1. A skin care clinic 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 (1a).

   (c) Based upon your answer in (1b), is the proportion of satisfied customers significantly higher than 0.80? Why?

2. 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?

3. Based upon a random sample of $n = 100$ individuals, a researcher tested $H_0 : p = 0.5$ versus $H_a : p > 0.5$ (using the score test) and determined that the $p-$value for the test was 0.0749. Find a 95% Wald confidence interval for p. *Hint: You need to first find the sample proportion $\hat{p}$ from the given information.*

4. A researcher sought to summarize the relationship between migraine headaches and caffeine consumption (low, medium, high). A random sample of 135 people yielded the following contingency table.

	Caffeine Consumption		
	Low (L)	Medium (M)	High (H)
Migraine (Mig)	5	8	15
No Migraine (Mig^c)	35	42	30

   Suppose we wish to test H_0 : caffeine and migraines are independent (no association) versus H_a : caffeine and migraines are not independent (association) at the $\alpha = 0.05$ significance level.

   (a) Find the test statistic and critical value, plot the rejection region, and state your decision and final conclusion.

   (b) Approximate the $p-$value for the test using the chi-square table.

   (c) Use the χ^2-Probability Applet at

   $$\texttt{http://www.stat.uiowa.edu/~mbognar/applets/chisq.html}$$

   to precisely determine the $p-$value for the test.

   (d) Based upon your analysis, is there a significant association between caffeine and migraines? Why?

5. Consider the following two-way table which summarizes gender and job position (manager, non-manager) for 100 randomly selected employees at a large hospital.

	Male	Female
Manager	30	10
Non-Manager	30	30

   A researcher wishes to test H_0 : no association between gender and position (i.e. independent) versus H_a : association between gender and position (i.e. not independent) at the $\alpha = 0.01$ significance level.

   (a) Find the test statistic and critical value, plot the rejection region, and state your decision and final conclusion.

(b) Approximate the $p-$value for the test using the chi-square table.

(c) Use the χ^2-Probability Applet at

$$\texttt{http://www.stat.uiowa.edu/~mbognar/applets/chisq.html}$$

to precisely determine the $p-$value for the test.

(d) Based upon the $p-$value, is there a significant association between gender and position? Why?

(e) At the $\alpha = 0.05$ significance level, is there a significant association between gender and position? Why?