INDIAN STATISTICAL INSTITUTE

M.S (QMS) First Year

Second Semester - Multivariate Data Analysis

Date: 06 March, 2015 Time: 2 hours Mid-Semester Exam

Answer any five questions. Maximum Marks: 50

1.

a. Let $A=\begin{bmatrix}1\\2\end{bmatrix}$ $B=\begin{bmatrix}3&5\\4&6\end{bmatrix}$ $C=\begin{bmatrix}4&5\\6&6\end{bmatrix}$ $D=\begin{bmatrix}-1&0\\-2&0\end{bmatrix}$

Which of the following statements are true? Give justification?

i. A + B = C

ii. B + C =D

iii. B – C = D

b. Let $A=\begin{bmatrix}3.8&4.9\\5.9&6.5\end{bmatrix}$ $B=\begin{bmatrix}4.2&5.1\\6.7&6.2\end{bmatrix}$ and $C=\begin{bmatrix}48.79&x\\y&70.39\end{bmatrix}$. If C = AB, compute the value of x and y?

c. Let $A=\begin{bmatrix}2.50&0.00&0.00\\0.00&38.6&0.00\\0.00&0.00&5.39\end{bmatrix}$ and A inverse is $A^{-1}=\begin{bmatrix}0.40&0.00&x\\0.00&y&0.00\\0.00&0.00&z\end{bmatrix}$, Compute the values of x, y and z?

[10]

2. Let a random vector x = $(x_1, x_2, - - -, x_p)'$ is multivariate normally distributed with mean vector μ and variance covariance matrix $\sum$.

a. Write the probability density function of x? Give the maximum likelihood estimator of μ and $\sum$?

b. Give two properties of multivariate normal distribution?

c. Define Mahalanobis distance? Give step by step procedure for detecting outliers in multivariate normal data? [10]

3. a. Give the step by step procedure for testing whether the mean vector of a multivariate normal random vector x is equal to a specified vector μ_0?

b. Briefly explain Analysis of Variance? Give the formula for computing at least two test statistics used in MANOVA? [10]

4. a. What is the objective of carrying out principal components analysis?

b. How the coefficients of the principal component are computed?

c. Suggest the commonly used methods to arrive at the number of principal components?

d. Write step by step procedure for conducting principal component analysis and interpretation of the results?

[10]

P.T.O

5.

a. Explain the two types of factor analysis?
b. List down the similarities and differences between factor analysis and principal components analysis?

[10]

6.

a. Define Euclidean distance between two objects x_i and x_j?

b. Define single, complete and average linkages?

c. Write step by step procedure for conducting hierarchical cluster analysis and interpretation of the results?

d. Suggest a method to arrive at optimum k in k means cluster analysis?

[10]