Model Question Paper

Second Semester M.Sc Degree Examination (CSS)

ST2C10 - STATISTICAL COMPUTING I

Time: 3 hours Total Weights: 30

(***Answer any three questions. Each question carries weightage 10.***)

1. The table below gives the probability and observed frequencies in 4 phenotype classes in a genetic experiment.

class	: AB	Ab	aB	ab
Observed frequency	: 125	18	20	34
probability	: $\frac{2+\theta}{4}$	$\frac{1-\theta}{4}$	$\frac{1-\theta}{4}$	$\frac{\theta}{4}$

(a) Estimate θ (i) by the method of maximum likelihood.

(ii) by the method of modified minimum chi-square.

(b) Obtain the information on θ supplied by the sample.

(c) Find the standard error of the estimate.

2. A random sample of 8 observations taken from a Cauchy population with density function

$$f(x) = \frac{1}{\pi}\frac{1}{1+(x-\mu)^2}$$

gave the following values 4.061, 2.598, 5.076, 3.895, -4.313, -3.112, 6.786, 19.076. Starting with the median as the first estimate of the parameter, approximate successively to its real value.

3. The following data gives measurements of blood pressure of 150 heart patients in a hospital. Fit a log normal distribution for the data and test the goodness of the fit :

Class Interval		*Frequency*	*Class Interval*	*Frequency*
90 − 100	···	3	150 − 160	11
100 − 110	···	12	160 − 170	10
110 − 120	···	26	170 − 180	9
120 − 130	···	32	180 − 190	3
130 − 140	···	23	190 − 200	2
150 − 160	···	16	200 − 210	3
			Total	150

4. A Markov Chain having states (1, 2, 3, 4, 5) has the one-step transition matrix.

$$P = \begin{pmatrix} 0.6 & 0.1 & 0 & 0.3 & 0 \\ 0.2 & 0.5 & 0.1 & 0.2 & 0 \\ 0.2 & 0.2 & 0.4 & 0.1 & 0.1 \\ 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 \end{pmatrix}$$

(a) Calculate the mean number of visits to each of the non-absorbing states before absorption.

(b) The mean number of steps for absorption.

(c) The probabilities of absorption from the non-absorbing states to each of the absorbing states.

5. (a) Obtain the stationary distribution of the Markov chain with the following transition probability matrix :

$$\begin{bmatrix} 1/4 & 3/4 & 0 & 0 \\ 1/3 & 2/3 & 0 & 0 \\ 0 & 1/2 & 1/2 & 0 \\ 0 & 1/4 & 1/4 & 1/2 \end{bmatrix}$$

(b) Determine the classes and the periodicity of the various states for the following Markov chain :

$$\begin{bmatrix} 0 & 0 & 1 & 0 \\ 1 & 0 & 0 & 0 \\ 1/2 & 1/2 & 0 & 0 \\ 1/3 & 1/3 & 1/3 & 0 \end{bmatrix}$$

6. A job involves three operations. The time (in minutes) taken for each operation are denoted by X_1, X_2 and X_3. The value of these variables for 80 persons are summarized in the following :-

		Mean vector	Covariance matrix		
X_1	$\cdots$	16.23	2.57	0.85	1.56
X_2	$\cdots$	18.47		37.00	3.34
X_3	$\cdots$	15.25			8.44

(a) Assuming normality on (X_1, X_2, X_3) with the above mean and covariance matrix, obtain the conditional distribution of (X_1, X_3) given $X_2 = x_2$.

(b) Compute the multiple correlation coefficient $R_{1.23}$ and test whether the population multiple correlation coefficient vanishes.

(c) Obtain the confidence region for the population mean vector μ.