ENTRANCE EXAMINATION FOR ADMISSION, MAY 2012.

Ph.D (STATISTICS)

COURSE CODE : 149

Register Number :

Signature of the Invigilator
(with date)

COURSE CODE : 149

Time : 2 Hours Max : 400 Marks

Instructions to Candidates :

1. Write your Register Number within the box provided on the top of this page and fill in the page 1 of the answer sheet using pen.
2. Do not write your name anywhere in this booklet or answer sheet. Violation of this entails disqualification.
3. Read each of the question carefully and shade the relevant answer (A) or (B) or (C) or (D) in the relevant box of the ANSWER SHEET using HB pencil.
4. Avoid blind guessing. A wrong answer will fetch you –1 mark and the correct answer will fetch 4 marks.
5. Do not write anything in the question paper. Use the white sheets attached at the end for rough works.
6. Do not open the question paper until the start signal is given.
7. Do not attempt to answer after stop signal is given. Any such attempt will disqualify your candidature.
8. On stop signal, keep the question paper and the answer sheet on your table and wait for the invigilator to collect them.
9. Use of Calculators, Tables, etc. are prohibited.

1. If X and Y are random variables having joint probability mass function

$P[x, y] = (x + 2y)/27;\ x = 0,1,2;\ y = 0,1,2$

$= 0$ elsewhere

then $P[X + Y \leq 4]$ is

(A) 1 (B) 2/9 (C) 4/9 (D) 1/3

2. Poisson process is

(A) Continuous time discrete state space stochastic process

(B) Continuous time continuous state space stochastic process

(C) Discrete time discrete state space stochastic process

(D) Discrete time continuous state space stochastic process

3. Consider a continuous time stochastic process $\{X(t); t \in T\}$. If $X(t_0)$, $X(t_2) - X(t_1), \ldots, X(t_n) - X(t_{n-1})$ for all $t_0 < t_1 < \ldots < t_n$ are independent then the process is called

(A) Stationary

(B) Widesense stationary

(C) Process with independent increments

(D) Markov process

4. A discrete time Markov Chain $\{X_n; n = 0,1,\ldots\}$ is

(A) Markov Stochastic Process

(B) Poisson process

(C) Markov stochastic process with countable state space

(D) Markov stochastic process with countable or finite state space

5. The transition probability matrix is

(A) Rectangular matrix with column sum is unity

(B) Hermitian matrix

(C) Stochastic matrix

(D) Idempotent matrix

6. Chapman Kolmogorov equation is useful for finding

(A) Periodicity of a Markov Chain (B) Higher order transition probabilities

(C) Recurrent state of Markov Chain (D) Auto correlation function

7. If $d(i)$ is the period of state i, then

(A) $d(i) = L.C.M.\{n, p_{ii}^n > 0\}$
(B) $d(i) = L.C.M.\{n, p_{ii}^n < 0\}$
(C) $d(i) = G.C.D.\{n, p_{ii}^n > 0\}$
(D) $d(i) = G.C.D.\{n, p_{ii}^n = 0\}$

8. If i and j are two communicative states of a Markov chain and if $d(.)$ is the periodicity, then

(A) $d(i) = d(j)$
(B) $d(i) > d(j)$
(C) $d(i) < d(j)$
(D) $d(i) = 2d(j)$

9. A state i of a Markov chain is recurrent iff

(A) $\sum_{n=0}^{\infty} p_{ii}^n = \infty$
(B) $\sum_{n=1}^{\infty} p_{ii}^n = \infty$
(C) $\sum_{n=1}^{\infty} p_{ii} < \infty$
(D) $\sum_{n=1}^{\infty} p_{ii}^n = 1$

10. The inter-arrival time of a Poisson process follow

(A) Weibull distribution
(B) Exponential distribution
(C) Laplace distribution
(D) Gamma distribution

11. In the one dimensional random walk, the state represented by the origin is

(A) Transient State
(B) Ergodic
(C) Recurrent State
(D) Evolutionary

12. Let $\{X_n; n = 0,1,...\}$ be the Markov chain with states 0, 1, 2 with transition probability matrix $P = \begin{bmatrix} \frac{1}{2} & \frac{1}{3} & \frac{1}{6} \\ \frac{1}{4} & \frac{1}{4} & \frac{1}{2} \\ 0 & \frac{3}{4} & \frac{1}{4} \end{bmatrix}$ and $P[X_0 = i] = \frac{1}{3}\ i = 1,2,3$ then $P[X_3 = 2, X_2 = 3, X_1 = 2, X_0 = 3]$

(A) $\frac{3}{32}$
(B) $\frac{1}{32}$
(C) $\frac{1}{16}$
(D) $\frac{2}{3}$

13. Poisson process is a

(A) Continuous time discrete state space
(B) Evolutionary
(C) Markov Process
(D) All the above

14. Which one of the following is not the property of Poisson process?

(A) The sum of two independent Poisson process is Poisson process
(B) Poisson process is a stationary process
(C) Poisson process is a Markov Process
(D) A random selection from Poisson process is a Poisson process.

15. Consider a pure birth process with infinitesimal birth rate λ_n. If $\lambda_n = n\lambda$, then the resulting process is

(A) Yule-Furry Process
(B) Linear Growth process
(C) Brownian Motion Process
(D) Branching Process

16. The efficiency of Randomized Block Design (RBD) with r blocks of size k (number of treatments $v = k$) as compared to Completely Randomized Design (CRD) is given by (s_B^2 and s_e^2 are mean sum of square due to blocks and error mean square respectively)

(A) $E = \frac{(r-1)s_B^2 + r(k-1)s_e^2}{(rk-1)s_e^2}$
(B) $E = \frac{(r-1)ks_B^2 + r(k-1)s_e^2}{(rk-1)s_e^2}$
(C) $E = \frac{(r-1)s_B^2 + (r-1)(k-1)s_e^2}{(rk-1)s_e^2}$
(D) $E = \frac{(r-1)(s_B^2 + s_e^2)}{(rk-1)s_B^2}$

17. Consider a Balanced Incomplete Block Design (BIBD) with parameters v, b, r, k, λ. A BIBD is said to be symmetric if

(A) $b = r,\ v = k$
(B) $b = v,\ r = k$
(C) $b = \lambda,\ v = b$
(D) $v = \lambda,\ b = k$

18. The effect of adding independent variables one after another in a multiple linear regression model

(A) increases the value of multiple correlation coefficient R^2
(B) decreases the value of multiple correlation coefficient R^2
(C) does not change the value of multiple correlation coefficient R^2
(D) initially increases and then decreases the value of R^2

19. Let a linear model be $Y = X\beta + \varepsilon$, where X is a $n \times (p+1)$ matrix of rank $(p+1) < n$. Then the Best Linear Unbiased Estimator (BLUE) of β is

(A) $\hat{\beta} = (X^T X) X^T Y$
(B) $\hat{\beta} = (X^{-1} X) X^T Y$
(C) $\hat{\beta} = (X^T X)^{-1} X^T Y$
(D) $\hat{\beta} = (X^T X)^{-1} X^{-1} Y$

20. Let a linear model be $Y = X\beta + \varepsilon$, where X is a $n \times (p+1)$ matrix and $\in \sim N(0, \sigma^2 I)$. The distribution of $\frac{(Y - X\hat{\beta})^T (Y - X\hat{\beta})}{\sigma^2}$ where $\hat{\beta}$ is an unbiased estimator of β is

(A) χ^2_{p-1}
(B) χ^2_{n-1}
(C) χ^2_{n+p-1}
(D) χ^2_{n-p-1}

21. The inequality $E^{1/r}(|X|+|Y|)^r \leq E^{1/r}(|X|)^r + E^{1/r}(|X|)^r$ is known as

(A) Schwartz Inequality

(B) Minkowski Inequality

(C) Cauchy Inequality

(D) Cramer Inequality

22. If $E(X^3)$ exists then

(A) $E(X^r)$, exists for $0 < r < 3$

(B) $E(X^{3+\delta})$ exists for $\delta > 0$

(C) The distribution of X is symmetric

(D) $E(|X|^3)$ need not exist

23. $X_n \xrightarrow{a.s.} X$ if

(A) $P(\lim X_n = X) = 0$

(B) $P(\lim X_n \neq X) = a;\ 0 < a < 1$

(C) $P(\lim X_n = X) = 1$

(D) $P(\lim X_n \neq X) = 0$

24. For any random variable X,

(A) The distribution function and characteristic function do not determine each other

(B) The distribution function determines the characteristic function but not conversely

(C) The characteristic function determines the distribution function but not conversely

(D) The distribution function and characteristic function determine each other

25. Let X_n be a sequence of iid random variables. Then the result that $\frac{S_n}{n} \xrightarrow{P} \mu$ where $S_n = \Sigma X_k$ and $\mu = E(X_k)$ is the consequence of

(A) Strong Law of Large Numbers

(B) Weak Law of Large Numbers

(C) Kolmogorov theorem

(D) Continuity theorem

26. A random sample of size 'n' is drawn from a distribution with density function $f(x;\theta) = \theta(1-x)^{1-\theta}$; $0 < x < 1$; $0 < x < 1$; $\theta > 0$. A sufficient statistic for θ is

(A) Sample mean

(B) Sample median

(C) $\sum_{i=1}^{n} \log(1-x_i)$

(D) $\sum_{i=1}^{n} x_i^2$

27. X_1, X_2 are two independent observations from $B(1,\theta)$. The statistic $X_1 - X_2$ is

(A) Sufficient and complete

(B) Neither sufficient nor complete

(C) Complete but not sufficient

(D) Sufficient but not compete

28. The number of distinct covariances in the variance – covariance matrix Σ of order $p \times p$ is

(A) $\frac{p(p+1)}{2}$ (B) $\frac{(p+1)}{2}$ (C) $\frac{p(p-1)}{2}$ (D) $\frac{(p-1)}{2}$

29. The mean vector for the data matrix $X = \begin{bmatrix} 4 & 5 \\ 2 & -3 \\ 3 & 1 \end{bmatrix}$ is

(A) [3, –1] (B) [3, 1] (C) [–3, 1] (D) [–3, –1]

30. Let $X_1, X_2, ..., X_n$ be a random sample of size n from a p-variate normal distribution with mean vector μ and covariance matrix Σ. Then the distribution of $\overline{X}$ is

(A) $N_p(\mu, \Sigma)$

(B) $N_p(\mu, n\Sigma)$

(C) $N_p(\mu, (1/n)\Sigma)$

(D) $N_p(\mu, (1/(n-1))\Sigma)$

31. Which of the following is an expression for sample variance-covariance matrix?

(A) $S = \frac{1}{2n}\sum_{i=1}^{n}(x_i - \overline{x})(x_i - \overline{x})^T$

(B) $S = \frac{1}{n-1}\sum_{i=1}^{n}(x_i - \overline{x})(x_i - \overline{x})^T$

(C) $S = \frac{1}{n}\sum_{i=1}^{n}(x_i - \overline{x})(x_i + \overline{x})^T$

(D) $S = \frac{1}{n-1}\sum_{i=1}^{n}(x_i - \overline{x})(x_i + \overline{x})^T$

32. The inverse of the dispersion matrix $\sum\begin{bmatrix} \sigma_{11} & \sigma_{12} \\ \sigma_{21} & \sigma_{22} \end{bmatrix}$ is

(A) $\Sigma^{-1}\frac{1}{\sigma_{11}\sigma_{22}\sigma_{12}^2}\begin{bmatrix} \sigma_{22} & -\sigma_{12} \\ -\sigma_{21} & \sigma_{11} \end{bmatrix}$

(B) $\Sigma^{-1} = \frac{1}{\sigma_{11}\sigma_{22}}\begin{bmatrix} \sigma_{22} & -\sigma_{12} \\ \sigma_{21} & \sigma_{11} \end{bmatrix}$

(C) $\Sigma^{-1} = \frac{1}{\sigma_{11}\sigma_{22} - \sigma_{12}^2}\begin{bmatrix} \sigma_{11} & -\sigma_{12} \\ \sigma_{21} & \sigma_{22} \end{bmatrix}$

(D) $\Sigma^{-1} = \frac{1}{\sigma_{11}\sigma_{22}}\begin{bmatrix} \sigma_{22} & \sigma_{12} \\ -\sigma_{21} & \sigma_{11} \end{bmatrix}$

33. Which of the following statements is true for a random vector $X = (X_1, ..., X_p)^T$ should have a multivariate normal distribution?

(a) All subsets of the components of X follow multivariate normal distribution

(B) The conditional distributions of the sub-vectors of X are multivariate normal

(C) The above statements (A) and (B) both are true

(D) Neither of the statements (A) and (B) are true

34. Let $X_1, X_2, ..., X_n$ be a random sample of size 'n' from multivariate normal distribution with mean vector μ and variance covariance matrix Σ. Then the sample mean vector $\overline{X}$ and sample variance-covariance S are

(a) Efficient

(B) unbiased for μ and Σ

(c) Jointly Sufficient for (μ, Σ)

(D) consistent for (μ, Σ)

35. Which of the following are true in the case of Canonical form of Linear Programming problem?

i. The Objective Function is of Maximization type;

ii. The constraints are equations;

iii. The decision variables under study are non negative;

iv. The sign on the right side of the equation are non negative

v. The constraints are of less than or equal to type

vi. The objective function is either Maximization or Minimization type.

vii. The decision variables have no restriction on the sign.

viii. There is no restriction on the sign of the right hand side of the in equation.

(A) i, ii, iii and iv

(B) ii, vi, iii and viii

(C) i, v, vi and viii

(D) i, iii, v and viii

36. Which of the following methods are suitable for solving the Linear Programming problems with artificial variables?

i. Charne's Penalty Method

ii. Ordinary simplex Method

iii. Hungarian Method

iv. Two Phase Method

(A) i and iii

(B) i and iv

(C) i and ii

(D) ii and iii

37. Which of the following are convex sets?

i. Union of Two Convex Sets

ii. Intersection of two convex sets

iii. Convex Hull

(A) i and iii are true

(B) ii and iii are true

(C) i, ii and iii are True

(D) i and ii are true

38. If one of the basic variables takes the value zero in the final iteration of a simplex table then the solution is known as

(A) Pseudo Optimal Basic Feasible Solution

(B) Degenerate Basic Feasible Solution

(C) Infeasible Basic Feasible Solution

(D) Optimal Basic Feasible Solution

39. A Hyper plane defined on n-dimensional Euclidian Real Space R^n is

(A) Convex set

(B) Non Convex Set

(C) Neither of the above mentioned spaces

(D) Both of the above mentioned spaces

40. Which of the following costs shall not change with item in the inventory models?

(A) Storage Cost (B) Shortage cost

(C) Set Up Cost (D) Production Cost

41. When the demand over certain period of time is not known with certainty, then the those inventory models may be classified as

(A) Probabilistic Models (B) Deterministic Models

(C) Static Models (D) Constant Rate Models

42. The value of Optimal Ordering Interval (t*) in Economic Lot size system with uniform demand is

(A) directly proportional to the square root of Holding Cost

(B) directly proportional to the square root of Set Up Cost

(C) directly proportional to the square root of Set Up Cost

(D) inversely proportional to the square root of Set up cost

43. Identify the multivariate data reduction techniques from the following :

i Principal Component Analysis ii Multi-dimensional Scaling

iii Discriminant Analysis iv Factor Analysis

(A) i and ii (B) ii and iii (C) i and iv (D) ii and iv

44. Re-order level of an item in inventory management is always

(A) Less than the minimum stock (B) More than its minimum stock

(C) Less than its maximum stock (D) More than its maximum stock

45. In the usual queueing model (A/B/C: ElF), F stands for

(A) Queue Capacity
(B) Queue Discipline
(C) Number of Service Channels
(D) Input/output Processes

46. Balking, Reneging, Priority and Jockeying in Queuing systems refers to

(A) Service Patterns
(B) Input Mechanisms
(C) Queue Operational models
(D) Customer Behaviour in the queue

47. The traffic intensity of a queue can be calculated with the arrival rate (λ) and the Service Rate (μ) as

(A) $(\lambda)-(\mu)$
(B) $(\lambda)/(\mu)$
(C) $(\mu)/(\lambda)$
(D) $(\mu)-(\lambda)$

48. In (M/M/1 : ∞/FIFO) model, the average number of customers in the system including the service is equal to

(A) $(1-\rho)/\rho$
(B) $\rho/(1-\rho)$
(C) $\rho/(1-\rho)^2$
(D) $\rho^2/(1-\rho)$

49. The skewness of Gamma life distribution with shape parameter k, is

(A) $\frac{2}{\sqrt{k}}$
(B) $2\sqrt{k}$
(C) $\frac{\sqrt{k}}{2}$
(D) $\frac{k}{\sqrt{2}}$

50. The canonical correlation is the correlation between

(A) Maximum correlation between two random vectors
(B) Maximum correlation between two quantitative variables
(C) Maximum correlation between a component and a random vector
(D) Maximum correlation between two qualitative variables

51. The percentile point function of the Weibull distribution is

(A) $G(p) = (-\ln(1+p))^{1/\gamma}; 0 \le p < 1; \gamma > 0$

(B) $G(p) = (\ln(1-p))^{1/\gamma}; 0 \le p < 1; \gamma > 0$

(C) $G(p) = (-\ln(1-p))^{1/\gamma}; 0 \le p < 1; \gamma > 0$

(D) $G(p) = (-\ln(1-p^2))^{1/\gamma}; 0 \le p < 1; \gamma > 0$

52. The three-parameter Weibull distribution reduces to the two parameter Exponential distribution, when β takes the value

(A) $\beta < 1$
(B) $\beta = 1$
(C) $\beta > 1$
(D) $\beta = 0$

53. Let $Y_1 \leq Y_2 \leq \ldots \leq Y_n$ represent the order statistics based on the sample of size n from a distribution having cumulative distribution function $F(.)$, then the marginal cumulative distribution of Y_α; $\alpha = 1,2,\ldots,n$ is

(A) $\sum_{j=0}^{n} \binom{n}{j} [F(y)]^j [1-F(y)]^{n-j}$

(B) $\sum_{j=1}^{n} \binom{n}{j} [F(y)]^j [1-F(y)]^{n-j}$

(C) $\sum_{j=\alpha}^{n} \binom{n}{j} [F(y)]^j [1-F(y)]^{n-j}$

(D) $\sum_{j=2}^{n} [F(y)]^j [1-F(y)]^{n-j}$

54. Let $X \sim Laplace(\mu, \lambda)$. Then the probability density function of X is

(A) $\frac{1}{2} e^{-\lambda|x-\mu|}$

(B) $\frac{1}{2} \mu e^{-\lambda|x-\mu|}$

(C) $\frac{1}{2} \lambda e^{\lambda|x-\mu|}$

(D) $\frac{1}{2} \lambda e^{-\lambda|x-\mu|}$

55. Variance of the regression estimate is smaller than that of the mean per unit if

(A) $\rho = 0$ (B) $\rho \neq 0$ (C) $S_y^2 = 1$ (D) $S_x^2 = 1$

56. If $X_1, \ldots, X_n$ is a random sample of size 'n' from Cauchy $(1, \theta)$, then a consistent estimator for θ is

(A) Sample Mean

(B) Sample variance

(C) Sample Median

(D) Maximum of $(X_1, \ldots, X_n)$

57. If the negative binomial variate X with the following probability mass function,

$$f(x) = \binom{x+r-1}{x} q^x p^r \,; x = 0,1,2,\ldots\ldots$$

has mean 2 and variance 3, then the value of p is

(A) 2/3 (B) 1/3 (C) 1/4 (D) 3/4

58. Let X have the probability density function

$$f(x) = \begin{cases} 0.75(1-x^2), & x \in [-1,1] \\ 0, & elsewhere \end{cases}$$

Then the probability distribution function of X is

(A) $F(x) = 0.5 + 0.75\,x - 0.25\,x^3$, $x \in (-1,1]$

(B) $F(x) = 0.75x - 0.25x^2$, $x \in (-1,1)$

(C) $F(x) = 0.5 + -0.25\,x^3$, $x \in (-1,1]$

(D) $F(x) = 0.4\text{-}0.25x^2$, $x \in (-1,1]$

59. Let X be a continuous random variable with probability density function

$$f(x) = \begin{cases} kx, & 0 \leq x < 1 \\ k, & 1 \leq x < 2 \\ -kx + 3k, & 2 \leq x < 3 \end{cases}$$

The value of k is

(A) 1 (B) 1/2 (C) 0 (D) 3/2

60. If F is the distribution function of one dimensional random variable X, then

(A) $F(-\infty) = 1$, $F(\infty) = 1$

(B) $F(-\infty) = 0$, $F(\infty) = 1$

(C) $F(-\infty) = 0$, $F(\infty) = 0$

(D) $F(-\infty) = 1$, $F(\infty) = 0$

61. The cumulative distribution function of the smallest order statistic $X_{(1)}$ is

(A) $1-[1-F(x)]^n$

(B) $[1-F(x)]^n$

(C) $[1-F(x)]^{n-1}$

(D) $1-F(x)$

62. The expected value of the random variable X with probability density function

$$f(x) = \begin{cases} \frac{x+1}{8}, 2 < x < 4 \\ 0, \text{ otherwise} \end{cases}$$ is

(A) 37/6 (B) 37/12 (C) 37/18 (D) 37/24

63. If the p-component vector Y is distributed according to $N(0, \Sigma)$ and Σ is non-singular then $Y\Sigma^{-1}Y$ is distributed according to

(A) χ^2 distribution with p degrees of freedom

(B) χ^2 distribution with (p-1) degrees of freedom

(C) $N_p(0, Y\Sigma Y)$

(D) $N_p(0, Y\Sigma^{-1}Y)$

64. Let the covariance matrix be $\Sigma = \begin{pmatrix} 1 & \rho \\ \rho & 1 \end{pmatrix}$ then the variances of the two principal components are given by

(A) ρ, ρ^2

(B) $1+\rho, \rho$

(C) $1-\rho, \rho$

(D) $1+\rho, 1-\rho$

65. Given two random samples, one from each of two populations with the same unknown variance and unequal means, the likelihood ratio criterion for testing of the hypothesis of equal means leads to

(A) Chi- Square test
(B) normal test
(C) t-test
(D) F-test

66. If a distribution possesses the monotone likelihood ratio property, then

(A) for every randomized test, there exists an equally good non randomized test
(B) there exists a uniformly most powerful test for one-sided alternatives for testing composite hypotheses
(C) the likelihood ratio test statistic is distributed normally
(D) expectation of the likelihood ratio test statistic is equal to zero.

67. A measure function is a

(A) point function on Master set with Range $(-\infty, \infty)$
(B) point function on a σ - field with Range $(0, \infty)$
(C) set function on Master set with Range $(0, \infty)$
(D) set function on a σ - field with Range $(0, \infty)$

68. Let $Y_1 < Y_2 < ... < Y_n$ be the order statistics from uniform distribution over (0,1), then the correlation coefficient between Y_1 and Y_n is

(A) 1
(B) 0
(C) directly proportional to sample size
(D) inversely proportional to sample size

69. For a random variable X degenerate at $a \in R$

(A) $P(X = a) = 0$
(B) $P(X = a) = \infty$
(C) $P(X = a) = -\infty$
(D) $P(X = a) = 1$

70. The number of independent contrasts on which a sum of square is based is called

(A) Multiple contrast
(B) Simple contrast
(C) Mean Squares
(D) Degrees of freedom

71. Consider the following bivariate probability distribution.

		Y	
X		-1	1
	-1	1/2	0
	1	0	1/2

The characteristic function of (X,Y) is

(A) $\frac{e^{i(t_1+t_2)}+e^{-i(t_1+t_2)}}{2}$ (B) 1/2

(C) $2e^{-i(t_1+t_2)}$ (D) $2e^{i(t_1+t_2)}$

72. Strong Law of Large Numbers is based on the concept of

(A) Weak convergence (B) Almost sure convergence

(C) Convergence in probability (D) Convergence in r^{th} mean

73. If X^2 and Y^2 are independent then

(A) X and Y are independent (B) X and Y need not be independent

(C) $E(X^2) = E(Y^2)$ (D) $E(XY) = 0$

74. In a stratified random sampling scheme the population characteristics can be more efficiently estimated from a stratified sample than from overall simple random sample if

(A) Strata means differ widely, and within strata variation is high

(B) Strata means do not differ widely, and within strata variation is high

(C) Strata means differ widely, and within strata variation is low

(D) Strata means do not differ widely, and within strata variation is low

75. Variance is always less than mean in the

(A) Poisson distribution (B) Negative Binomial distribution

(C) Binomial distribution (D) Chi-square distribution

76. Let $X \sim B(n_1, p_1)$ and $Y \sim B(n_2, p_2)$ be two independent random variables then X + Y is

(A) not a Binomial variate (B) a Binomial variate

(C) a Hypergeometric variate (D) a Negative Binomial varaite

77. Characteristic function of Binomial distribution with parameters n and p is

(A) $(q + pe^{it})^n$ (B) $(p+qe^{it})^n$ (C) $(1+pe^{it})^n$ (D) $(p+e^{it})^n$

78. Let X and Y be two independent random variables such that X~ Binomial $(3, \frac{1}{3})$ and Y~ Binomial $(5, \frac{1}{3})$. Then $P[X + Y \geq 1]$ is equal to

(A) $\left(\frac{2}{3}\right)^8$ (B) $1 - \left(\frac{2}{3}\right)^8$ (C) $1+\left(\frac{2}{3}\right)^8$ (D) 1

79. If X and Y are independent Poisson variates, then the conditional distribution of X given $X \pm Y$ is

(A) Binomial distribution
(B) Geometric distribution
(C) Uniform distribution
(D) Hypergeometric distribution

80. If X is a Poisson variate such that P(X = 2) = 9 P(X=4) + 90 P(X = 6) then the mean of X is

(A) 1 (B) 2 (C) 3 (D) 4

81. If X has uniform distribution in [0,1], then pdf of Y= – 2 log X is given by

(A) $\frac{e^{-\frac{y}{2}}}{2}$ (B) $e^{-\frac{y}{2}}$ (C) $-\frac{y}{2}$ (D) $\frac{y}{2}$

82. If $X \sim \beta_2(\mu, \nu)$ then $Y = \frac{1}{1+X}$ follows

(A) $\beta_1(\mu,\nu)$ (B) $\beta_2(\mu,\nu)$ (C) $\beta_1(0,\nu)$ (D) $\beta_2(\mu,0)$

83. If $X \sim \chi^2_n$, then X/2 follows Gamma distribution with parameter

(A) $\frac{n}{2}$ (B) $\frac{1}{2}$ (C) 1 (D) 2

84. Systematic sampling is

(A) selection of n contiguous units
(B) selection of n units situated at equal distances
(C) selection of n largest units
(D) selection of n middle units in a sequence

85. If X ~ B(n,p), then $\text{Cov}\left(\frac{X}{n}, \frac{n-X}{n}\right)$ is

(A) $\frac{-pq}{n}$ (B) $\frac{pq}{n}$ (C) $\frac{-p}{n}$ (D) $\frac{-q}{n}$

86. In a latin square design of order 5 with two missing values it is found that the error sum of square is 120. Then the mean error sum of square is

(A) 10 (B) 12 (C) 15 (D) 8

87. A researcher conducts each replicate of a 2^7 Factorial experiment in 16 blocks of size 8 each. The number of interactions to be confounded is

(A) 8 (B) 7 (C) 15 (D) 16

88. For a Balanced Incomplete Block Design with parameters (v, b, r, k, λ), which of the design given below is not a BIBD?

(A) 6, 10, 5, 3, 2 (B) 7, 7, 3, 3, 1 (C) 8, 14, 7, 4, 2 (D) 7, 7, 4, 4, 2

89. A block design with v treatments in b blocks is said to be connected if the rank of the design matrix C is equal to

(A) b – 1 (B) b (C) v – 1 (D) v

90. A population consists of 10 students. The mark obtained by one student is 10 less than the average of the marks obtained by the remaining 9 students. Then the variance of the population of marks (σ^2) will always satisfy

(A) $\sigma^2 \geq 10$ (B) $\sigma^2 = 10$ (C) $\sigma^2 \leq 10$ (D) $\sigma^2 \geq 9$

91. With usual notation finite population correction is

(A) $(N-1)/n$ (B) $(N-n)/N$ (C) $(N-n)/n$ (D) $1-(1/n)$

92. In samples of moderate size the distribution of the ratio estimate shows a tendency to

(A) symmetry (B) negative skewness
(C) non-normal (D) positive skewness

93. Let $Y_1 \leq Y_2 \leq \ldots \leq Y_n$ be order statistics based on the sample of size 'n' from a population having p.d.f. f(.), then the density function of $Y_1, Y_2, \ldots, Y_n$ is

(A) $f(y_1).f(y_2)\ldots.f(y_n)$ (B) $n!f(y_1).f(y_2)\ldots.f(y_n)$

(C) $\frac{n!}{f(y_1).f(y_2)\ldots.f(y_n)}$ (D) $\frac{1}{f(y_1).f(y_2)\ldots.f(y_n)}$

94. Let X_1 , X_2 , X_3 be the sample of size 3 from a population having probability density function

$f(x) = 2x ; 0 < x < 1$

$= 0$; otherwise

Then the median of the distribution is

(A) $\frac{1}{\sqrt{3}}$ (B) $\sqrt{3}$ (C) $\sqrt{2}$ (D) $\frac{1}{\sqrt{2}}$

95. Let X be a random variable denoting failure time of a component. Failure rate of the component is constant if and only if p.d.f. of X is

(A) Exponential (B) Negative binomial

(C) Weibull (D) Normal

96. The hazard rate of weibull distribution is monotonic and it has increasing(decreasing) failure rate when the shape parameter (β) is

(A) $\beta >(<)1$ (B) $\beta <(>)1$ (C) $\beta >(=)1$ (D) $\beta =(<)1$

97. A two component system in parallel set up has constant failure rate. What is the reliability function for such configuration?

(A) $R(t) = 1 - [\exp(-\lambda_1 t) + \exp(-\lambda_2 t)]$

(B) $R(t) = \exp(-\lambda_1 t) + \exp(-\lambda_1 t) + \exp(-(\lambda_1 + \lambda_2) t)$

(C) $R(t) = (1- \exp(-\lambda_1 t))(1-\exp(-\lambda_2 t))$

(D) $R(t) = 1+ (1- \exp(-\lambda_1 t))(1- \exp(-\lambda_2 t))$

98. A continuous distribution which has properties similar to the Poisson distribution is

(A) Multinomial (B) Pascal distribution

(C) Chi- Square Distribution (D) Exponential Distribution

99. Under censoring scheme, a batch of transistors are kept for the life test in a random experiment and the test is terminated at a pre specific time t_c. This test experiment is called

(A) Type-I censoring (B) Type-II censoring

(C) Random censoring (D) Progressive censoring

100. The mgf of a r.v is given by $M_X(t) = (1 - t/5)^{-1}; t < 5$, then the mean and variance of X are

(A) 1/5, 1/25 (B) 1/25, 1/5 (C) 2/5, 3/25 (D) 3/25, 2/5