Math 263, Section 5 **Name**_____
Third Test Spring 2014
75 minutes; total 125 points.

For Questions 1-10, circle *one* answer.[1] **(5 points each.)**

1. An automaker claims that the gas mileage of their new model car is 35 miles per gallon; a consumer watchdog is skeptical of this claim. What hypotheses should the consumer group use to test the claim?

(a) $H_0: \mu < 35$ and $H_a: \mu \geq 35$
(b) $H_0: \mu \leq 35$ and $H_a: \mu > 35$
(c) $H_0: \mu \neq 35$ and $H_a: \mu = 35$
(d) $H_0: \mu \neq 35$ and $H_a: \mu < 35$
(e) $H_0: \mu = 35$ and $H_a: \mu > 35$
(f) $H_0: \mu = 35$ and $H_a: \mu < 35$

2. A random sample of the costs of forty repair jobs at a muffler repair shop has mean \$127.95 and standard deviation \$24.03. Which of the following is approximately the 90% confidence interval?

(a) $\$127.95 \pm \$3.80$
(b) $\$127.95 \pm \$4.87$
(c) $\$127.95 \pm \$6.40$
(d) $\$127.95 \pm \$7.68$
(e) $\$127.95 \pm \$24.03$

3. Which of the following is a criterion for choosing a t-test rather than a z-test when making an inference about the mean of a population?

(a) The mean of the population is unknown
(b) The standard deviation of the population is unknown
(c) The sample was not a simple random sample
(d) The population is not normally distributed
(e) The sample size is more than 120
(f) There is more than one sample

4. When a virus is placed on a tobacco leaf, small lesions appear on the leaf. To compare the number of lesions produced by two different strains of virus, one strain is applied to each side of a leaf. The side of the leaf is decided randomly. The lesions that appear on each side are counted on eight leaves. To test whether there is a significant difference between the numbers of lesions produced by each strain, what is the number of degrees of freedom of the appropriate t-test?

(a) 7
(b) 8
(c) 11
(d) 14
(e) 15
(f) 16

[1] CB-AP 1997

5. When performing hypothesis tests at significance level α, if the p-value obtained is _____ α, the null hypothesis will *not* be rejected.
(a) Larger than
(b) Smaller than
(c) The same as
(d) None of the above.

6. A two-sided hypothesis test was done, leading to a p-value of 0.02. What is p-value of the corresponding one-sided test?
(a) 0.98
(b) 0.04
(c) 0.03
(d) 0.02
(e) 0.01
(f) 0

7. In a test of statistical hypotheses, what does the p-value tell us?
(a) The probability that the null hypothesis is true.
(b) The probability that the alternative hypothesis is true.
(c) Probability of obtaining the data we did if the null hypothesis is true
(d) Probability of obtaining the data we did if the alternate hypothesis is true

8. For a chi-square analysis of the data in a two-way table, which of the following statements is (are) true?

(a) Under the null hypothesis, the expected cell count is

$$\text{Expected cell count} = \frac{(\text{Row total}) \cdot (\text{Column total})}{\text{Overall total}}$$

(b) In a table with r rows and c columns, the number of degrees of freedom is

$$df = (\mathrm{r} - 1)(\mathrm{c} - 1)$$

(c) A possible null hypothesis is that there is no association between the row and column variables.
(d) All of the above are true.
(e) Only (a) and (b) are true.

Use this information for Problems 9 and 10:
Television networks frequently run public opinion polls on issues of concern. During the Iraq War, one network conducted a telephone poll asking a question about the way President Obama was handling the war. At the same time, a second network ran an online poll using a very similar question. The results of the two polls are summarized in the following table:

	Poll		
	Telephone	Online	Total
Approve	339	385	724
Disapprove	780	573	1353
Total	1119	958	2077

We would like to test to see if the two polls are consistent with respect to the proportion who approve of President Obama's handling of the war, that is we want to test $H_0: p_{\text{telephone}} = p_{\text{online}}$

9. A statistic (calculated from the data assuming the null hypothesis) has the value 22.28. If the respondents in both polls can be considered to come from random samples, what is this statistic?

(a) A t statistic with 1 degree of freedom.
(b) A t statistic with 957 degrees of freedom.
(c) A chi-square statistic with 3 degrees of freedom.
(d) A chi-square statistic with 1 degree of freedom.
(e) A z statistic.

10. If the chi-square test is used to test the null hypothesis, the expected cell count in the online poll for those who approve and that cell's contribution to the value of the test statistic are, respectively, about:

(a) 390.1 and 7.70
(b) 333.9 and 6.78
(c) 390.1 and 6.69
(d) 333.9 and 7.81
(e) 362.0 and 1.46

11. (**15 points**) Wayne Gretzky ("The Great One") is a famous Canadian hockey player who is the lead scorer in National Hockey League history. He played for the Edmonton Oilers and retired in 1999. In his last season, Gretzky played 41 games and missed 17 due to injury. The statistics for these games are in the table.[2]

	Number	Mean number of goals per game	Standard deviation
Games with Gretzky	41	4.73	1.29
Games without Gretzky	17	3.88	1.18

Consider the 41 games a random sample of the games the Oilers played with Gretzky and the 17 games a random sample of games they played without him. Is there evidence that the Oilers scored higher when Gretzky was playing? Use a 1% significance level and the following steps to decide:

(a) What is the null hypothesis?

(b) What is the alternate hypothesis?

(c) Find the test statistic.

(d) Find the p-value.

(e) What is your conclusion about Gretzky?

[2] "The Great Gretzky" in *Chance,* Reported in *Statistics: Learning from Data*, R. Peck, Brooks-Cole 2014.

12. (**22 points**) A classic randomized trial tested the efficacy of the drug sulphinpyrazone in reducing the risk of death in heart attack patients. The treatment group was given sulphinpyrazone and the control group was given a placebo; none of the patients were told which group they were in. The results were:

	Outcome	
Group	Lived	Died
Treatment	692	41
Control	682	60

(a) Was the drug effective? Use the following steps to decide

(i) What is the null hypothesis?

(ii) What is the alternate hypothesis?

(iii) Find the pooled proportion.

(iv) What is the z-value? (Use the pooled proportion.)

(v) What is the p-value?

(vi) What is your conclusion?

(b) Explain why

(i) Patients were randomly assigned to the treatment or control group.

(ii) Patients were not informed of which group they were in.

13. (**16 points**) An AP-GfK Poll conducted Oct. 3-7, 2013, about the Health Exchange roll out said 40% of the 1227 adults surveyed said the Health roll out had not gone well.[3]

(a) What is the 95% margin of error of this poll?

(b) Is the following statement true or false? "If the poll was repeated many times, 95% of the poll results would be within the interval between 40% minus the margin of error and 40% plus the margin of error."
True___ False____(check one)
Give a reason if true; give a correction if false.

(c) When restricted to a subgroup of the 1227 people who had tried to buy health insurance, the same poll gave $(0.068, 0.292)$ as the 95% confidence interval for the proportion who said the Health Exchange worked well.

(i) What is the point estimate of the population proportion from this restricted poll? (That is, the best single number estimate.)

(ii) What is the margin of error of this poll?

(iii) What is the sample size of this poll?

[3] http://news.yahoo.com/poll-health-exchange-rollout-gets-poor-reviews-072742111--finance.html, Oct 10, 2013.

14. (**22 points**) In 1998, the Nabisco Company, makers of "Chips Ahoy!" cookies, announced their "1000 Chips Challenge" in which they asked the public to confirm that there were at least 1000 chocolate chips in every 18-ounce bag of cookies. The cadets at the US Air Force Academy accepted the challenge and obtained bags of cookies from around the country.[4] By first dissolving the cookies in water, they counted the chocolate chips in 42 bags. The mean was 1261.571 chips per bag with standard deviation 117.579.

(a) Do their results confirm that the mean number of chips a bag is more than 1000? Use the following steps to decide.

(i) State the null hypothesis.

(ii) State the alternate hypothesis.

(iii) Find the z-value or t-value.

(iv) What is its distribution? (Is it t or z, and if t how many degrees of freedom?)

(v) What is the p-value?

(vi) What is your conclusion about the cookies?

(b) Why did the cadets ask for bags of cookies from around the country?

(c) Does your solution to part (a) answer Nabisco's challenge? Yes____ No____ (check one) Explain.

[4] From "Checking the Chips Ahoy! Guarantee" by Brad Warner and Jim Rutledge, *Chance,* 1999.