$, and comment on whether this supports your answer.

g) How would the power change if the significance level were smaller? Explain why this makes sense intuitively. Then calculate the power using $\alpha = .01$ (for an alternative value of $\pi = .5$), and comment on whether this supports your answer.

h) How would the power change if the sample size were larger? Explain why this makes sense intuitively. Then calculate the power using $n = 96$ (with $\alpha = .05$ for an alternative value of $\pi = .5$), and comment on whether this supports your answer.