Final Exam, Part 1 (take home)

STAT 2215

Dr. Mc Name _____

Instructions. This take-home part of the final exam will be due on Monday, December 13 at 10:00 noon **SHARP, regardless of your section and/or scheduled exam time**; it is worth 80 points. Each hour or portion thereof late will incur a 10 point penalty, no exceptions. You may use your text and accompanying CD-ROM, class notes, MS Excel, and a calculator. You MAY NOT consult with any of your classmates or use any outside sources. You have two (2) hours MAXIMUM to do this exam. Be sure to label your answers/printouts carefully; I will most intolerant of messy, disorganized work. Write out and sign the official McDaniel College Honor Code in a visible location on your exam. Also record the date you did the exam, and the start and end time on your answers. Finally, deliver a hard copy of your exam to me *personally*. Good luck.

[*50 pts.*] 1. A few weeks ago, I was watching a dippy horror movie on television where some scientists were studing flesh-eating zombies. Before the zombies (predictably) escaped and brain-eating mayhem ensued, the scientists monitored the behavior of a bunch of caputured zombies, enumerating the number of times a given zombie bashed its head against the wall of its cage in an hour. These data are stored in the first tab of the Excel file named `zombies.xls`, posted in the usual spot on the course website.

(a) The researchers theorized that the amount of time one had been undead affected head-banging behavior. As such, the scientists divided their data into four samples: newly infected[1], early-stage zombies, middle-state zombies, and older zombies that have more or less rotted away. Are the scientists correct? Perform an appropriate one-way ANOVA test to find out. Use the usual four steps using level of significance $\alpha = .01 = 1\%$. Be sure to write down this test's p-value and carefully interpret your results. [HINT: you will need to manipulate your data somewhat to obtain the correct result if you plan on using the Excel toolkits (which you should) here.]

(b) The scientists experimented on their caputured zombies by playing them various kinds of music in an attempt to limit their aggressive behavior. Three types of music were employed: piano concertos, baby lullabys, and the easy-listening hits of Barry Manilow. Does the type of music affect zombie behavior? Perform another one-way ANOVA test to find out. Use the usual four steps using level of significance $\alpha = .01 = 1\%$. Be sure to write down this test's p-value and carefully interpret your results.

(c) The researchers subsequently surmised that there might be an interaction between vintage and music that is significant to zombie behavior. To investigate, perform a two-way ANOVA test on your zombie data. Use the usual four steps using level of significance $\alpha = .01 = 1\%$. Be sure to write down this test's p-value and carefully interpret your results, taking special care to discuss the interaction results. In addition, compare/contrast your direct effect (level) results obtained here with the results of your previous one-way analyses. Do things change?

(d) I would imagine that having to listen to Barry Manilow would make anyone—even zombies—want to bang one's head against the wall more than other forms of music. Am I correct? That is, does Barry Manilow make zombies more aggressive than the other types of music employed? Perform an appropriate two-tailed test at the $\alpha = .01 = 1\%$ level of significance to find out. [NOTE: You now know how to check for differences in variances, so you will need to do two hypothesis tests here, one on the variances and then an appropriate t-test. For the first test, use $\alpha = .05 = 5\%$ as your level of significance.]

[1] Horror fans all know that zombification is an infectious disease, passed from zombie to non-zombie, usually via bite. If the infected person survives this initial attack, s/he will subsequently die, and then rise as an undead, mindless zombie with an appetite for brains.

[*30 pts.*] 2. Keeping with the above theme, I have started to keep track of the undead attacks the surviving citizens of Westminster have had to withstand over the past year (365 days) of the zombie apocalypse. These data are reproduced below:

# of zombie attacks	# of days
less than 20	100
20-39	73
40-59	60
60-79	48
80-99	37
100-119	20
120-139	20
more than 140	7
	365 days

Although survival is my first priority, I still remember fondly the good old days when I was a beloved economics professor at McDaniel College. After looking at this data for awhile, I surmised that zombie attacks are normally distributed with mean $\mu = 50$ and standard deviation $\sigma = 45$. Given the lack of electricity and working computers (it is the end of the world, after all), I am unable to check for sure. Perform an appropriate goodness of fit test for me, using the $\alpha = .05 = 5\%$ level of significance. Interpret your results. That is, am I correct?

[HINT: using your normal table, or better, Excel, to find the probabilities that a random variable having the normal distribution with mean 50 and standard deviation 45 will take on a value less than 20, between 20 and 39, 40 and 59, and so on. Use these probabilities to find your expected frequencies.][2]

[2]Note that I am fudging somewhat, given the continuity of the normal distribution. That is, the normal distribution tells us there is a non-zero probability of experiencing between say, 39 and 40 zombie attacks. I ignored this when putting this problem together.

Final Exam, Part 2

STAT 2215

Dr. McIntyre Name _____

Instructions. You have *90 MINUTES* to complete this exam. There are 80 total points. Answer all the questions correctly in the blue books provided. You may use your formula sheet, calculator, your standard normal table and the statistical tables in your text. Please take this exam in pencil. Show all of your work and BE NEAT. Finally, be sure to write out and sign the McDaniel College Honor Code on the front cover of your blue book. Please do well on this exam. Tests with lots of mistakes take longer to mark and tend to make me grouchy. *Good luck and have a safe and restful winter break!*

[*20 pts.*] 1. My cat Scratchy has recently developed a fairly annoying habit of stealing q-tips from the cabinet underneath my bathroom sink. In order to better plan my q-tip budget, I have kept track of the number of q-tips Scratchy takes for the past two weeks:

Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14
# of q-tips	250	8	32	5	250	0	6	4	4	0	0	0	3	5

Cursory inspection showsmy data is bedeviled with outliers; you will note that on two occasions, Scratchy managed to commandeer an entire box of 250 q-tips while on four others, she did not managed to steal a single q-tip. A cursory glance at this data leads me to believe that Scratchy's median daily q-tip heist is 2. Perform an appropriate (two-tailed) hypothesis test to see if I am right, using the following steps.

(a) Write down the null and alternative hypotheses.

(b) Calculate your test statistic.

(c) Perform this test at the $\alpha = .10 = 10\%$ level of significance. Write down the appropriate critical value.

(d) Hence reject or retain H_0.

(e) Find this test's p-value. (You will be able to find a specific value but be careful! This is a two-tailed test.)

[*10 pts.*] 2. A statistician working for Gallup is taking a poll on President Obama's approval ratings. After collecting her data, the statistical will estimate p, the share of the U.S. population that thinks Mr. Obama is doing a good job as president. If she wants her poll to have a margin of error of ± 2 percentage points with a level of significance $\alpha = .02 = 2\%$, how many households will she need to contact to in order to estimate p?

[*25 pts.*] 3. The use of the word "bitches"—as in "What's up, bitches?" or "I go to McDaniel College, bitches!"—is increasingly common in today's vernacular. This word is still considered to be a misogynistic quasi-swear word, however, and its use is offensive to some people. Intuition would lead one to belive that the older one is, the more likely one is to be offended when hearing "bitches" used in a non-canine sense. To look into this, I did a little poll where I asked people how offended they were by the use of the word "bitches" and how old they were. My data are summarized in the table below:

	Teens	20s	30s
Very offensive	15	18	25
Slightly offensive	21	20	21
Not offensive	34	30	40
No opinion	34	40	10
TOTAL	104	108	96

Do the shares of the population offended differ by age? Perform a χ^2 test to find out. Proceed by following these steps:

(a) Write down your null and alternative hypotheses.

(b) Use the given data to estimate $\widehat{p}_{very}$, the share of the population who find the word "bitches" very offensive (recall that under H_0, this share is common across age groups). Likewise calcualte the other three $\widehat{p}$'s.

(c) Hence construct your test statistic, χ^2.

(d) Perform this test at the $\alpha = .05 = 5\%$ level. Look up the appropriate critical value and henc reject or not reject H_0.

(e) Write down an inequality describing this test's p-value.

[*25 pts.*] 4. Knowing that the increasing prevalence of the word "bitches" follows from pop culture, I retained my evil sister-in-law Jeanette to see how frequently this term is used on TV. (Jeanette is an especially good choice for this task as she watches an **excessive**—as in 'quit watching TV and get a damn job' excessive—amount of television and will work for Cheetos.) Jeanette collected data for me over a two week ($n = 14$) period, and from that data I calculated that the term in question is used an average of $\overline{x} = 9.3$ times per day, with a standard deviation of $s = 2.6$.

(a) With this information, calculate a 95% confidence interval for the number of times the word "bitches" is uttered on TV during a given day.

(b) My wife Diane—who also thinks Jeanette is really evil—is pretty hip and up-to-date with pop culture, and she is shocked by how many times Jeanette heard the word "bitches" on TV. Diane says that there is no way that she hears "bitches" more than eight times a day. Is she correct? Perform an appropriate one-tailed test to find out. Follow these steps:

1. Write down you null and alternative hypotheses.
2. Calculate your test statistic, t.
3. You will perform this test at the $\alpha = .05 = 5\%$ level of significanc. With this in mind, look up the appropriate critical value.
4. Reject or not reject H_0.