THE UNIVERSITY OF CHICAGO
Booth School of Business
Business 41912-01, Spring Quarter 2020, Mr. Ruey S. Tsay

Homework Assignment #2

Due Date: April 28, 2018 (before class). You may use any software to solve the problem. Don't hand in all outputs; use cut-and-paste to select the relevant part of the output.

1. You may **discuss** the problems with other students, but must **write** your own solutions.
2. You may use 5% type-I error in all tests and 95% to construct confidence regions.

Data files: Available on the course web.

1. Consider the data in the file `SonsHead.DAT`, which consists of head measurements on first and second sons of certain families. Let $\boldsymbol{y}_i = (FHL_i, FHB_i)'$ be the head length and head breadth of the first son and $\boldsymbol{x}_i = (SHL_i, SHB_i)'$ be the measurements of the second son of the ith family.
   (a) Obtain a matrix scatterplot for all four measurements and add a linear least squares line to each scatterplot.
   (b) Are the head measurements of the first sons jointly normally distributed?
   (c) Consider jointly the head measurements of the first sons. Let $\boldsymbol{\mu}_y = E(\boldsymbol{y})$. Test $H_o : \boldsymbol{\mu}_y = (184, 149)'$ versus $H_a : \boldsymbol{\mu}_y \neq (184, 149)'$. Perform the test and draw your conclusion.
2. Construct simultaneous T^2, Bonferroni, marginal, and asymptotic chi-square confidence intervals for the means of head measurements of the first son.
3. Obtain a bivariate boxplot for the head measurements of the 2nd son. Add marginal density functions to the bivariate boxplot.
4. Test the hypothesis $H_0 : \boldsymbol{\mu}_y = \boldsymbol{\mu}_x$ versus $H_a : \boldsymbol{\mu}_y \neq \boldsymbol{\mu}_x$, where $\boldsymbol{\mu}_x$ denotes the mean vector of the second son. Perform a proper test and draw your conclusion.
5. Consider jointly the four measurements. Compute the eigenvalues and eigenvectors of the sample covariance matrix. Provide an interpretation for each of the 1st and 2nd eigenvectors.

Reading assignments: Chapters 5 & 6 of the textbook.