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SARDAR PATEL UNIVERSITY
M.Sc. (IV Semester) Examination
2012
Friday, 30th November
2:30 p.m. to 5:30 p.m.
STATISTICS COURSE No. PS04CSTA01
(Computer Oriented Statistical Methods)

Note: Figures to the right indicate full marks of the questions. **(Total Marks: 70)**

1 Attempt all, write correct answers **08**

(i) The only natural random number generation method is

a) congruential method b) inverse method

c) none of these d) Pi based method

(ii) Canonical correlation analysis helps in

a) increasing the dimension of data b) reducing the dimension of data

c) finding the minimum possible correlation among linear combinations

d) finding the maximum possible correlation among linear combinations

(iii) If the random numbers are generated through multiplicative congruential method with seed 3, multiplier 11 and modulus 100 then cycle repeats after each ____ numbers.

a) 9 b) none of these

c) 10 d) 11

(iv) Which of the following decomposition is used in generation of multivariate normal random numbers

a) Jordan decomposition b) Lebesgue decomposition

c) Cholesky decomposition d) singular value decomposition

(v) The inverse function of the Triangular distribution function $\frac{2}{a}\left(x - \frac{x^2}{2a}\right)$ as per inverse method is

a) a(1-U) b) a(1-√U)

c) a(1-√2-U) d) 2(a-√U)

(vi) The logit value is zero when the probability of event is

a) 1 b) .5

c) 0 d) None of these

(vii) The Monte Carlo integration value of $\int_2^5 f(x)$

a) 3 b) E(f(x))

c) 5 d) 3 times E(f(x))

(viii) In variance reduction technique using control variates the data X is modified using another data Y through

a) –Cov (X,Y) b) –Cov(X,Y)/ V(Y)
c) None of these d) Cov(X,Y)/ V(X)

2 Attempt ANY 7, each carries 2 marks **14**

(a) Describe mixed congruential method of generating random numbers with an illustration.

(b) Prove that, If U is uniform on (0, 1), and F(x) be a d.f. with inverse d.f. $F^{-1}(.)$, then $F^{-1}(U)$ has d.f. F(x).

(c) Distinguish between parametric and non-parametric bootstrapping.

(d) Show that the total variance of the variables equals to the total variance of the Principle Components.

(e) Define Cox- hazard ratio of a pair of persons in the sample and show that it is not necessary to know the baseline hazard.

(f) Write down method of generating symmetric random walk random deviates.

(g) Explain how logistic regression approach brings out the relation between binary variable and explanatory variables.

(h) Explain one of the variance reduction techniques.

(i) Define the terms in the context of multivariate techniques
(i) biplot (ii) communality

(j) Describe the method of obtaining canonical variable pairs given two sets of variables and the correlation matrix.

3 (a) Describe steps of Monte Carlo simulation. Discuss about the advantages and limitations of simulation. 6

(b) Using random numbers to simulate a sample, find the probability that a packet of 8 products does not contain any defective product, when the production line produces 10 percent defective products. Compare your answer with expected probability. 6

OR

(b) Observations showed the following patterns in respect of inter-arrival durations and service durations in a single channel queuing system.

Inter-arrival time		Service time	
Minutes	Probability	Minute	Probability
2	.15	1	.10
4	.28	3	.20
6	.40	5	.47
8	.17	7	.23

Simulate the queue behavior for a period of 90 minutes and estimate the probability of the server being idle and the mean time spent by a customer waiting for the service.

4 (a) Describe the main objective of canonical correlation. Show that the squared canonical correlations are the roots of the equation and that 6

$$|\Sigma_{12}\Sigma_{22}^{-1}\Sigma_{21} - \lambda\Sigma_{11}| = 0$$

the canonical correlation vectors for variables satisfy

$$\Sigma_{12}\Sigma_{22}^{-1}\Sigma_{21}\alpha_i = \lambda\Sigma_{11}\alpha_i$$

(b) Discuss the assumptions and the objective of discriminant analysis. Obtain a discriminant rule to assign an individual to one of the two multivariate normal populations such that expected cost of misclassification is minimized. Give two applications of discriminant analysis. 6

OR

(b) Let $X' = [X_1, \ldots, X_p]$ have covariance matrix $\sum$, with eigen values-eigen vector pairs $(\lambda_1, e_1), (\lambda_2, e_2), \ldots, (\lambda_p, e_p)$, where $\lambda_1 \geq \lambda_2 \geq \ldots \geq \lambda_p \geq 0$. Then show that the r^{th} principal component is given by $Y_r = e_r'X$, $(r = 1, \ldots, p)$ with $var(Y_i) = \lambda_i$ and $Cov(Y_i Y_j) = 0$ for $i \neq j = 1, 2, \ldots, p$. 6

5 (a) Explain rejection method of generating random numbers, and illustrate. 6

(b) Describe an algorithm for generating random deviates having (i) Weibull distribution (ii) t- distribution. 6

OR

(b) Write algorithm for generating 'n' binomial B(10, .5) deviates. Using your algorithm carry out generating such 5 binomial deviates.

6 (a) Explain what is clustering in a multivariate data set. Give an algorithm used for clustering. 6

(b) Explain method of generating multivariate normal deviates. Generate four bivariate normal numbers having mean $[2, -1]'$ and covariance matrix $\begin{bmatrix} 2 & 1 \\ 1 & 2 \end{bmatrix}$. 6

OR

(b) Give the bootstrap algorithm for approximating the standard error of an estimator.
