MTH 422
Exam 3 Take-Home Part
Spring 2024

60 points possible on the take-home part.

Due Thursday, April 25, at 11:59 p.m.

Most of these problems ask you to use R. Write your answers on paper, and also submit a plain text file with a copy of the contents of the R console. I will set Blackboard so that you have the option of submitting multiple files: multiple text files, and a scan or scans of your written solutions. You don't have to submit everything at once. You can upload as you go, if you want.

Open book, open note, open talk.

1. Use R. The ozone measurements in Thirsk on 14 randomly selected days were 34, 73, 50, 42, 21, 46, 56, 38, 46, 79, 26, 43, 48, and 64. Assume the ozone count follows a normal distribution. Find a 99% confidence interval for the mean ozone concentration in Thirsk.

2. Use R. A manufacturer is developing a nickel-metal hydride battery that is to be used in cellular telephones in lieu of nickel-cadmium batteries. The director of quality control decides to evaluate the newly developed battery against the widely used nickel-cadmium battery with respect to performance. A random sample of 6 nickel-cadmium batteries and a random sample of 8 of the newly developed nickel-metal hydride batteries are placed in cellular telephones of the same brand and model. The performance measure of interest is the talking time (in minutes) prior to recharging. The results are as follows.

Nickel-Cadmium Battery
54.5 67.6 64.5 70.2 72.5 64.9

Nickel-Metal Hydride Battery
78.3 95.2 69.4 87.3 62.5 85.0 85.1 72.1

Assuming that the performance measures are normally distributed for each battery type, find a 98% confidence interval for the difference in mean performance measures for the two types of batteries. Since the variances might not be equal, use Welch's t.

3. Use R. A sample of 200 transistors selected randomly from the production of Machine A revealed that 11 were defective. A similar sample of 300 from Machine B showed 16 defective. Find a 95% confidence interval for the difference in defective rates for the two machines.

4. Use R. Patients with chronic fatigue syndrome were tested, then retested after being treated with fludrocortisone. Listed below are the changes in fatigue after the treatment (based on data from "The Relationship Between Neurally Medicated Hypotension and the Chronic Fatigue Syndrome" by Bou-Holaigah, Rowe, Kan, and Calkins, *Journal of the American Medical Association*, Vol. 274, No. 12). A standard scale from -7 to $+7$ was used, with positive values representing improvements. Assume that the population has an approximately normal distribution. Use $\alpha = 0.05$ to test the claim that the mean change is positive. Use R to find the p-value. Is there evidence that the treatment is effective?

6 5 0 5 6 7 3 3 2 6 5 5 0 6 3 4 3 7

1. Hypotheses

H_0 :

H_1 :

2. Test Statistic

3. Decision Rule ($\alpha =$)

Picture:

Reject H_0 if

Otherwise, fail to reject H_0.

4. Observed Value

5. Conclusion

Reject H_0/Fail to reject H_0 (Circle one)

In English:

5. No R needed. A teacher develops a true/false test with the answers given below. At the 0.05 level of significance, test the claim that the sequence of answers is randomly arranged. Use the format from class.

F T T T F T T T F T T T F T T F F F F F T T T T T F F F F F

1. Hypotheses

H_0 :

H_1 :

2. Test Statistic

3. Decision Rule ($\alpha =$)

Picture:

Reject H_0 if

Otherwise, fail to reject H_0.

4. Observed Value

5. Conclusion

Reject H_0/Fail to reject H_0 (Circle one)

In English:

6. Use R. A group of five individuals with high blood pressure were given a new drug that was designed to lower blood pressure. Systolic blood pressure was measured before and after treatment for each individual, with the following results.

Subject	1	2	3	4	5
Before (y)	168	166	172	160	182
After (x)	145	132	129	135	145

Let μ_D denote the mean of the difference $x - y$. Assume approximate normal distribution, and test $H_0 : \mu_D = 0$ against $H_1 : \mu_D < 0$, using a paired t test with the differences. Use $\alpha = 0.05$. Also use R to find the P-value.

1. Hypotheses

H_0 :

H_1 :

2. Test Statistic

3. Decision Rule ($\alpha =$)

Picture:

Reject H_0 if

Otherwise, fail to reject H_0.

4. Observed Value

5. Conclusion

Reject H_0/Fail to reject H_0 (Circle one)

In English: