Homework 14 **Name:** _____

Prob. and Stat. for Eng. (STAT:2020; Bognar)

Print this pdf file, show your work in the provided space, use 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.

1. Textbook 9.54 — Answer the following only.

   (a) Find a 95% Wald CI for p.

   (b) Find a 95% Agresti-Coull CI for p.

2. Textbook 10.58 — Answer the following only.

   (a) Test $H_0 : p = 0.60$ vs $H_a : p \neq 0.60$ at the $\alpha = 0.05$ significance level using a 3-step score test.

   (b) Find the $p-$value for the test.

(c) Find a 95% Wald CI for p.

(d) Find a 95% Agresti-Coull CI for p.

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

	Male	Female
Manager	30	10
Non-Manager	30	30

A researcher wishes to test H_0 : no association between gender and position versus H_a : association between gender and position 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?

4. Textbook 9.72

5. Textbook 10.68 — Answer the following only.

(a) Test $H_0 : \sigma^2 = 36$ vs $H_a : \sigma^2 < 36$ at the $\alpha = 0.05$ significance level.

(b) Find a 95% one-sided upper-bound CI for σ^2.

6. A watch maker wanted to compare four robotic milling machines for cut roughness. The roughness is measured in microns (1/1000 of a mm). Assume the roughness for Machine i follows a $N(\mu_i, \sigma_i^2)$ distribution, $i = 1, 2, 3, 4$, and assume that $\sigma_1 = \sigma_2 = \sigma_3 = \sigma_4$. After milling a number of parts on each machine, he summarized the data in the following table.

Mach 1	Mach 2	Mach 3	Mach 4
$n_1 = 5$	$n_2 = 5$	$n_3 = 6$	$n_4 = 6$
$\bar{x}_1 = 11.5$	$\bar{x}_2 = 8.9$	$\bar{x}_3 = 9.3$	$\bar{x}_4 = 12.2$
$s_1 = 1.3$	$s_2 = 1.5$	$s_3 = 1.0$	$s_4 = 1.1$

(a) Find the mean squares between groups, $MS(Between)$. *Show your work using clear notation.*

(b) Find the mean squares within groups, $MS(Within)$. *Show your work using clear notation.*

(c) Test $H_0 : \mu_1 = \mu_2 = \mu_3 = \mu_4$ vs H_a : not H_0 at the $\alpha = 0.05$ significance level using a 3-step one-way ANOVA test. *Find the test statistic and critical value (use Matt's super sweet $F-$distribution web/phone app to find the critical value), plot the rejection region (be sure to label the distribution), and state your decision and final conclusion. Show your work using clear notation.*

(d) Find the $p-$value for the test in part (c). You will have to use the $F-$distribution web/phone applet to find the $p-$value. *Show your work using clear notation.*

(e) Perform the Bonferroni pairwise comparison $H_0 : \mu_3 = \mu_4$ versus $H_a : \mu_3 \neq \mu_4$ at the α^* significance level. *You must state the test statistic and critical value (use the web/phone $t-$distribution app to find the critical value), plot the rejection region (be sure to label your graph), and state your decision and final conclusion. Also, use the web/phone $t-$distribution app to find the $p-$value. Show your work using clear notation.*

(f) Write out H_0 and H_a for the remaining 5 Bonferonni pairwise comparisons.