SEAT No._____ No of Printed pages: 03

[50/647]

Sardar Patel university
M.Sc. (IV Semester) Examination
2020
Monday, 28th December
10:00 am to 12:00 Noon
STATISTICS / APPLIED STATISTICS COURSE No. PS04CSTA21 / PS04CAST21
(Computer Oriented Statistical Methods)
Note: Figures to the right indicate full marks of the questions. (Total Marks: 70)

Q1(A) Multiple Choice Questions [08]

1. The value of X_4 according to the LCG $(13X_i + 1) \bmod 16$ with $X_0=5$ is ____
   (a) 16 (b) 1
   (c) 13 (d) 15
2. Inverse function of d.f. F(x) = x, x taking value in R, is ____
   (a) x in R (b) 1
   (c) -x in R (d) u ~ U(0,1)
3. In order to generate a Poi(a) random number one must return the count of trials : a = a* u, u is U(0,1) number, until a _____
   (a) < exp(-a) (b) < = exp(-a)
   (c) > exp(a) (d) < exp(a)
4. Monte Carlo integration uses the theorem on
   a) Strong law of large numbers (b) Empirical distribution function
   (c) Central limit (d) Ergodic Markov chain
5. In context to the Principal Component Analysis If $\underline{X} \sim N_p(\underline{0}, \Sigma)$ then the principal components $\underline{Y} = \Gamma'\underline{X}$ distributed as
   (a) $N_p(\underline{0}, \Sigma)$ (b) $N_p(\underline{\mu}, \Sigma)$
   (c) $N_p\left(\underline{\mu}, \sum_{i=1}^{p} \lambda_i\right)$ (d) $N_p(\underline{0}, diag(\lambda_1, \lambda_2, \ldots, \lambda_p))$
6. In usual notation, in discriminant analysis, while applying maximum likelihood discriminant rule for 3 groups having disrciminant function $(D_{ij}; i, j = 1,2,3, i \neq j)$, the rule to allocate X to population π_1 if
   (a) $D_{12} > 0$ and $D_{13} > 0$ (b) $D_{13} > 0$ and $D_{23} > 0$
   (c) $D_{12} > 0$ and $D_{13} < 0$ (d) $D_{12} < 0$ and $D_{23} < 0$
7. In the Canonical Correlation Analysis, the importance of variables is to be studied from

_____.

(a) canonical loadings (b) cross loadings

(c) redundancy coefficient (d) Eigen value

8. In factor analysis, the deletion of variable is decided by _____.

(a) Scree Plot (b) MSA

(c) KMO (d) factor extraction method

Q1(B) Do As Directed (one mark each) [16]

Fill in the blanks: Q1-6

1. For full period LCG the choice of 'a' in $x_n = ax_{n-1} + 2 \bmod 16$ should be _____.
2. Given u ~ U (0, 1), the inverse transform method step for exp(1) RNG is _____.
3. Given u ~ U (0, 1), then the distribution function of (1- u) is _____.
4. In cluster analysis, _____ distance is free of unit of measurement.
5. In Context to factor analysis, in the factor model $X = \Lambda F + U$, F and U are respectively known as_____.
6. _____ multivariate method is useful for investigating the relationship between two sets of variables.

State TRUE or FALSE Q7-12

7. The maximizing constant in case of rejection method for negative truncated normal RNG $2e/\pi$.
8. Given only single u ~ U (0, 1), we can generate Beta (a, 1) deviate.
9. Only 100 uniform random numbers are needed to generate ten Binom$(10, p)$ deviates.
10. Principal component analysis a multivariate method that can reduce multicollinearity of data.
11. In reference to Discriminant Analysis, Wilks Λ test statistic useful to test hypothesis$H_0: \Sigma_1 = \Sigma_2 = \cdots = \Sigma_k$, where Σ_i is the variance covariance matrix of $i-th$ $(i = 1,2\ldots,k)$ group.
12. In the cluster analysis, the distance between i-th and j-th object, $d_{ij} = \sum_{k=1}^{p} |X_{ik} - X_{jk}|$ known as City-block metric.

Answer in one word: Q13-16

13. Give the full form of MCMC.
14. Give a standard value of modulo m for a good LCG to be run on regular computer.

15. Name the method which is more suitable to drop specific components from the model, in principal component regression analysis.

16. Name the test used for testing equality of several mean vectors across the group during linear discriminant analysis, when variance-covariance matrix across group are homogeneous.

Q2 **Short Answer Type Question (Any Seven)** [14]

1. Define LCG. Give an example.
2. State and prove the theorem of Inverse transform method of RNG.
3. Give algorithm of Poisson (λt) process random number generation.
4. State (at least five) properties of a good random number generator.
5. Perform Cholesky decomposition of the covariance matrix $\begin{bmatrix} 2 & 1 \\ 1 & 3 \end{bmatrix}$.
6. Distinguish between binary logistic regression and linear discriminant analysis.
7. What do you understand by Measure of Sample Adequacy (MSA)?
8. Distinguish between principal component analysis and factor analysis.
9. Describe briefly, the complete linkage method.

Q3 Name all the variance reduction techniques you know. Derive one of them. [08]

[OR]

Q3 Discuss Box-Muller algorithm of generating standard normal deviates. Using this provide an algorithm of generating a multivariate normal deviate. [08]

Q4 State and prove the theorem of acceptance-rejection method. Illustrate use of this method in generation of standard normal deviate. [08]

[OR]

Q4 What is Monte Carlo integration? Give an illustration. Explain how you can make use of importance sampling to improve Monte Carlo estimation of integral. [08]

Q5 Define principal component. Explain principal component regression analysis in details. [08]

[OR]

Q5 Define three terms of Factor analysis (FA) and describe FA procedure. [08]

Q6 Define three distance measures of Cluster analysis (CA) and explain how to perform CA. [08]

[OR]

Q6 Define discriminant function, Give detail procedure of linear discriminant analysis. [08]

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