STAT 636, Fall 2015 - Assignment 4
Due Monday, October 12, 11:55pm Central
Online Students: Submit your assignment through WebAssign.
On-Campus Students: Email your assignment to the TA.

1. For the sweat data in Table 5.1 of the textbook:

   (a) Construct univariate Q-Q plots for each of the three variables. Also make the three pairwise scatterplots. Does the multivariate normal assumption seem reasonable?

   (b) Determine the 95% confidence ellipse for $\boldsymbol{\mu}$. Where is it centered? What are its axes and corresponding half-lengths?

   (c) Compute 95% T^2 simultaneous confidence intervals for the three mean components.

   (d) Compute 95% Bonferroni simultaneous confidence intervals for the three mean components.

   (e) Carry out a Hotelling's T^2 test of the null hypothesis $H_0 : \boldsymbol{\mu}' = [4.0, 45.0, 10.0]$ at $\alpha = 0.05$. What is the test statistic, critical value, and the p-value? What is your conclusion regarding H_0?

   (f) Is $\boldsymbol{\mu}' = [4.0, 45.0, 10.0]$ inside the 95% confidence ellipse you computed in part (b)? Is this consistent with your findings in part (e)? Hint: It should be.

   (g) Use the bootstrap to test the same null hypothesis as in part (e), now using this as your test statistic

   $$\Lambda = \left(\frac{|\mathbf{S}|}{|\mathbf{S}_0|} \right)^{n/2},$$

   where

   $$\mathbf{S} = \frac{1}{n-1} \sum_{j=1}^{n} (\mathbf{x}_j - \bar{\mathbf{x}}) (\mathbf{x}_j - \bar{\mathbf{x}})'$$

   is the sample covariance matrix, and

   $$\mathbf{S}_0 = \frac{1}{n-1} \sum_{j=1}^{n} (\mathbf{x}_j - \boldsymbol{\mu}_0) (\mathbf{x}_j - \boldsymbol{\mu}_0)'$$

   is the sample covariance matrix computed under the assumption that H_0 is true. So that all of our answers match, first do `set.seed(101)`, and use $B = 500$ bootstrap iterations. What is the p-value?