

HOMEWORK 11
BIOSTATISTICS (STAT:3510; BOGNAR)

NAME: _____

Print this pdf file (do not use notebook paper), show your work in the provided space, use a scanning app to scan pages (in order) into a single pdf file, submit in Gradescope. Be sure to get entire page in each shot — lay each page flat when scanning. You can use an iPad/tablet too. The Gradescope app works well for submitting too. Make sure the pages upload in order.

1. Textbook 9.2.14

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

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

2. 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 (2a).

(c) Based upon your answer in (2b), is the proportion of satisfied customers significantly higher than 0.80? Why?

3. 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?

4. 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 0.0548. Find a 95% Wald confidence interval for p . *Hint: You need to first find the sample proportion \hat{p} from the given information.*

5. 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

<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?

6. 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

<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?