

BLOCK PRINT YOUR NAME:

PROBABILITY AND STATISTICS, FALL 2009, QUIZ 5
SECTIONS 4.3-4.5, HYPOTHESIS TESTING

- No resources are allowed, except for a calculator/computer for basic arithmetic; do not use any pre-programmed formulas.
- Explain your answers in order on additional sheets of paper as needed.
- There is a strict 90 minute limit for this quiz. Set an alarm. (A goal should be to finish in 60 minutes.)

Initial Quiz Download/View (Time and Date):

End of Quiz (Time and Date):

The following formulas might be helpful. If you use them, explain your choices.

$$Z = \frac{\bar{X} - \mu}{\sigma/\sqrt{n}}$$

$$T = \frac{\bar{X} - \mu}{S/\sqrt{n}} \quad , \quad (n - 1) \text{ degrees of freedom}$$

$$\chi^2 = (n - 1)S^2/\sigma^2 \quad , \quad (n - 1) \text{ degrees of freedom}$$

$$Z = \frac{(\bar{X} - \bar{Y}) - (\mu_X - \mu_Y)}{\sqrt{\sigma_X^2/n + \sigma_Y^2/m}}$$

$$T = \frac{(\bar{X} - \bar{Y}) - (\mu_X - \mu_Y)}{\sqrt{\frac{(n-1)S_X^2 + (m-1)S_Y^2}{n+m-2} (1/n + 1/m)}} \quad , \quad (n + m - 2) \text{ degrees of freedom}$$

$$F = \frac{S_X^2/\sigma_X^2}{S_Y^2/\sigma_Y^2} \quad , \quad (n - 1) \text{ numerator degrees of freedom and } (m - 1) \text{ denominator degrees of freedom}$$

1. A manufacturer of fuses claims that with a 20% overload, the fuses will blow in 12.40 minutes on the average. It is well known that the standard deviation of the time it takes fuses to blow is 2.6 minutes. To test this claim, a sample of 20 of the fuses was subjected to a 20% overload, and the times it took them to blow had a sample mean of 11.30 minutes. Assume that the data constitutes a random sample from a normal population. You want to test the null hypothesis H_0 that $\mu = 12.40$ at an $\alpha = .05$ level of significance.
 - (a) if the alternative hypothesis H_a is that $\mu \neq 12.40$, does the above data give evidence to reject or fail to reject the null hypothesis?
 - (b) if the alternative hypothesis H_a is that $\mu < 12.40$, does the above data give evidence to reject or fail to reject the null hypothesis?
2. Two pedagogical methods for teaching basic mathematics are being evaluated in a school district. Two random groups of elementary school children were selected for the study. The first group was taught by Method A, while the second was taught by Method B. At the end of the study, both groups

were given a test to measure their basic math skills. It is widely believed that Method B is superior to Method A and thus would lead to higher test scores. The summary data are shown above. Find a 95% confidence interval for the difference in population means between these two groups. Based on your result, what conclusions can be drawn as to any differences in effectiveness between the two teaching methods?

Statistic	Method A	Method B
n	11	14
\bar{x}	64	69
s^2	52	71

3. It is desirable to have aptitude tests that produce scores (in points) with a large amount of variation so that an administrator can distinguish between persons with low aptitude and persons with high aptitude. The standard aptitude test used by an industry has been producing scores with a variance of 100. A new test is given to 20 prospective employees, which produces a sample variance in scores of 158.63. Using a 0.01 significance level, is the new test significantly different in producing highly variables scores than the standard test? Compute the p -value to determine the largest significance level for which one can reject H_0 .
4. A common debate between men and women is “Who has the higher pain threshold?”, where each gender believes they can endure greater pain than the other. An experiment to explore the pain thresholds to electric shocks for males and females resulted in the following data:

Statistic	Men	Women
n	13	10
\bar{x}	16.2	14.9
s^2	9.1	26.4

- (a) Do the data provide sufficient evidence to indicate a significant difference in mean pain thresholds for men and women? Use a significance level of 0.05.
- (b) Do the data provide sufficient evidence to indicate a significant difference in the variability of pain thresholds for men and women? Use a significance level of 0.1.