Stat 577 Homework 3

Due in Canvas using SubmitHW3 by Friday, October 13

Name:

**Total points: 58**

**Note: No R code should be provided. You may only insert relevant R outputs when answering questions. Your scores not only depend on the correctness of the problem, but also on the presentation style.**

## Question #1

Bear growth data: The Alaska Fish and Game Department monitors grizzly bears with the goal of maintaining a healthy population. Bears are shot with a dart to induce sleep and weighed on a scale hanging from a tripod. Measurements of length are taken with a steel tape. The dataset “BearGrowth” available in Canvas has 8 columns: Columns 1-4 give the weight in kilograms and columns 5-8 give the length in centimeters of seven female bears at 2,3,4 and 5 years of age. In this question, you will only work on length variables. Assuming that the length variables at four different years of age follow jointly a multivariate normal distribution.

1. [8 points] Perform the Hotelling’s test to test the null hypothesis that the population mean vector is equal to by reporting the following values:

. Test statistic value

. Numerator and denominator degrees of freedom

. p-value associated with the test

. Your conclusion at level of significance.

1. [8 points] In case your conclusion is to reject the null hypothesis in part (a), please further investigate which variable mean significantly differs from the hypothesized value by constructing Bonferroni confidence intervals for each population mean with corrected confidence level.

## Question #2

College Test score: The scores obtained from college students on the College Level Examination Program (CLEP) are given in the dataset named “CollegeTest” in Canvas. The columns of the data are scores on =social science and history, =verbal and =science. Assume that the data is coming from a Multivariate normal distribution.

1. [10 points] We would like to test the null hypothesis that the population mean vector is equal to .

. Name the test you will be using here.

. What is the Test statistic value?

. Write the numerator and denominator degrees of freedom

. Report the p-value associated with the test

. Your conclusion at level of significance.

1. [6 points] In case you reject the null hypothesis in part (a), please further investigate which variable mean significantly differs from the hypothesized value by constructing Bonferroni confidence intervals for each population mean with corrected confidence level.
2. [6 points] Draw a normal QQ plot for each of the variables in the study and provide your graph with appropriate axes labels. Does each variable appear to be normally distributed?
3. [6 points] To do a formal check of normality, perform Shapiro-Wilk test of normality for each variable at 5% level of significance. Draw your conclusion of normality of each variable based on observed the .
4. [4 points] Based on the conclusion on part (d), is our assumption of multivariate normality in part (a) valid? Explain your reasoning.

## Question #3

The LASERI data in the ICSNP library is a data frame with 32 measurements made on each of 223 healthy Finnish subjects. The subjects were monitored while in a supine position and then again with their heads elevated on a motorized table. We will concentrate on four measurements and their average differences: average heart rate (HRT1T4); average cardiac output (COT1T4); average systemic vascular resistance index (SVRIT1T4); and average pulse wave velocity (PWVT1T4). Each of these variables is expressed as a difference of the pre- and post-tilt values. More detail on this study and the other variables in the data frame are available in help(LASERI). Following R codes will be helpful to download the data and choosing the aforementioned four variables.

[10 points] Perform the Hotelling’s test to test the equality of means of pre- and post-values.

Write down the followings:

1. null hypothesis
2. alternative hypothesis
3. Test statistic value
4. p-value associated with the test
5. Your conclusion at level of significance.