# MA 207 Hypothesis Test for Two Sample Population Proportions Name: Key

1. The North Carolina State University looked at the factors that affect the success of students in a required engineering course. Students must get a C or better in the course to continue as an engineering major, so a “success” is a grade of C or better. They want to know if there is evidence of a difference between the proportions of men and women who succeed. They found that 23 of the 34 women and 60 of the 89 men succeeded in the course. Prior to performing the test, we decide on a level of significance of

1. Explain the idea behind a significance test (also called a hypothesis test).

Assume the null hypothesis is true, and test the strength of the evidence against it.

1. State the hypotheses. Is the alternative hypothesis one-sided or two-sided?

(or equivalently, )

(two-sided alternative)

1. Check the assumptions needed for the test.

The study did not indicate random samples.

There are two independent populations.

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1. Compute the test statistic.

The pooled proportion is 

The test statistic is 

1. Determine the P-value. Sketch a region under a labeled curve to represent it.

Look up in the standard normal table to see that the left-tail probability is So the right-tail probability is Therefore, the two-sided *P*-value is

1. Interpret the P-value in practical terms in the context of this problem (use the specific P-value).

Assuming there is no difference between the proportions of men and women who succeed, the probability of getting a test statistic as extreme or more extreme than what we got is 98.40%. In other words, it is very likely that it just happened by chance variation between samples.

1. Complete the sentence: Test results are statistically significant if…  
   they are unlikely to occur by chance variation between samples.
2. Explain in complete sentences what you would conclude based on your P-value.

The results are not statistically significant since Therefore, we do not reject the null hypothesis. There is not sufficient evidence to conclude that there is a difference in the proportions of men and women who succeed.

1. Find a 95% confidence interval for the difference between the two population proportions. (Note that we choose a 95% confidence interval so that it corresponds appropriately to the two-sided significance test at the level of significance of) Choose population 1 to be the one with larger sample proportion so that the difference between the sample proportions is positive.



According to the 68%-95%-99.7% rule, we use a critical value of (or if you use the table) to get

(or , if you use the table). In interval form this is

(-0.1864, 0.1910) or (-0.1827, 0.1873).

1. Explain what the confidence interval means in practical terms.

We are 95% confident that this interval contains the true value of the unknown difference between to population proportion of men who succeed and the population proportion of women who succeed. In other words, if we created a large number of confidence intervals (using the same sample sizes), approximately 95% of them would contain the true unknown difference between to population proportion of men who succeed and the population proportion of women who succeed.

1. Does the null hypothesis value for the difference between the two population proportions lie in the confidence interval? Does this match what you expected based on your significance test? Explain.

The confidence interval does contain 0 (the null hypothesis value for the difference between the proportions), so we do not reject the null hypothesis. This matches our results from the significance test.

1. Repeat the above for the level of significance. Be sure to compute the appropriate confidence interval. Did the margin of error on the confidence interval increase or decrease? Why?

The P-value is the same: If the results were not significant at the 5% level of significance, they are certainly not significant at the 2% level of significance. The conclusion is the same.

For the confidence interval, we need a 98% confidence interval to correspond to a level of significance for a two-sided alternative. The critical value is The confidence interval is The conclusion is the same.

The margin of error for the 98% confidence interval is larger because the critical value *z*\* is larger. Alternatively, you could say that the margin of error must be larger to be more confident that the interval contains the true value of the unknown difference between the population proportions of men and women who succeed.