1. Let p denote the population proportion of (budget) LCD panels that have defective pixels. A researcher randomly selected 100 LCD panels and determined that 8 have defective pixels.

   (a) Suppose we wish to test $H_0 : p = 0.12$ versus $H_a : p \neq 0.12$ at the $\alpha = 0.05$ significance level using the score test. Approximate the p−value for this test.

   (b) In reference to 1a, does the proportion of defective panels significantly differ from 0.12? Why?

   (c) Find an approximate 95% Wald confidence interval for p.

   (d) Based upon your answer in 1c, does the proportion of defective panels significantly differ from 0.12? Why?

   (e) What is the estimated standard error of $\hat{p}$, $\widehat{se}(\hat{p})$?

   (f) What is the estimated margin of error (at 95% confidence)?

   (g) How many panels would need to be selected for the margin of error (at 95% confidence) to equal 0.03?

2. Suppose the population proportion of computer keyboards that fail is p. To infer about p, a manufacturer randomly selected 60 keyboards and determined that 6 had failed.

   (a) Find an approximate 95% Wald confidence interval for p.

   (b) Find an approximate 95% Agresti-Coull confidence interval for p.

   (c) Based upon your answer in 2b, does p significantly differ from 0.15? Why?

   (d) Based upon your answer in 2b, does p significantly differ from 0.50? Why?

   (e) Suppose we wish to test $H_0 : p = 0.50$ versus $H_a : p \neq 0.50$ at the $\alpha = 0.05$ significance level. Based upon your answer in 2b, will the p−value for the test be less than or greater than α? Why?

3. A retailer is seeking to study the satisfaction of its customers. The population proportion of satisfied customers is p. A random sample of 100 customers yielded 90 that were satisfied. We would like to determine if more than 80% of the customers are satisfied.

   (a) Test $H_0 : p = 0.8$ versus $H_a : p > 0.8$ at the $\alpha = 0.05$ significance level using the score test. *Find the test statistic and critical value, plot the rejection region, and state your decision and final conclusion.*

   (b) Find the p−value for the test in 3a.

   (c) Based upon your answer in 3b, is the proportion of satisfied customers significantly higher than 0.80? Why?

4. After smoking marijuana, 7 out of 100 subjects failed a driving test on the Iowa Driving Simulator. Only 7 out of 140 subjects *not* under the influence of marijuana failed the test. Let p_1 denote the population proportion of marijuana users that fail the test, and let p_2 denote the population proportion of drivers *not* under the influence of marijuana that fail the driving test.

   (a) Find an 80% confidence interval for $p_1 - p_2$. Is there a significant difference between the groups? Why?

   (b) Suppose we wish to test $H_0 : p_1 = p_2$ versus $H_a : p_1 \neq p_2$. Find the p−value for this test. Is there a significant difference in the proportion of marijuana users and non-marijuana users fail the test? Why?

5. A high-quality diamond cutter can receive raw diamonds from two mines: one is in Russia and the other is in Africa. The Russian mine charges slightly more for its diamonds. However, if the Russian mine has a higher proportion of "colorless" diamonds, the diamond cutter will choose to buy his diamonds from them. Let p_1 denote the proportion of colorless diamonds from the Russian mine, and let p_2 denote the proportion of colorless diamonds from the African mine. A random sample of 50 diamonds from each mine found the following:

$$\text{Russia:} \quad n_1 = 50, \text{ number of colorless} = 10$$
$$\text{Africa:} \quad n_2 = 50, \text{ number of colorless} = 6$$

   (a) Test $H_0 : p_1 = p_2$ versus $H_a : p_1 > p_2$ at the $\alpha = 0.05$ significance level. *Find the test statistic and critical value, plot the rejection region, and state your decision and final conclusion.*

   (b) Find the p−value for the test in 5a.

   (c) Based upon your analysis, is it worthwhile for the diamond cutter to pay extra for diamonds from the Russian mine? Why?