

Indian Statistical Institute, Bangalore

M.S. (QMS) First Year

Second Semester – Multivariate Data Analysis

Date: 24 February, 2016

Time: 2 hours

Answer *any three questions*. Maximum you can score is 50

1. [20]

- a. Define Mahalanobis distance? Give step by step procedure for detecting outliers in multivariate normal data?
- b. The data on multiple performance characteristics of carbonitrided bushes and their inverse covariance matrix are given below. Is there any outlier? ($\chi^2_{0.975,3} = 9.35$)

Data

Bush Id	Surface Hardness	Case Depth	Dimensional Variation
1	54.1	2.89	0.2404
2	54.7	2.28	0.1743
3	56.5	2.65	0.213
4	51.6	3.06	0.0622
5	55.4	2.76	0.1575

Inverse Covariance Matrix

	Surface Hardness	Case Depth	Dimensional Variation
Surface Hardness	0.81343237	0.450889266	-11.31568097
Case Depth	0.450889266	13.47746869	34.15616091
Dimensional Variation	-11.31568097	34.15616091	524.7922343

2. [20]

- a. Describe the similarities and differences between factor analysis and principal component analysis?
- b. The correlation matrix of two correlated variables x_1 and x_2 are given below. Perform principal component analysis and identified the proportion of variance explained by each component. Identify the optimum number of components required through Scree plot as well as cumulative proportion method?

Correlation Matrix		
	x_1	x_2
x_1	1.0	0.65
x_2	0.65	1.0

3. [20]
- a. Write step by step procedure for conducting hierarchical cluster analysis and interpretation of the results?
 - b. The between sum of squares and within sum of squares obtained for different values of k in k mean clustering method is given below. Identify the optimum k using suitable graphical technique?

k	Between SS	Within SS
1	0.0	328.6
2	155.9	172.7
3	248.9	79.7
4	264.1	64.5
5	269.8	58.8
6	279.4	49.3
7	292.0	36.6
8	300.9	27.8
9	302.4	26.3

4. An online retailer wants to enhance the mobile handset business. The company has conducted a conjoint analysis to obtain the customer preferences. The details of the conjoint analysis with aggregate ranking are given below. Analyze the data, compute part worth utilities and importance scores. What suggestions can you provide to the retailer to optimize the mobile handset business? [20]

Combinations	Brand	Operating System	Screen Size	Camera Resolution	Score
1	Nokia	Windows	5.5 inches	Above 6 MP	1.2
2	Nokia	Android	5.0 inches	4 - 6 MP	1.5
3	Nokia	iOS	4.5 inches	2 - 4 MP	1.7
4	Sony	Windows	5.0 inches	2 - 4 MP	1.3
5	Sony	Android	4.5 inches	Above 6 MP	4.4
6	Sony	iOS	5.5 inches	4 - 6 MP	6.9
7	Apple	Windows	4.5 inches	4 - 6 MP	4.3
8	Apple	Android	5.5 inches	2 - 4 MP	6.8
9	Apple	iOS	5.0 inches	Above 6 MP	9.5