STAT450/550 Multivariate Analysis, Fall 21

MT1 Name: _____

Note: To get a full credit, you must show your work in details. Unless otherwise specified, the significance level is 0.05. In case the df is not available in the prob. table, use the closest one.

1. Consider a bivariate normal random vector with

$$\underline{\mu} = \begin{bmatrix} 2 \\ 5 \end{bmatrix},\ \Sigma = \begin{bmatrix} 4 & \sqrt{2} \\ \sqrt{2} & 3 \end{bmatrix},$$

Give the center, lengths, and directions of major and minor axes of 95% contour plot.

2. A sample of n_1=25 and n_2 =25 is selected from two bivariate normal populations. The summary statistics for the sample are

$$\bar{x}_1 = \begin{bmatrix} 12 \\ 5 \end{bmatrix},\ S_1 = \begin{bmatrix} 2 & 1 \\ 1 & 3 \end{bmatrix} \text{ and } \bar{x}_2 = \begin{bmatrix} 10 \\ 5 \end{bmatrix},\ S_2 = \begin{bmatrix} 6 & 1 \\ 1 & 5 \end{bmatrix}.$$

Assume that data are from a bivariate normal population.

(a) Perform a hypothesis test testing equality of two covariance matrices.

(b) Based on the result in (a), perform a hypothesis test testing equality of the mean vectors of two populations; that is $H_0 : \underline{\mu}_1 - \underline{\mu}_2 = \underline{0}$

3. A sample of n_1=20 n_2 =20 from two 3-variate normal populations gave the following summary statistics.

$$\bar{x}_1 = \begin{bmatrix} 6 \\ 4 \\ 7 \end{bmatrix},\ S_1 = \begin{bmatrix} 2 & 1 & 0 \\ 1 & 3 & 1 \\ 0 & 1 & 2 \end{bmatrix} \text{ and } \bar{x}_2 = \begin{bmatrix} 6 \\ 3 \\ 6 \end{bmatrix},\ S_2 = \begin{bmatrix} 3 & 1 & 1 \\ 1 & 3 & 0 \\ 1 & 0 & 4 \end{bmatrix}$$

Perform a complete profile analysis.