



# Ramakrishna Mission Vivekananda University

Belur Math, Howrah, West Bengal

School of Mathematical Sciences, Department of Data Science

M.Sc. in Big Data Analytic 2016, Mid Semester Exam

Date: 11 March 2017

Course : **DA310: Multivariate Statistics**

Time:  $1\frac{1}{2}$  hrs

Instructor : *Dr. Sudipta Das*

Max marks: 40+10

Student signature and Id:

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1. Evaluate  $T^2$ , for testing  $H_0 : \mu = \begin{bmatrix} 7 \\ 11 \end{bmatrix}$ , using the data

$$X = \begin{bmatrix} 2 & 12 \\ 8 & 9 \\ 6 & 9 \\ 8 & 10 \end{bmatrix}.$$

Specify the distribution of  $T^2$  and test  $H_0$  at the  $\alpha = 0.05$  level. What conclusion do you reach? [13+2+2=17]

2. The sample mean vector and the sample covariance matrix, as given below, are calculated from pairs of 42 observations.

$$\bar{x} = \begin{bmatrix} 0.564 \\ 0.603 \end{bmatrix}, \text{ and } S = \begin{bmatrix} 0.0144 & 0.0117 \\ 0.0117 & 0.0146 \end{bmatrix}.$$

Compare the 95%  $T^2$  and 95% Bonferroni simultaneous confidence intervals. [13]

3. Let  $X_1$  be  $N(0, 1)$ , and let

$$X_2 = \begin{cases} -X_1 & \text{if } -1 \leq X_1 \leq 1 \\ X_1 & \text{otherwise.} \end{cases}$$

Show that  $X_2 \sim N(0, 1)$  and  $(X_1, X_2)$  is not bivariate normal. [10]

4. Show that, if  $A$  is square, then  $|A| = |A_{22}||A_{11} - A_{12}A_{22}^{-1}A_{21}|$  for  $|A_{22}| \neq 0$ . [10]

You may need some values:

$$t_{41}(0.05) = 1.68, t_{41}(0.0125) = 2.327,$$

$$F_{3,2}(0.05) = 19.16, F_{2,3}(0.05) = 9.55, F_{2,40}(0.05) = 3.23, F_{40,2}(0.05) = 19.47$$

This exam has total 4 questions, for a total of 40 points and 10 bonus points.

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