SET–"Z"

(DO NOT OPEN THIS QUESTION BOOKLET BEFORE TIME OR UNTIL YOU ARE ASKED TO DO SO)

(Ph.D/URS–EE Jan.2022)

STATISTICS

10025

Sr. No._____

Code **A**

Time : 1¼ Hours **Total Questions : 100** **Max. Marks : 100**

Roll No. _____ (in figure)_____ (in words)

Name : _____ Father's Name : _____

Mother's Name : _____ Date of Examination : _____

(Signature of the candidate) (Signature of the Invigilator)

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3. Keeping in view the transparency of the examination system, carbonless OMR Sheet is provided to the candidate so that a copy of OMR Sheet may be kept by the candidate.
4. Question Booklet along with answer key of all the A,B,C and D code will be got uploaded on the university website after the conduct of Entrance Examination. In case there is any discrepancy in the Question Booklet/Answer Key, the same may be brought to the notice of the Controller of Examinations in writing/through E-Mail within 24 hours of uploading the same on the University Website. Thereafter, no complaint in any case, will be considered.
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7. Use only Black or Blue **BALL POINT PEN** of good quality in the OMR Answer-Sheet.
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Question No.	Questions
1.	If a random variable X has pdf $f(x) = kx(1-x)$, $0 \le x \le 1$ then value of the constant k is : (1) $1/2$ (2) 2 (3) 4 (4) 6
2.	Mean of the random variable X having pdf $f(x) = 6x^3(4-x)^2$, $0 \le x \le 4$ is (1) 9/14 (2) 14/9 (3) 9/20 (4) None of these
3.	If F (x) denote the distribution function of a continuous random variable X then which one is not true (1) $F(-\infty) = 0$ (2) $F(\infty) = 1$ (3) F (x) is left continuous (4) None of these
4.	If X and Y are independent random variables, then (1) $E(XY) < E(X) \cdot E(Y)$ (2) $E(XY) > E(X) \cdot E(Y)$ (3) $E(XY) = E(X) \cdot E(Y)$ (4) None of these
5.	The skewness of a binomial distribution having probability of success $p = 1/2$ is (1) –1 (2) 0 (3) 1 (4) None of these

Question No.	Questions
6.	The variance of a distribution having M.G.F. $M(t) = \left(\frac{1}{2} + \frac{1}{2}e^t\right)^4$ is (1) 2 (2) 3/2 (3) 2/3 (4) None of these
7.	M.G.F. of Poisson distribution is (1) $M(t) = e^{\lambda(e^t - 1)}$ (2) $M(t) = e^{-\lambda(e^t - 1)}$ (3) $M(t) = e^{-\lambda e^t} + 1$ (4) $M(t) = e^{-\lambda e^t} - 1$
8.	If X is uniformly distributed over the interval [0, 1] then Var (X) is (1) 5/12 (2) 1/3 (3) 1/12 (4) 3/12
9.	If X and Y are random variables such that their expectations exist and $P(X \leq Y) = 1$, then (1) $E(X) \geq E(Y)$ (2) $E(X) \leq E(Y)$ (3) $E(X) = E(Y)$ (4) None of these
10.	Level of significance is equal to the probability of (1) Not committing Type-I error (2) Committing Type-II error (3) Not committing Type-II error (4) None of the above

Question No.	Questions
11.	To test $H_0 : \mu_0$ against $H_1 : \mu > \mu_0$ when the population variance is unknown and sample size is small, the appropriate test is (1) t-test (2) Z-test (3) Chi-square test (4) F-Test
12.	Paired t-test is applicable when the observations in the two samples are (1) Independent (2) Mutually independent (3) Paired (4) None of these
13.	Association of attributes in a 2×2 contingency table can be tested by (1) F-test (2) Z-test (3) t-test (4) Fisher Exact test
14.	The χ^2 statistic with usual notations in case of contingency table of order $(m \times n)$ is (1) $\chi^2 = \sum_{i=1}^{m}\sum_{j=1}^{n}\frac{(O_{ij}-E_{ij})^2}{E_{ij}}$ (2) $\chi^2 = \sum_{i=1}^{m}\sum_{j=1}^{n}\frac{O_{ij}^2-E_{ij}^2}{E_{ij}}$ (3) $\chi^2 = \sum_{i=1}^{m}\sum_{j=1}^{n}\left(\frac{O_{ij}-E_{ij}}{E_{ij}}\right)^2$ (4) None of these

Question No.	Questions
15.	If $r_{xy} = 0$, the two lines of regression (1) Coincide (2) Are parallel (3) Are perpendicular to each other (4) None of the above
16.	Correlation coefficient is independent of change of (1) Origin only (2) Scale only (3) Both origin and scale (4) None of these
17.	Given the two lines of regression as, $3x - 4y + 8 = 0$ and $4x - 3y = 1$, the means of x and y are respectively : (1) 4 and 5 (2) 5 and 4 (3) $\frac{4}{3}$ and $\frac{5}{4}$ (4) $\frac{3}{4}$ and $\frac{4}{5}$
18.	Skewness of a frequency curve shows (1) Flatness of the frequency curve (2) Lack of symmetry (3) Peakedness of the frequency curve (4) None of these
19.	For a leptokurtic distribution (1) $\beta_2 > 3$ (2) $\beta_2 < 3$ (3) $\beta_2 = 3$ (4) None of these

Question No.	Questions
20.	If $X_1, X_2, \ldots\ldots X_n$ is a random sample from a uniform distribution defined over the interval $0 < x < \theta$, $\theta > 0$, then with usual notations MLE of θ is (1) $X_{(1)}$ (2) $X_{(n)}$ (3) $(X_{(1)} + X_{(n)})/2$ (4) None of these
21.	The mean and variance of a chi-square distribution with degrees of freedom 4 are (1) 8 and 4 respectively (2) 4 and 8 respectively (3) 4 and 4 respectively (4) 8 and 8 respectively
22.	If $X \sim N(\mu, \sigma^2)$, the points of inflexion of normal curve are : (1) $\mu \pm 2\sigma$ (2) $\sigma \pm 2\mu$ (3) $\mu \pm \sigma$ (4) None of these
23.	If X is a Poisson variates with P (X = 1) = P (X = 2), then mean of the Poisson variate is equal to (1) 1 (2) 2 (3) 3 (4) 4
24.	Which of the following relation is true for the F-distribution : (1) $F_\alpha(n_1, n_2) = 1/F_\alpha(n_2, n_1)$ (2) $F_\alpha(n_1, n_2) = F_{1-\alpha}(n_2, n_1)$ (3) $F_\alpha(n_1, n_2) = 1/F_{1-\alpha}(n_2, n_1)$ (4) None of the above

Question No.	Questions
25.	Which of the following true is case of MGF of a random variable X (1) MGF may not exist (2) If exists MGF is unique (3) Both (1) and (2) are true (4) None of these
26.	If $X_1, X_2, \ldots\ldots X_N$ is a random sample from a multivariate distribution with mean vector μ and covariance matrix Σ, then distribution of sample mean vector $\overline{X}$ is : (1) $N(\mu, \Sigma)$ (2) $N(\mu, N\Sigma)$ (3) $N(\mu, \Sigma/N)$ (4) None of these
27.	If $X_1, X_2, \ldots\ldots X_N$ is a random sample from a p-variate normal distribution with mean vector μ and covariance matrix Σ, then MLE of Σ is given by : (1) $\frac{1}{N}\sum_{\alpha=1}^{N}(X_\alpha-\overline{X})^t(X_\alpha-\overline{X})$ (2) $\frac{1}{N+1}\sum_{\alpha=1}^{N}(X_\alpha-\overline{X})(X_\alpha-\overline{X})^t$ (3) $\frac{1}{N-1}\sum_{\alpha=1}^{N}(X_\alpha-\overline{X})^t(X_\alpha-\overline{X})$ (4) None of these
28.	If X has p-variate normal distribution with mean vector 0 and covariance matrix Σ and $\lvert\Sigma\rvert > 0$, then with usual notations the joint pdf can be written as the product of marginal pdfs of $X_1 : q \times 1$ and $X_2 : (p-q) \times 1$ if and only if (1) $\Sigma_{12} = 0$ (2) $\Sigma_{11} = 0$ (3) $\Sigma_{22} = 0$ (4) None of these

Question No.	Questions
29.	Let $X_1, X_2, ..., X_N$ be a random sample from a p-variate normal distribution with mean vector μ and covariance matrix Σ, then which of the following is true (1) $(N-1)S$ has Wishart Distribution (2) Sample mean and S are independent (3) Sample mean is distributed as $N_p(\mu, \Sigma/N)$ (4) All of these
30.	If $Y_1, Y_2, ..., Y_n$ dentote the principal components based on correlation matrix (R) and $\lambda_1 > \lambda_2, ... > \lambda_p$ are eigenvalues of R, then which of the following is true (1) $tr(\Sigma) = \sum_{i=1}^{p} Var(Y_i)$ (2) $\sum_{i=1}^{p} \lambda_i = \sum_{i=1}^{p} Var(Y_i)$ (3) $Var(Y_p) = p$ (4) All of the above
31.	In a RBD with v = 5 and r = 4 one treatment is added, the increase in error degrees of freedom will be : (1) 1 (2) 2 (3) 3 (4) 4

Question No.	Questions
32.	Which of the following is true about the Principal Component Analysis (1) Principal components are ordered linear combinations of the given variables (2) First Principal component has maximum variance (3) Both (1) and (2) are true (4) None of the above
33.	In experimental designs the experimental error is controlled by using the (1) Local control (2) Randomization (3) Replication (4) None of the above
34.	Which of the following is a principle of design of experiments (1) Replication (2) Local Control (3) Randomization (4) All of the above
35.	An investigator randomly assigns 10 patients to each of the 4 different treatments to study their effects of diastolic blood pressure. F test was used to test that the mean response was same between different groups. The numerator and denominator degrees of freedom for F test are (1) 3 and 10 respectively (2) 4 and 9 respectively (3) 3 and 36 respectively (4) None of these

Question No.	Questions
36.	If the overall F test in ANOVA is found to be significant then pair wise comparision between treatment means is made using : (1) Chi-square test (2) Two sample t test (3) Variance ratio test (4) None of these
37.	A sampling procedure in which the sampling units are selected at a regular interval systematically from the population is known as : (1) Systematic sampling (2) Stratified sampling (3) Systematic random sampling (4) Both (1) and (3)
38.	In RCBD, which of the following principle is adopted ? (1) Replication (2) Randomization (3) Local control (4) All of these
39.	The common device to reduce the block size in experiments studying main effects and interaction is : (1) Confounding (2) Block Interaction (3) BIBD (4) Asymmetrical factorial design
40.	In designs of experiment. A general rule is to use as many replications which provides at least : (1) 20 error DF (2) 12 error DF (3) 30 error DF (4) None of these

Question No.	Questions
41.	A stratified random sample of size 32 is drawn from three strata of sizes 20, 40 and 100. The samples drawn using proportional allocation have sizes : (1) 6, 10, 16 (2) 4, 8, 20 (3) 5, 9, 18 (4) None of these
42.	Non-response in sample surveys means (1) Non-availability of respondents (2) Non-return of questionnaire by the respondents (3) Refusal to give information (4) All of these
43.	Which of the following is an example of a non-random sampling technique ? (1) Purposive (2) Quota (3) Convenience (4) All of these
44.	Sample survey is advantageous over census because it (1) is less costly (2) has greater scope (3) both (1) and (2) (4) none of these

Question No.	Questions
45.	Which of these does not match with others (1) Harvit-Thompson estimator (2) Murthy unordered estimator (3) Des Raj ordered estimator (4) Rao, Hartley and Chochran estimator
46.	Infant mortality rate is defined as the number of deaths under one year of age in a year : (1) Per 1000 live births (2) Per 1000 population (3) Per 1000 women (4) None of these
47.	Which of the following is not a method of collecting vital statistics : (1) Census Method (2) Analytical Method (3) Registration Method (4) None of these
48.	Total fertility rate is derived from : (1) Age specific birth rate (2) Gross reproduction rate (3) Net reproductive rate (4) None of these

Question No.	Questions
49.	The formula $\frac{\sum p_{0i} q_{1i}}{\sum p_{0i} q_{0i}} \times 100$ represents (1) Fisher's Index (2) Kelly's Index (3) Paasche's Index (4) None of these
50.	Fertility refers to : (1) Actual bearing of children (2) Capacity to bear the child (3) Average No. of live birth per woman in the year (4) None of these
51.	The region of feasible solution in LPP graphical method is called (1) unbounded region (2) feasible region (3) infeasible region (4) infinite region
52.	In Simplex method, which of the following is correct about the basic feasible solution. (1) a basic feasible solution is a solution with a maximal set of non-zero variables (2) a basic feasible solution is a solution with a minimal set of non-zero variables (3) a basic feasible solution does not correspond to a corner of the polyhedron of feasible solutions (4) None of these

Question No.	Questions
53.	In transportation models the points of demand are called : (1) Origins (2) Supply centres (3) Destinations (4) None of these
54.	Which of the following are the entities whose values are to be determined from the solution of the LPP : (1) objective function (2) decision variables (3) constraints (4) opportunity cost
55.	A constraint in an LP model restricts (1) Value of the objective function (2) Values of the decision variables (3) Use of the available resources (4) All of the above
56.	Operations Research is a very powerful tool for (1) Research (2) Operations (3) Decision Making (4) None of the above

Question No.	Questions
57.	In transportation table every loop has (1) An even number of cells (2) An odd number of cells (3) An equal number of cells (4) None of the above
58.	When it is not possible to find solution in LPP, it is called as (1) Infeasible solution (2) Unbounded solution (3) Improper solution (4) None of the above
59.	One disadvantage of using North-West Corner Rule to find initial solution to the transportation problem is that (1) It is complicated to use (2) It ignores the cost of transportation (3) It leads to degenerate initial solution (4) All of the above
60.	Game theory models are classified by the (1) Number of players (2) Sum of payoffs (3) Number of strategies (4) All of the above
61.	When the sum of gains of one player is equal to the sum of losses to another player is a game, this situation is known as (1) Biased game (2) Non-zero-sum game (3) Fair game (4) None of these

Question No.	Questions
62.	Saddle point exists in game theory when (1) Maximin and minimax value of the game are same (2) Maximin value of the game is greater than minimax value (3) Maximin value of the game is less than minimax value (4) None of the above
63.	The time over which the inventory level will be controlled is called : (1) Time Horizon (2) Lead Time (3) Time to take decision (4) None of these
64.	Which of the following is true about the buffer stock ? (1) A buffer stock scheme is an attempt to use commodity storage for the purposes of Stabilising prices in an entire economy or an individual market. (2) Commodities are bought and stored when a surplus exists in the economy. (3) Commodities are sold from the stores when economic shortages in the economy occur. (4) All of these
65.	The variable added to the LHS of a less than or equal to constraint to convert it into equality is called variable (1) artificial (2) surplus (3) slack (4) additional

Question No.	Questions
66.	If a customer decides not to enter the queue because of its huge length, he is said to have (1) Balked (2) Reneged (3) Jockey (4) None of these
67.	When a maximization assignment problem is converted in minimization problem, the resulting matrix is called matrix . (1) cost (2) profit (3) regret (4) dummy
68.	Cars arrive at a service station according to Poisson distribution with a mean rate of 5 per hour. The service time per car follows an exponential distribution with a mean of 10 minutes. At the steady state, the average waiting time in the queue is : (1) 50 minutes (2) 25 minutes (3) 20 minutes (4) None of these
69.	Efficiency of M/M/C model in terms of the Total Number of Customers (TNC) and Average Number of Customers Served (ANCS) is given by (1) TNC/ANCS (2) ANCS/TN (3) ANCS × TNC (4) None of these

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70.	Which of the following is true about an evolutionary random process ? (1) It is not stationary (2) Poisson process is an example of evolutionary random process (3) Both (1) and (2) are true (4) None of these
71.	If a closed set C contains only one state j, then the state is called : (1) Non-absorbing state (2) Persistent state (3) Transient state (4) None of these
72.	Which of the following is true about an absorbing Markov chain : (1) A Markov chain is said to be absorbing if it has at least one absorbing state. (2) If the state j is absorbing the $p_{ij} = 1$ (3) It is impossible to leave an absorbing state (4) All of these
73.	Extinction of a stochastic process means that the sequence $\{X_n\}$ consists of (1) Zeros for all except a finite number of values of n (2) Zeros for all values of n (3) Zeros for at least one value of n (4) None of these

Question No.	Questions
74.	For an immigration-emigration process which of the following is true (1) $\lambda_n = \lambda$ (2) $\mu_n = \mu$ (3) $\lambda_n = 1$ and $\mu_n = \mu$ (4) None of these
75.	Which of the following is true about a Yule-Furry Process : (1) It is a Pure Birth Process (2) It is a Pure Death Process (3) It is a Birth and Death Process (4) None of these
76.	A matrix is in reduced row-echelon form if it meets the following condition(s) : (1) If there is a row where every entry is zero, then this row lies below any other row that contains a nonzero entry. (2) The leftmost non-zero entry of a row is equal to 1. (3) Both (1) and (2) (4) None of these
77.	If A is square matrix, then roots of the equation $\|A - \lambda I\| = 0$ are called : (1) Latent roots (2) Eigenvalues (3) Both (1) and (2) are true (4) None of these

Question No.	Questions
78.	A quadratic form is a polynomial with all terms of degree two (1) 1 (2) 2 (3) 3 (4) 4
79.	The index of the quadratic form is equal to (1) The difference between the number of positive Eigen values and the number of negative Eigen values of the matrix of quadratic form. (2) The sum of the number of positive Eigen values and the number of negative Eigen values of the matrix of quadratic form. (3) Neither (1) nor (2) (4) None of the above
80.	A one-element vector space is an example of a (1) Trivial space (2) Universal space (3) Sample space (4) None of these
81.	Angle between the vectors $a = (1, 1, 0)^t$ and $b = (0, 3, 2)^t$ is (1) $\arccos\left(\frac{2}{\sqrt{3}\sqrt{13}}\right)$ (2) $\arccos\left(\frac{13}{\sqrt{2}\sqrt{3}}\right)$ (3) $\arccos\left(\frac{3}{\sqrt{2}\sqrt{13}}\right)$ (4) None of these

Question No.	Questions
82.	Which of the following is true regarding basis of a vector space (1) It is a sequence of vectors (2) It spans the space if the set of elements of the sequence spans the space (3) Vectors in basis are linearly independent (4) All of these
83.	Which of the following is true about f (z) = z2 + 2z ? (1) Continuous and Differentiable (2) Continuous but not Differentiable (3) Neither Continuous Nor Differentiable (4) None of these
84.	The radius of convergence of a power series f centered on a point a is equal to the distance from a to the nearest point where f (1) Can not be defined in a way that makes it holomorphic. (2) Can be defined in a way that makes it holomorphic. (3) Can not be defined in a way that does not make it holomorphic (4) None of these

Question No.	Questions
85.	Which of the following is true about the radius of convergence of a power series : (1) is the radius of the largest disk at the center of the series in which the series converges (2) is the radius of the smallest disk at the center of the series in which the series converges (3) is the radius of the largest disk at the center of the series in which the series diverges (4) None of these
86.	The Cauchy integral theorem in complex analysis is (1) the fundamental theorem of circular integrals (2) an important statement about line integrals for holomorphic functions in the complex plane (3) an important statement about line integrals for homomorphic functions in the real plane (4) None of these
87.	A sequence $\left\{\frac{1}{n}\right\}$ is (1) Bounded (2) Unbounded (3) Divergent (4) None of these

Question No.	Questions
88.	Which of the following is true about a closed set ? (1) Contains all its limit points (2) Does not contains all of its limit points (3) Is unbounded (4) None of these
89.	Let A = [0, 1] and B = [2, 3], then which of the following is correct (1) Both A and B are connected (2) $A \cup B$ is not connected (3) Both (1) and (2) are correct (4) None of these
90.	Let U = (– 1, 0) and V = (0, 1), then which of the following is not true (1) U and V are disjoint open sets (2) U and V are disjoint closed sets (3) Distance between U and V is 0 (4) None of these
91.	Let $f(x) = x^2$ and U = (– 1, 1), then f (U) = [0, 1) is (1) Bounded open set (2) Unbounded open set (3) Not an open set (4) None of these

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92.	A point at which an analytical function ceases to possess a derivative is called (1) Stagnation Point (2) Saddle Point (3) Critical Point (4) Singular Point
93.	The Newton-Raphson Method fails if (1) $f(x0) = 0$ (2) $f'(x0) = 0$ (3) $f''(x0) = 0$ (4) None of these
94.	If $f(z)$ is analytic within and on a closed curve and if a is any point within C, then $f(a) = \frac{1}{2\pi i}\int_C \frac{f(z)\,dz}{z-a}$ represents (1) Cauchy's Theorem (2) Residue Theorem (3) Morera's Theorem (4) Cauchy's Integral Formula
95.	Which of the following is not a method of Numerical Integration (1) Runges's method (2) Weddle's rule (3) Simpson's one-third rule (4) Trapezoidal rule
96.	Which of the following is true in relation to the Regula-Falsi method : (1) Is method of finding real roots of an equation $f(x) = 0$ (2) Closely resembles the bisection method (3) Both (1) and (2) are true (4) None of these

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97.	The formula used for solving the equation using Regula Falsi method is (1) $x = \frac{bf(a) - af(b)}{f(a) - f(b)}$ (2) $x = \frac{af(a) - bf(b)}{f(a) - f(b)}$ (3) $x = \frac{bf(a) - af(b)}{a - b}$ (4) None of these
98.	With usual notations, which of the following relations between operator is correct : (1) $\delta = E^{1/2} - E^{-1/2}$ (2) $\delta = E^{1/2} + E^{-1/2}$ (3) $\delta = E - E^{-1/2}$ (4) None of these
99.	Which of the following is true about the Newton's Forward Interpolatio formula : (1) Is used for interpolating y values near the end of a set of tabulate values (2) Is used for extrapolating y values a little ahead of y_n (3) Both (1) and (2) are true (4) None of these
100.	Which of the following is a method for a numerical solution of ODEs : (1) Runge-Kutta Method (2) Picard's Method (3) Euler's Method (4) All of these

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1.	To test $H_0 : \mu_0$ against $H_1 : \mu > \mu_0$ when the population variance is unknown and sample size is small, the appropriate test is (1) t-test (2) Z-test (3) Chi-square test (4) F-Test
2.	Paired t-test is applicable when the observations in the two samples are (1) Independent (2) Mutually independent (3) Paired (4) None of these
3.	Association of attributes in a 2×2 contingency table can be tested by (1) F-test (2) Z-test (3) t-test (4) Fisher Exact test
4.	The χ^2 statistic with usual notations in case of contingency table of order (m × n) is (1) $\chi^2 = \sum_{i=1}^{m}\sum_{j=1}^{n}\frac{(O_{ij}-E_{ij})^2}{E_{ij}}$ (2) $\chi^2 = \sum_{i=1}^{m}\sum_{j=1}^{n}\frac{O_{ij}^2-E_{ij}^2}{E_{ij}}$ (3) $\chi^2 = \sum_{i=1}^{m}\sum_{j=1}^{n}\left(\frac{O_{ij}-E_{ij}}{E_{ij}}\right)^2$ (4) None of these

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5.	If $r_{xy} = 0$, the two lines of regression (1) Coincide (2) Are parallel (3) Are perpendicular to each other (4) None of the above
6.	Correlation coefficient is independent of change of (1) Origin only (2) Scale only (3) Both origin and scale (4) None of these
7.	Given the two lines of regression as, $3x - 4y + 8 = 0$ and $4x - 3y = 1$, the means of x and y are respectively : (1) 4 and 5 (2) 5 and 4 (3) $\frac{4}{3}$ and $\frac{5}{4}$ (4) $\frac{3}{4}$ and $\frac{4}{5}$
8.	Skewness of a frequency curve shows (1) Flatness of the frequency curve (2) Lack of symmetry (3) Peakedness of the frequency curve (4) None of these
9.	For a leptokurtic distribution (1) $\beta_2 > 3$ (2) $\beta_2 < 3$ (3) $\beta_2 = 3$ (4) None of these

Question No.	Questions
10.	If $X_1, X_2, \ldots\ldots X_n$ is a random sample from a uniform distribution defined over the interval $0 < x < \theta, \theta > 0$, then with usual notations MLE of θ is (1) $X_{(1)}$ (2) $X_{(n)}$ (3) $(X_{(1)} + X_{(n)})/2$ (4) None of these
11.	Let $f(x) = x^2$ and $U = (-1, 1)$, then $f(U) = [0, 1)$ is (1) Bounded open set (2) Unbounded open set (3) Not an open set (4) None of these
12.	A point at which an analytical function ceases to possess a derivative is called (1) Stagnation Point (2) Saddle Point (3) Critical Point (4) Singular Point
13.	The Newton-Raphson Method fails if (1) $f(x0) = 0$ (2) $f'(x0) = 0$ (3) $f''(x0) = 0$ (4) None of these
14.	If $f(z)$ is analytic within and on a closed curve and if a is any point within C, then $f(a) = \frac{1}{2\pi i}\int_C \frac{f(z)\,dz}{z-a}$ represents (1) Cauchy's Theorem (2) Residue Theorem (3) Morera's Theorem (4) Cauchy's Integral Formula

Question No.	Questions
15.	Which of the following is not a method of Numerical Integration (1) Runges's method (2) Weddle's rule (3) Simpson's one-third rule (4) Trapezoidal rule
16.	Which of the following is true in relation to the Regula-Falsi method : (1) Is method of finding real roots of an equation $f(x) = 0$ (2) Closely resembles the bisection method (3) Both (1) and (2) are true (4) None of these
17.	The formula used for solving the equation using Regula Falsi method is (1) $x = \frac{bf(a) - af(b)}{f(a) - f(b)}$ (2) $x = \frac{af(a) - bf(b)}{f(a) - f(b)}$ (3) $x = \frac{bf(a) - af(b)}{a - b}$ (4) None of these
18.	With usual notations, which of the following relations between operators is correct : (1) $\delta = E^{1/2} - E^{-1/2}$ (2) $\delta = E^{1/2} + E^{-1/2}$ (3) $\delta = E - E^{-1/2}$ (4) None of these

Question No.	Questions
19.	Which of the following is true about the Newton's Forward Interpolation formula : (1) Is used for interpolating y values near the end of a set of tabulated values (2) Is used for extrapolating y values a little ahead of y_n (3) Both (1) and (2) are true (4) None of these
20.	Which of the following is a method for a numerical solution of ODEs : (1) Runge-Kutta Method (2) Picard's Method (3) Euler's Method (4) All of these
21.	If a closed set C contains only one state j, then the state is called : (1) Non-absorbing state (2) Persistent state (3) Transient state (4) None of these
22.	Which of the following is true about an absorbing Markov chain : (1) A Markov chain is said to be absorbing if it has at least one absorbing state. (2) If the state j is absorbing the $p_{ij} = 1$ (3) It is impossible to leave an absorbing state (4) All of these

Question No.	Questions
23.	Extinction of a stochastic process means that the sequence $\{X_n\}$ consists of (1) Zeros for all except a finite number of values of n (2) Zeros for all values of n (3) Zeros for at least one value of n (4) None of these
24.	For an immigration-emigration process which of the following is true (1) $\lambda_n = \lambda$ (2) $\mu_n = \mu$ (3) $\lambda_n = 1$ and $\mu_n = \mu$ (4) None of these
25.	Which of the following is true about a Yule-Furry Process : (1) It is a Pure Birth Process (2) It is a Pure Death Process (3) It is a Birth and Death Process (4) None of these
26.	A matrix is in reduced row-echelon form if it meets the following condition(s) : (1) If there is a row where every entry is zero, then this row lies below any other row that contains a nonzero entry. (2) The leftmost non-zero entry of a row is equal to 1. (3) Both (1) and (2) (4) None of these

Question No.	Questions
27.	If A is square matrix, then roots of the equation $\|A - \lambda I\| = 0$ are called : (1) Latent roots (2) Eigenvalues (3) Both (1) and (2) are true (4) None of these
28.	A quadratic form is a polynomial with all terms of degree two (1) 1 (2) 2 (3) 3 (4) 4
29.	The index of the quadratic form is equal to (1) The difference between the number of positive Eigen values and the number of negative Eigen values of the matrix of quadratic form. (2) The sum of the number of positive Eigen values and the number of negative Eigen values of the matrix of quadratic form. (3) Neither (1) nor (2) (4) None of the above
30.	A one-element vector space is an example of a (1) Trivial space (2) Universal space (3) Sample space (4) None of these

Question No.	Questions
31.	The region of feasible solution in LPP graphical method is called (1) unbounded region (2) feasible region (3) infeasible region (4) infinite region
32.	In Simplex method, which of the following is correct about the basic feasible solution. (1) a basic feasible solution is a solution with a maximal set of non-zero variables (2) a basic feasible solution is a solution with a minimal set of non-zero variables (3) a basic feasible solution does not correspond to a corner of the polyhedron of feasible solutions (4) None of these
33.	In transportation models the points of demand are called : (1) Origins (2) Supply centres (3) Destinations (4) None of these
34.	Which of the following are the entities whose values are to be determined from the solution of the LPP : (1) objective function (2) decision variables (3) constraints (4) opportunity cost

Question No.	Questions
35.	A constraint in an LP model restricts (1) Value of the objective function (2) Values of the decision variables (3) Use of the available resources (4) All of the above
36.	Operations Research is a very powerful tool for (1) Research (2) Operations (3) Decision Making (4) None of the above
37.	In transportation table every loop has (1) An even number of cells (2) An odd number of cells (3) An equal number of cells (4) None of the above
38.	When it is not possible to find solution in LPP, it is called as (1) Infeasible solution (2) Unbounded solution (3) Improper solution (4) None of the above

Question No.	Questions
39.	One disadvantage of using North-West Corner Rule to find initial solution to the transportation problem is that (1) It is complicated to use (2) It ignores the cost of transportation (3) It leads to degenerate initial solution (4) All of the above
40.	Game theory models are classified by the (1) Number of players (2) Sum of payoffs (3) Number of strategies (4) All of the above
41.	In a RBD with v = 5 and r = 4 one treatment is added, the increase in error degrees of freedom will be : (1) 1 (2) 2 (3) 3 (4) 4
42.	Which of the following is true about the Principal Component Analysis (1) Principal components are ordered linear combinations of the given variables (2) First Principal component has maximum variance (3) Both (1) and (2) are true (4) None of the above

Question No.	Questions
43.	In experimental designs the experimental error is controlled by using the (1) Local control (2) Randomization (3) Replication (4) None of the above
44.	Which of the following is a principle of design of experiments (1) Replication (2) Local Control (3) Randomization (4) All of the above
45.	An investigator randomly assigns 10 patients to each of the 4 different treatments to study their effects of diastolic blood pressure. F test was used to test that the mean response was same between different groups. The numerator and denominator degrees of freedom for F test are (1) 3 and 10 respectively (2) 4 and 9 respectively (3) 3 and 36 respectively (4) None of these
46.	If the overall F test in ANOVA is found to be significant then pair wise comparision between treatment means is made using : (1) Chi-square test (2) Two sample t test (3) Variance ratio test (4) None of these
47.	A sampling procedure in which the sampling units are selected at a regular interval systematically from the population is known as : (1) Systematic sampling (2) Stratified sampling (3) Systematic random sampling (4) Both (1) and (3)

Question No.	Questions
48.	In RCBD, which of the following principle is adopted ? (1) Replication (2) Randomization (3) Local control (4) All of these
49.	The common device to reduce the block size in experiments studying main effects and interaction is : (1) Confounding (2) Block Interaction (3) BIBD (4) Asymmetrical factorial design
50.	In designs of experiment. A general rule is to use as many replications which provides at least : (1) 20 error DF (2) 12 error DF (3) 30 error DF (4) None of these
51.	The mean and variance of a chi-square distribution with degrees of freedom 4 are (1) 8 and 4 respectively (2) 4 and 8 respectively (3) 4 and 4 respectively (4) 8 and 8 respectively
52.	If $X \sim N(\mu, \sigma^2)$, the points of inflexion of normal curve are : (1) $\mu \pm 2\sigma$ (2) $\sigma \pm 2\mu$ (3) $\mu \pm \sigma$ (4) None of these

Question No.	Questions
53.	If X is a Poisson variates with P (X = 1) = P (X = 2), then mean of the Poisson variate is equal to (1) 1 (2) 2 (3) 3 (4) 4
54.	Which of the following relation is true for the F-distribution : (1) $F_{\alpha}(n_1, n_2) = 1/F_{\alpha}(n_2, n_1)$ (2) $F_{\alpha}(n_1, n_2) = F_{1-\alpha}(n_2, n_1)$ (3) $F_{\alpha}(n_1, n_2) = 1/F_{1-\alpha}(n_2, n_1)$ (4) None of the above
55.	Which of the following true is case of MGF of a random variable X (1) MGF may not exist (2) If exists MGF is unique (3) Both (1) and (2) are true (4) None of these
56.	If $X_1, X_2, \ldots\ldots X_N$ is a random sample from a multivariate distribution with mean vector μ and covariance matrix Σ, then distribution of sample mean vector $\overline{X}$ is : (1) $N(\mu, \Sigma)$ (2) $N(\mu, N\Sigma)$ (3) $N(\mu, \Sigma/N)$ (4) None of these

Question No.	Questions
57.	If $X_1, X_2, \ldots\ldots X_N$ is a random sample from a p-variate normal distribution with mean vector μ and covariance matrix Σ, then MLE of Σ is given by : (1) $\frac{1}{N}\sum_{\alpha=1}^{N}(X_\alpha - \bar{X})^t (X_\alpha - \bar{X})$ (2) $\frac{1}{N+1}\sum_{\alpha=1}^{N}(X_\alpha - \bar{X})(X_\alpha - \bar{X})^t$ (3) $\frac{1}{N-1}\sum_{\alpha=1}^{N}(X_\alpha - \bar{X})^t (X_\alpha - \bar{X})$ (4) None of these
58.	If X has p-variate normal distribution with mean vector 0 and covariance matrix Σ and $\lvert\Sigma\rvert > 0$, then with usual notations the joint pdf can be written as the product of marginal pdfs of $X_1 : q \times 1$ and $X_2 : (p-q) \times 1$ if and only if (1) $\Sigma_{12} = 0$ (2) $\Sigma_{11} = 0$ (3) $\Sigma_{22} = 0$ (4) None of these
59.	Let $X_1, X_2, \ldots\ldots, X_N$ be a random sample from a p-variate normal distribution with mean vector μ and covariance matrix Σ, then which of the following is true (1) (N – 1) S has Wishart Distribution (2) Sample mean and S are independent (3) Sample mean is distributed as $N_p(\mu, \Sigma/N)$ (4) All of these

Question No.	Questions
60.	If $Y_1, Y_2, \ldots, Y_n$ dentote the principal components based on correlation matrix (R) and $\lambda_1 > \lambda_2, \ldots > \lambda_p$ are eigenvalues of R, then which of the following is true (1) $tr(\Sigma) = \sum_{i=1}^{p} Var(Y_i)$ (2) $\sum_{i=1}^{p} \lambda_i = \sum_{i=1}^{p} Var(Y_i)$ (3) $Var(Y_p) = p$ (4) All of the above
61.	A stratified random sample of size 32 is drawn from three strata of sizes 20, 40 and 100. The samples drawn using proportional allocation have sizes : (1) 6, 10, 16 (2) 4, 8, 20 (3) 5, 9, 18 (4) None of these
62.	Non-response in sample surveys means (1) Non-availability of respondents (2) Non-return of questionnaire by the respondents (3) Refusal to give information (4) All of these
63.	Which of the following is an example of a non-random sampling technique ? (1) Purposive (2) Quota (3) Convenience (4) All of these

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64.	Sample survey is advantageous over census because it (1) is less costly (2) has greater scope (3) both (1) and (2) (4) none of these
65.	Which of these does not match with others (1) Harvit-Thompson estimator (2) Murthy unordered estimator (3) Des Raj ordered estimator (4) Rao, Hartley and Chochran estimator
66.	Infant mortality rate is defined as the number of deaths under one year of age in a year : (1) Per 1000 live births (2) Per 1000 population (3) Per 1000 women (4) None of these
67.	Which of the following is not a method of collecting vital statistics : (1) Census Method (2) Analytical Method (3) Registration Method (4) None of these

Question No.	Questions
68.	Total fertility rate is derived from : (1) Age specific birth rate (2) Gross reproduction rate (3) Net reproductive rate (4) None of these
69.	The formula $\frac{\sum p_{0i} q_{1i}}{\sum p_{0i} q_{0i}} \times 100$ represents (1) Fisher's Index (2) Kelly's Index (3) Paasche's Index (4) None of these
70.	Fertility refers to : (1) Actual bearing of children (2) Capacity to bear the child (3) Average No. of live birth per woman in the year (4) None of these
71.	When the sum of gains of one player is equal to the sum of losses to another player is a game, this situation is known as (1) Biased game (2) Non-zero-sum game (3) Fair game (4) None of these
72.	Saddle point exists in game theory when (1) Maximin and minimax value of the game are same (2) Maximin value of the game is greater than minimax value (3) Maximin value of the game is less than minimax value (4) None of the above

Question No.	Questions
73.	The time over which the inventory level will be controlled is called : (1) Time Horizon (2) Lead Time (3) Time to take decision (4) None of these
74.	Which of the following is true about the buffer stock ? (1) A buffer stock scheme is an attempt to use commodity storage for the purposes of Stabilising prices in an entire economy or an individual market. (2) Commodities are bought and stored when a surplus exists in the economy. (3) Commodities are sold from the stores when economic shortages in the economy occur. (4) All of these
75.	The variable added to the LHS of a less than or equal to constraint to convert it into equality is called variable (1) artificial (2) surplus (3) slack (4) additional
76.	If a customer decides not to enter the queue because of its huge length, he is said to have (1) Balked (2) Reneged (3) Jockey (4) None of these

Question No.	Questions
77.	When a maximization assignment problem is converted in minimization problem, the resulting matrix is called matrix : (1) cost (2) profit (3) regret (4) dummy
78.	Cars arrive at a service station according to Poisson distribution with a mean rate of 5 per hour. The service time per car follows an exponential distribution with a mean of 10 minutes. At the steady state, the average waiting time in the queue is : (1) 50 minutes (2) 25 minutes (3) 20 minutes (4) None of these
79.	Efficiency of M/M/C model in terms of the Total Number of Customers (TNC) and Average Number of Customers Served (ANCS) is given by (1) TNC/ANCS (2) ANCS/TN (3) ANCS × TNC (4) None of these
80.	Which of the following is true about an evolutionary random process ? (1) It is not stationary (2) Poisson process is an example of evolutionary random process (3) Both (1) and (2) are true (4) None of these

Question No.	Questions
81.	If a random variable X has pdf $f(x) = kx(1-x)$, $0 \le x \le 1$ then value of the constant k is : (1) $\frac{1}{2}$ (2) 2 (3) 4 (4) 6
82.	Mean of the random variable X having pdf $f(x) = 6x^3(4-x)^2$, $0 \le x \le 4$ is (1) 9/14 (2) 14/9 (3) 9/20 (4) None of these
83.	If F (x) denote the distribution function of a continuous random variable X then which one is not true (1) $F(-\infty) = 0$ (2) $F(\infty) = 1$ (3) F (x) is left continuous (4) None of these
84.	If X and Y are independent random variables, then (1) $E(XY) < E(X) \cdot E(Y)$ (2) $E(XY) > E(X) \cdot E(Y)$ (3) $E(XY) = E(X) \cdot E(Y)$ (4) None of these
85.	The skewness of a binomial distribution having probability of success p = 1/2 is (1) –1 (2) 0 (3) 1 (4) None of these

Question No.	Questions
86.	The variance of a distribution having M.G.F. $M(t) = \left(\frac{1}{2} + \frac{1}{2}e^t\right)^4$ is (1) 2 (2) 3/2 (3) 2/3 (4) None of these
87.	M.G.F. of Poisson distribution is (1) $M(t) = e^{\lambda(e^t - 1)}$ (2) $M(t) = e^{-\lambda(e^t - 1)}$ (3) $M(t) = e^{-\lambda e^t} + 1$ (4) $M(t) = e^{-\lambda e^t} - 1$
88.	If X is uniformly distributed over the interval [0, 1] then Var (X) is (1) 5/12 (2) 1/3 (3) 1/12 (4) 3/12
89.	If X and Y are random variables such that their expectations exist and $P(X \leq Y) = 1$, then (1) $E(X) \geq E(Y)$ (2) $E(X) \leq E(Y)$ (3) $E(X) = E(Y)$ (4) None of these
90.	Level of significance is equal to the probability of (1) Not committing Type-I error (2) Committing Type-II error (3) Not committing Type-II error (4) None of the above

Question No.	Questions
91.	Angle between the vectors $a = (1, 1, 0)^t$ and $b = (0, 3, 2)^t$ is (1) $\arccos\left(\frac{2}{\sqrt{3}\sqrt{13}}\right)$ (2) $\arccos\left(\frac{13}{\sqrt{2}\sqrt{3}}\right)$ (3) $\arccos\left(\frac{3}{\sqrt{2}\sqrt{13}}\right)$ (4) None of these
92.	Which of the following is true regarding basis of a vector space (1) It is a sequence of vectors (2) It spans the space if the set of elements of the sequence spans the space (3) Vectors in basis are linearly independent (4) All of these
93.	Which of the following is true about f (z) = z2 + 2z ? (1) Continuous and Differentiable (2) Continuous but not Differentiable (3) Neither Continuous Nor Differentiable (4) None of these

Question No.	Questions
94.	The radius of convergence of a power series f centered on a point a is equal to the distance from a to the nearest point where f (1) Can not be defined in a way that makes it holomorphic. (2) Can be defined in a way that makes it holomorphic. (3) Can not be defined in a way that does not make it holomorphic (4) None of these
95.	Which of the following is true about the radius of convergence of a power series : (1) is the radius of the largest disk at the center of the series in which the series converges (2) is the radius of the smallest disk at the center of the series in which the series converges (3) is the radius of the largest disk at the center of the series in which the series diverges (4) None of these
96.	The Cauchy integral theorem in complex analysis is (1) the fundamental theorem of circular integrals (2) an important statement about line integrals for holomorphic functions in the complex plane (3) an important statement about line integrals for homomorphic functions in the real plane (4) None of these

Question No.	Questions
97.	A sequence $\left\{\frac{1}{n}\right\}$ is (1) Bounded (2) Unbounded (3) Divergent (4) None of these
98.	Which of the following is true about a closed set ? (1) Contains all its limit points (2) Does not contains all of its limit points (3) Is unbounded (4) None of these
99.	Let A = [0, 1] and B = [2, 3], then which of the following is correct (1) Both A and B are connected (2) $A \cup B$ is not connected (3) Both (1) and (2) are correct (4) None of these
100.	Let U = (– 1, 0) and V = (0, 1), then which of the following is not true (1) U and V are disjoint open sets (2) U and V are disjoint closed sets (3) Distance between U and V is 0 (4) None of these

SET–"Z"

(DO NOT OPEN THIS QUESTION BOOKLET BEFORE TIME OR UNTIL YOU ARE ASKED TO DO SO)

(Ph.D/URS–EE Jan. 2022)

STATISTICS

10023

Sr. No._____

Code **C**

Time : 1¼ Hours **Total Questions : 100** **Max. Marks : 100**

Roll No. _____ (in figure)_____ (in words)

Name : _____ Father's Name : _____

Mother's Name : _____ Date of Examination : _____

(Signature of the candidate) (Signature of the Invigilator)

CANDIDATES MUST READ THE FOLLOWING INFORMATION/ INSTRUCTIONS BEFORE STARTING THE QUESTION PAPER.

1. **All questions are compulsory.**
2. The candidates must return the Question book-let as well as OMR answer-sheet to the Invigilator concerned before leaving the Examination Hall, failing which a case of use of unfair-means / mis-behaviour will be registered against him / her, in addition to lodging of an FIR with the police. Further the answer-sheet of such a candidate will not be evaluated.
3. Keeping in view the transparency of the examination system, carbonless OMR Sheet is provided to the candidate so that a copy of OMR Sheet may be kept by the candidate.
4. Question Booklet along with answer key of all the A,B,C and D code will be got uploaded on the university website after the conduct of Entrance Examination. In case there is any discrepancy in the Question Booklet/Answer Key, the same may be brought to the notice of the Controller of Examinations in writing/through E-Mail within 24 hours of uploading the same on the University Website. Thereafter, no complaint in any case, will be considered.
5. The candidate MUST NOT do any rough work or writing in the OMR Answer-Sheet. Rough work, if any, may be done in the question book-let itself. Answers **MUST NOT** be ticked in the Question book-let.
6. **There will be no negative marking. Each correct answer will be awarded one full mark. Cutting, erasing, overwriting and more than one answer in OMR Answer-Sheet will be treated as incorrect answer.**
7. Use only Black or Blue **BALL POINT PEN** of good quality in the OMR Answer-Sheet.
8. BEFORE ANSWERING THE QUESTIONS, THE CANDIDATES SHOULD ENSURE THAT THEY HAVE BEEN SUPPLIED CORRECT AND COMPLETE BOOK-LET. COMPLAINTS, IF ANY, REGARDING MISPRINTING ETC. WILL NOT BE ENTERTAINED 30 MINUTES AFTER STARTING OF THE EXAMINATION.

Confidential

Question No.	Questions
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17.	If $X_1, X_2, \ldots\ldots X_N$ is a random sample from a p-variate normal distribution with mean vector μ and covariance matrix Σ, then MLE of Σ is given by : (1) $\frac{1}{N}\sum_{\alpha=1}^{N}(X_\alpha - \overline{X})^t(X_\alpha - \overline{X})$ (2) $\frac{1}{N+1}\sum_{\alpha=1}^{N}(X_\alpha - \overline{X})(X_\alpha - \overline{X})^t$ (3) $\frac{1}{N-1}\sum_{\alpha=1}^{N}(X_\alpha - \overline{X})^t(X_\alpha - \overline{X})$ (4) None of these

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18.	If X has p-variate normal distribution with mean vector 0 and covariance matrix Σ and $\lvert\Sigma\rvert > 0$, then with usual notations the joint pdf can be written as the product of marginal pdfs of $X_1 : q \times 1$ and $X_2 : (p-q) \times 1$ if and only if (1) $\Sigma_{12} = 0$ (2) $\Sigma_{11} = 0$ (3) $\Sigma_{22} = 0$ (4) None of these
19.	Let $X_1, X_2, \ldots, X_N$ be a random sample from a p-variate normal distribution with mean vector μ and covariance matrix Σ, then which of the following is true (1) $(N-1)S$ has Wishart Distribution (2) Sample mean and S are independent (3) Sample mean is distributed as $N_p(\mu, \Sigma/N)$ (4) All of these
20.	If $Y_1, Y_2, \ldots, Y_n$ dentote the principal components based on correlation matrix (R) and $\lambda_1 > \lambda_2, \ldots > \lambda_p$ are eigenvalues of R, then which of the following is true (1) $\text{tr}(\Sigma) = \sum_{i=1}^{p} \text{Var}(Y_i)$ (2) $\sum_{i=1}^{p} \lambda_i = \sum_{i=1}^{p} \text{Var}(Y_i)$ (3) $\text{Var}(Y_p) = p$ (4) All of the above

Question No.	Questions
21.	If a random variable X has pdf $f(x) = kx(1-x)$, $0 \le x \le 1$ then value of the constant k is : (1) $\frac{1}{2}$ (2) 2 (3) 4 (4) 6
22.	Mean of the random variable X having pdf $f(x) = 6x^3(4-x)^2$, $0 \le x \le 4$ is (1) 9/14 (2) 14/9 (3) 9/20 (4) None of these
23.	If F (x) denote the distribution function of a continuous random variable X then which one is not true (1) $F(-\infty) = 0$ (2) $F(\infty) = 1$ (3) F (x) is left continuous (4) None of these
24.	If X and Y are independent random variables, then (1) $E(XY) < E(X) \cdot E(Y)$ (2) $E(XY) > E(X) \cdot E(Y)$ (3) $E(XY) = E(X) \cdot E(Y)$ (4) None of these
25.	The skewness of a binomial distribution having probability of success $p = 1/2$ is (1) -1 (2) 0 (3) 1 (4) None of these

Question No.	Questions
26.	The variance of a distribution having M.G.F. $M(t) = \left(\frac{1}{2} + \frac{1}{2}e^t\right)^4$ is (1) 2 (2) 3/2 (3) 2/3 (4) None of these
27.	M.G.F. of Poisson distribution is (1) $M(t) = e^{\lambda(e^t - 1)}$ (2) $M(t) = e^{-\lambda(e^t - 1)}$ (3) $M(t) = e^{-\lambda e^t + 1}$ (4) $M(t) = e^{-\lambda e^t - 1}$
28.	If X is uniformly distributed over the interval [0, 1] then Var (X) is (1) 5/12 (2) 1/3 (3) 1/12 (4) 3/12
29.	If X and Y are random variables such that their expectations exist and $P(X \leq Y) = 1$, then (1) $E(X) \geq E(Y)$ (2) $E(X) \leq E(Y)$ (3) $E(X) = E(Y)$ (4) None of these
30.	Level of significance is equal to the probability of (1) Not committing Type-I error (2) Committing Type-II error (3) Not committing Type-II error (4) None of the above

Question No.	Questions
31.	Let $f(x) = x^2$ and $U = (-1, 1)$, then $f(U) = [0, 1)$ is (1) Bounded open set (2) Unbounded open set (3) Not an open set (4) None of these
32.	A point at which an analytical function ceases to possess a derivative is called (1) Stagnation Point (2) Saddle Point (3) Critical Point (4) Singular Point
33.	The Newton-Raphson Method fails if (1) $f(x0) = 0$ (2) $f'(x0) = 0$ (3) $f''(x0) = 0$ (4) None of these
34.	If $f(z)$ is analytic within and on a closed curve and if a is any point within C, then $f(a) = \frac{1}{2\pi i}\int_C \frac{f(z)\,dz}{z-a}$ represents (1) Cauchy's Theorem (2) Residue Theorem (3) Morera's Theorem (4) Cauchy's Integral Formula
35.	Which of the following is not a method of Numerical Integration (1) Runges's method (2) Weddle's rule (3) Simpson's one-third rule (4) Trapezoidal rule

Question No.	Questions
36.	Which of the following is true in relation to the Regula-Falsi method : (1) Is method of finding real roots of an equation $f(x) = 0$ (2) Closely resembles the bisection method (3) Both (1) and (2) are true (4) None of these
37.	The formula used for solving the equation using Regula Falsi method is (1) $x = \frac{bf(a) - af(b)}{f(a) - f(b)}$ (2) $x = \frac{af(a) - bf(b)}{f(a) - f(b)}$ (3) $x = \frac{bf(a) - af(b)}{a - b}$ (4) None of these
38.	With usual notations, which of the following relations between operators is correct : (1) $\delta = E^{1/2} - E^{-1/2}$ (2) $\delta = E^{1/2} + E^{-1/2}$ (3) $\delta = E - E^{-1/2}$ (4) None of these
39.	Which of the following is true about the Newton's Forward Interpolation formula : (1) Is used for interpolating y values near the end of a set of tabulated values (2) Is used for extrapolating y values a little ahead of y_n (3) Both (1) and (2) are true (4) None of these

Question No.	Questions
40.	Which of the following is a method for a numerical solution of ODEs : (1) Runge-Kutta Method (2) Picard's Method (3) Euler's Method (4) All of these
41.	When the sum of gains of one player is equal to the sum of losses to another player is a game, this situation is known as (1) Biased game (2) Non-zero-sum game (3) Fair game (4) None of these
42.	Saddle point exists in game theory when (1) Maximin and minimax value of the game are same (2) Maximin value of the game is greater than minimax value (3) Maximin value of the game is less than minimax value (4) None of the above
43.	The time over which the inventory level will be controlled is called : (1) Time Horizon (2) Lead Time (3) Time to take decision (4) None of these

Question No.	Questions
44.	Which of the following is true about the buffer stock ? (1) A buffer stock scheme is an attempt to use commodity storage for the purposes of Stabilising prices in an entire economy or an individual market. (2) Commodities are bought and stored when a surplus exists in the economy. (3) Commodities are sold from the stores when economic shortages in the economy occur. (4) All of these
45.	The variable added to the LHS of a less than or equal to constraint to convert it into equality is called variable (1) artificial (2) surplus (3) slack (4) additional
46.	If a customer decides not to enter the queue because of its huge length, he is said to have (1) Balked (2) Reneged (3) Jockey (4) None of these
47.	When a maximization assignment problem is converted in minimization problem, the resulting matrix is called matrix : (1) cost (2) profit (3) regret (4) dummy

Question No.	Questions
48.	Cars arrive at a service station according to Poisson distribution with a mean rate of 5 per hour. The service time per car follows an exponential distribution with a mean of 10 minutes. At the steady state, the average waiting time in the queue is : (1) 50 minutes (2) 25 minutes (3) 20 minutes (4) None of these
49.	Efficiency of M/M/C model in terms of the Total Number of Customers (TNC) and Average Number of Customers Served (ANCS) is given by (1) TNC/ANCS (2) ANCS/TN (3) ANCS × TNC (4) None of these
50.	Which of the following is true about an evolutionary random process ? (1) It is not stationary (2) Poisson process is an example of evolutionary random process (3) Both (1) and (2) are true (4) None of these
51.	In a RBD with v = 5 and r = 4 one treatment is added, the increase in error degrees of freedom will be : (1) 1 (2) 2 (3) 3 (4) 4

Question No.	Questions
52.	Which of the following is true about the Principal Component Analysis (1) Principal components are ordered linear combinations of the given variables (2) First Principal component has maximum variance (3) Both (1) and (2) are true (4) None of the above
53.	In experimental designs the experimental error is controlled by using the (1) Local control (2) Randomization (3) Replication (4) None of the above
54.	Which of the following is a principle of design of experiments (1) Replication (2) Local Control (3) Randomization (4) All of the above
55.	An investigator randomly assigns 10 patients to each of the 4 different treatments to study their effects of diastolic blood pressure. F test was used to test that the mean response was same between different groups. The numerator and denominator degrees of freedom for F test are (1) 3 and 10 respectively (2) 4 and 9 respectively (3) 3 and 36 respectively (4) None of these

Question No.	Questions
56.	If the overall F test in ANOVA is found to be significant then pair wise comparision between treatment means is made using : (1) Chi-square test (2) Two sample t test (3) Variance ratio test (4) None of these
57.	A sampling procedure in which the sampling units are selected at a regular interval systematically from the population is known as : (1) Systematic sampling (2) Stratified sampling (3) Systematic random sampling (4) Both (1) and (3)
58.	In RCBD, which of the following principle is adopted ? (1) Replication (2) Randomization (3) Local control (4) All of these
59.	The common device to reduce the block size in experiments studying main effects and interaction is : (1) Confounding (2) Block Interaction (3) BIBD (4) Asymmetrical factorial design
60.	In designs of experiment. A general rule is to use as many replications which provides at least : (1) 20 error DF (2) 12 error DF (3) 30 error DF (4) None of these

Question No.	Questions
61.	If a closed set C contains only one state j, then the state is called : (1) Non-absorbing state (2) Persistent state (3) Transient state (4) None of these
62.	Which of the following is true about an absorbing Markov chain : (1) A Markov chain is said to be absorbing if it has at least one absorbing state. (2) If the state j is absorbing the $p_{ij} = 1$ (3) It is impossible to leave an absorbing state (4) All of these
63.	Extinction of a stochastic process means that the sequence $\{X_n\}$ consists of (1) Zeros for all except a finite number of values of n (2) Zeros for all values of n (3) Zeros for at least one value of n (4) None of these
64.	For an immigration-emigration process which of the following is true (1) $\lambda_n = \lambda$ (2) $\mu_n = \mu$ (3) $\lambda_n = 1$ and $\mu_n = \mu$ (4) None of these

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65.	Which of the following is true about a Yule-Furry Process : (1) It is a Pure Birth Process (2) It is a Pure Death Process (3) It is a Birth and Death Process (4) None of these
66.	A matrix is in reduced row-echelon form if it meets the following condition(s) : (1) If there is a row where every entry is zero, then this row lies below any other row that contains a nonzero entry. (2) The leftmost non-zero entry of a row is equal to 1. (3) Both (1) and (2) (4) None of these
67.	If A is square matrix, then roots of the equation $\|A - \lambda I\| = 0$ are called : (1) Latent roots (2) Eigenvalues (3) Both (1) and (2) are true (4) None of these
68.	A quadratic form is a polynomial with all terms of degree two (1) 1 (2) 2 (3) 3 (4) 4

Question No.	Questions
69.	The index of the quadratic form is equal to (1) The difference between the number of positive Eigen values and the number of negative Eigen values of the matrix of quadratic form. (2) The sum of the number of positive Eigen values and the number of negative Eigen values of the matrix of quadratic form. (3) Neither (1) nor (2) (4) None of the above
70.	A one-element vector space is an example of a (1) Trivial space (2) Universal space (3) Sample space (4) None of these
71.	Angle between the vectors $a = (1, 1, 0)^t$ and $b = (0, 3, 2)^t$ is (1) $\arccos\left(\frac{2}{\sqrt{3}\sqrt{13}}\right)$ (2) $\arccos\left(\frac{13}{\sqrt{2}\sqrt{3}}\right)$ (3) $\arccos\left(\frac{3}{\sqrt{2}\sqrt{13}}\right)$ (4) None of these
72.	Which of the following is true regarding basis of a vector space (1) It is a sequence of vectors (2) It spans the space if the set of elements of the sequence spans the space (3) Vectors in basis are linearly independent (4) All of these

Question No.	Questions
73.	Which of the following is true about f (z) = z2 + 2z ? (1) Continuous and Differentiable (2) Continuous but not Differentiable (3) Neither Continuous Nor Differentiable (4) None of these
74.	The radius of convergence of a power series f centered on a point a is equal to the distance from a to the nearest point where f (1) Can not be defined in a way that makes it holomorphic. (2) Can be defined in a way that makes it holomorphic. (3) Can not be defined in a way that does not make it holomorphic (4) None of these
75.	Which of the following is true about the radius of convergence of a power series : (1) is the radius of the largest disk at the center of the series in which the series converges (2) is the radius of the smallest disk at the center of the series in which the series converges (3) is the radius of the largest disk at the center of the series in which the series diverges (4) None of these

Question No.	Questions
76.	The Cauchy integral theorem in complex analysis is (1) the fundamental theorem of circular integrals (2) an important statement about line integrals for holomorphic functions in the complex plane (3) an important statement about line integrals for homomorphic functions in the real plane (4) None of these
77.	A sequence $\left\{\frac{1}{n}\right\}$ is (1) Bounded (2) Unbounded (3) Divergent (4) None of these
78.	Which of the following is true about a closed set ? (1) Contains all its limit points (2) Does not contains all of its limit points (3) Is unbounded (4) None of these
79.	Let A = [0, 1] and B = [2, 3], then which of the following is correct (1) Both A and B are connected (2) $A \cup B$ is not connected (3) Both (1) and (2) are correct (4) None of these

Question No.	Questions
80.	Let U = (– 1, 0) and V = (0, 1), then which of the following is not true (1) U and V are disjoint open sets (2) U and V are disjoint closed sets (3) Distance between U and V is 0 (4) None of these
81.	To test $H_0 : \mu_0$ against $H_1 : \mu > \mu_0$ when the population variance is unknown and sample size is small, the appropriate test is (1) t-test (2) Z-test (3) Chi-square test (4) F-Test
82.	Paired t-test is applicable when the observations in the two samples are (1) Independent (2) Mutually independent (3) Paired (4) None of these
83.	Association of attributes in a 2×2 contingency table can be tested by (1) F-test (2) Z-test (3) t-test (4) Fisher Exact test

Question No.	Questions
84.	The χ^2 statistic with usual notations in case of contingency table of order $(m \times n)$ is (1) $\chi^2 = \sum_{i=1}^{m}\sum_{j=1}^{n} \frac{(O_{ij} - E_{ij})^2}{E_{ij}}$ (2) $\chi^2 = \sum_{i=1}^{m}\sum_{j=1}^{n} \frac{O_{ij}^2 - E_{ij}^2}{E_{ij}}$ (3) $\chi^2 = \sum_{i=1}^{m}\sum_{j=1}^{n} \left(\frac{O_{ij} - E_{ij}}{E_{ij}}\right)^2$ (4) None of these
85.	If $r_{xy} = 0$, the two lines of regression (1) Coincide (2) Are parallel (3) Are perpendicular to each other (4) None of the above
86.	Correlation coefficient is independent of change of (1) Origin only (2) Scale only (3) Both origin and scale (4) None of these
87.	Given the two lines of regression as, $3x - 4y + 8 = 0$ and $4x - 3y = 1$, the means of x and y are respectively : (1) 4 and 5 (2) 5 and 4 (3) $\frac{4}{3}$ and $\frac{5}{4}$ (4) $\frac{3}{4}$ and $\frac{4}{5}$

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88.	Skewness of a frequency curve shows (1) Flatness of the frequency curve (2) Lack of symmetry (3) Peakedness of the frequency curve (4) None of these
89.	For a leptokurtic distribution (1) $\beta_2 > 3$ (2) $\beta_2 < 3$ (3) $\beta_2 = 3$ (4) None of these
90.	If $X_1, X_2, \ldots\ldots X_n$ is a random sample from a uniform distribution defined over the interval $0 < x < \theta$, $\theta > 0$, then with usual notations MLE of θ is (1) $X_{(1)}$ (2) $X_{(n)}$ (3) $(X_{(1)} + X_{(n)})/2$ (4) None of these
91.	The region of feasible solution in LPP graphical method is called (1) unbounded region (2) feasible region (3) infeasible region (4) infinite region
92.	In Simplex method, which of the following is correct about the basic feasible solution. (1) a basic feasible solution is a solution with a maximal set of non-zero variables (2) a basic feasible solution is a solution with a minimal set of non-zero variables (3) a basic feasible solution does not correspond to a corner of the polyhedron of feasible solutions (4) None of these

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93.	In transportation models the points of demand are called : (1) Origins (2) Supply centres (3) Destinations (4) None of these
94.	Which of the following are the entities whose values are to be determined from the solution of the LPP : (1) objective function (2) decision variables (3) constraints (4) opportunity cost
95.	A constraint in an LP model restricts (1) Value of the objective function (2) Values of the decision variables (3) Use of the available resources (4) All of the above
96.	Operations Research is a very powerful tool for (1) Research (2) Operations (3) Decision Making (4) None of the above

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97.	In transportation table every loop has (1) An even number of cells (2) An odd number of cells (3) An equal number of cells (4) None of the above
98.	When it is not possible to find solution in LPP, it is called as (1) Infeasible solution (2) Unbounded solution (3) Improper solution (4) None of the above
99.	One disadvantage of using North-West Corner Rule to find initial solution to the transportation problem is that (1) It is complicated to use (2) It ignores the cost of transportation (3) It leads to degenerate initial solution (4) All of the above
100.	Game theory models are classified by the (1) Number of players (2) Sum of payoffs (3) Number of strategies (4) All of the above

SET–"Z"

(DO NOT OPEN THIS QUESTION BOOKLET BEFORE TIME OR UNTIL YOU ARE ASKED TO DO SO)

(Ph.D/URS–EE Jan. 2022)

10024

STATISTICS

Sr. No._____

Code **D**

Time : 1¼ Hours **Total Questions : 100** **Max. Marks : 100**

Roll No. _____ (in figure)_____ (in words)

Name : _____ Father's Name : _____

Mother's Name : _____ Date of Examination : _____

(Signature of the candidate) (Signature of the Invigilator)

CANDIDATES MUST READ THE FOLLOWING INFORMATION/ INSTRUCTIONS BEFORE STARTING THE QUESTION PAPER.

1. **All questions are compulsory.**
2. The candidates must return the Question book-let as well as OMR answer-sheet to the Invigilator concerned before leaving the Examination Hall, failing which a case of use of unfair-means / mis-behaviour will be registered against him / her, in addition to lodging of an FIR with the police. Further the answer-sheet of such a candidate will not be evaluated.
3. Keeping in view the transparency of the examination system, carbonless OMR Sheet is provided to the candidate so that a copy of OMR Sheet may be kept by the candidate.
4. Question Booklet along with answer key of all the A,B,C and D code will be got uploaded on the university website after the conduct of Entrance Examination. In case there is any discrepancy in the Question Booklet/Answer Key, the same may be brought to the notice of the Controller of Examinations in writing/through E-Mail within 24 hours of uploading the same on the University Website. Thereafter, no complaint in any case, will be considered.
5. The candidate MUST NOT do any rough work or writing in the OMR Answer-Sheet. Rough work, if any, may be done in the question book-let itself. Answers MUST NOT be ticked in the Question book-let.
6. **There will be no negative marking. Each correct answer will be awarded one full mark. Cutting, erasing, overwriting and more than one answer in OMR Answer-Sheet will be treated as incorrect answer.**
7. Use only Black or Blue **BALL POINT PEN** of good quality in the OMR Answer-Sheet.
8. BEFORE ANSWERING THE QUESTIONS, THE CANDIDATES SHOULD ENSURE THAT THEY HAVE BEEN SUPPLIED CORRECT AND COMPLETE BOOK-LET. COMPLAINTS, IF ANY, REGARDING MISPRINTING ETC. WILL NOT BE ENTERTAINED 30 MINUTES AFTER STARTING OF THE EXAMINATION.

Confidential SEAL

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36.	Correlation coefficient is independent of change of (1) Origin only (2) Scale only (3) Both origin and scale (4) None of these
37.	Given the two lines of regression as, $3x - 4y + 8 = 0$ and $4x - 3y = 1$, the means of x and y are respectively : (1) 4 and 5 (2) 5 and 4 (3) $\frac{4}{3}$ and $\frac{5}{4}$ (4) $\frac{3}{4}$ and $\frac{4}{5}$
38.	Skewness of a frequency curve shows (1) Flatness of the frequency curve (2) Lack of symmetry (3) Peakedness of the frequency curve (4) None of these
39.	For a leptokurtic distribution (1) $\beta_2 > 3$ (2) $\beta_2 < 3$ (3) $\beta_2 = 3$ (4) None of these

Question No.	Questions
40.	If $X_1, X_2, \ldots\ldots X_n$ is a random sample from a uniform distribution defined over the interval $0 < x < \theta, \theta > 0$, then with usual notations MLE of θ is (1) $X_{(1)}$ (2) $X_{(n)}$ (3) $(X_{(1)} + X_{(n)})/2$ (4) None of these
41.	Let $f(x) = x^2$ and $U = (-1, 1)$, then $f(U) = [0, 1)$ is (1) Bounded open set (2) Unbounded open set (3) Not an open set (4) None of these
42.	A point at which an analytical function ceases to possess a derivative is called (1) Stagnation Point (2) Saddle Point (3) Critical Point (4) Singular Point
43.	The Newton-Raphson Method fails if (1) $f(x0) = 0$ (2) $f'(x0) = 0$ (3) $f''(x0) = 0$ (4) None of these
44.	If $f(z)$ is analytic within and on a closed curve and if a is any point within C, then $f(a) = \frac{1}{2\pi i}\int_C \frac{f(z)\,dz}{z-a}$ represents (1) Cauchy's Theorem (2) Residue Theorem (3) Morera's Theorem (4) Cauchy's Integral Formula

Question No.	Questions
45.	Which of the following is not a method of Numerical Integration (1) Runges's method (2) Weddle's rule (3) Simpson's one-third rule (4) Trapezoidal rule
46.	Which of the following is true in relation to the Regula-Falsi method : (1) Is method of finding real roots of an equation $f(x) = 0$ (2) Closely resembles the bisection method (3) Both (1) and (2) are true (4) None of these
47.	The formula used for solving the equation using Regula Falsi method is (1) $x = \frac{bf(a) - af(b)}{f(a) - f(b)}$ (2) $x = \frac{af(a) - bf(b)}{f(a) - f(b)}$ (3) $x = \frac{bf(a) - af(b)}{a - b}$ (4) None of these
48.	With usual notations, which of the following relations between operators is correct : (1) $\delta = E^{1/2} - E^{-1/2}$ (2) $\delta = E^{1/2} + E^{-1/2}$ (3) $\delta = E - E^{-1/2}$ (4) None of these

Question No.	Questions
49.	Which of the following is true about the Newton's Forward Interpolation formula : (1) Is used for interpolating y values near the end of a set of tabulated values (2) Is used for extrapolating y values a little ahead of y_n (3) Both (1) and (2) are true (4) None of these
50.	Which of the following is a method for a numerical solution of ODEs : (1) Runge-Kutta Method (2) Picard's Method (3) Euler's Method (4) All of these
51.	When the sum of gains of one player is equal to the sum of losses to another player is a game, this situation is known as (1) Biased game (2) Non-zero-sum game (3) Fair game (4) None of these
52.	Saddle point exists in game theory when (1) Maximin and minimax value of the game are same (2) Maximin value of the game is greater than minimax value (3) Maximin value of the game is less than minimax value (4) None of the above

Question No.	Questions
53.	The time over which the inventory level will be controlled is called : (1) Time Horizon (2) Lead Time (3) Time to take decision (4) None of these
54.	Which of the following is true about the buffer stock ? (1) A buffer stock scheme is an attempt to use commodity storage for the purposes of Stabilising prices in an entire economy or an individual market. (2) Commodities are bought and stored when a surplus exists in the economy. (3) Commodities are sold from the stores when economic shortages in the economy occur. (4) All of these
55.	The variable added to the LHS of a less than or equal to constraint to convert it into equality is called variable (1) artificial (2) surplus (3) slack (4) additional
56.	If a customer decides not to enter the queue because of its huge length, he is said to have (1) Balked (2) Reneged (3) Jockey (4) None of these

Question No.	Questions
57.	When a maximization assignment problem is converted in minimization problem, the resulting matrix is called matrix : (1) cost (2) profit (3) regret (4) dummy
58.	Cars arrive at a service station according to Poisson distribution with a mean rate of 5 per hour. The service time per car follows an exponential distribution with a mean of 10 minutes. At the steady state, the average waiting time in the queue is : (1) 50 minutes (2) 25 minutes (3) 20 minutes (4) None of these
59.	Efficiency of M/M/C model in terms of the Total Number of Customers (TNC) and Average Number of Customers Served (ANCS) is given by (1) TNC/ANCS (2) ANCS/TN (3) ANCS × TNC (4) None of these
60.	Which of the following is true about an evolutionary random process ? (1) It is not stationary (2) Poisson process is an example of evolutionary random process (3) Both (1) and (2) are true (4) None of these

Question No.	Questions
61.	Angle between the vectors $a = (1, 1, 0)^t$ and $b = (0, 3, 2)^t$ is (1) $\arccos\left(\frac{2}{\sqrt{3}\sqrt{13}}\right)$ (2) $\arccos\left(\frac{13}{\sqrt{2}\sqrt{3}}\right)$ (3) $\arccos\left(\frac{3}{\sqrt{2}\sqrt{13}}\right)$ (4) None of these
62.	Which of the following is true regarding basis of a vector space (1) It is a sequence of vectors (2) It spans the space if the set of elements of the sequence spans the space (3) Vectors in basis are linearly independent (4) All of these
63.	Which of the following is true about f (z) = z2 + 2z ? (1) Continuous and Differentiable (2) Continuous but not Differentiable (3) Neither Continuous Nor Differentiable (4) None of these

Question No.	Questions
64.	The radius of convergence of a power series f centered on a point a is equal to the distance from a to the nearest point where f (1) Can not be defined in a way that makes it holomorphic. (2) Can be defined in a way that makes it holomorphic. (3) Can not be defined in a way that does not make it holomorphic (4) None of these
65.	Which of the following is true about the radius of convergence of a power series : (1) is the radius of the largest disk at the center of the series in which the series converges (2) is the radius of the smallest disk at the center of the series in which the series converges (3) is the radius of the largest disk at the center of the series in which the series diverges (4) None of these
66.	The Cauchy integral theorem in complex analysis is (1) the fundamental theorem of circular integrals (2) an important statement about line integrals for holomorphic functions in the complex plane (3) an important statement about line integrals for homomorphic functions in the real plane (4) None of these

Question No.	Questions
67.	A sequence $\left\{\frac{1}{n}\right\}$ is (1) Bounded (2) Unbounded (3) Divergent (4) None of these
68.	Which of the following is true about a closed set ? (1) Contains all its limit points (2) Does not contains all of its limit points (3) Is unbounded (4) None of these
69.	Let A = [0, 1] and B = [2, 3], then which of the following is correct (1) Both A and B are connected (2) $A \cup B$ is not connected (3) Both (1) and (2) are correct (4) None of these
70.	Let U = (– 1, 0) and V = (0, 1), then which of the following is not true (1) U and V are disjoint open sets (2) U and V are disjoint closed sets (3) Distance between U and V is 0 (4) None of these

Question No.	Questions
71.	A stratified random sample of size 32 is drawn from three strata of sizes 20, 40 and 100. The samples drawn using proportional allocation have sizes : (1) 6, 10, 16 (2) 4, 8, 20 (3) 5, 9, 18 (4) None of these
72.	Non-response in sample surveys means (1) Non-availability of respondents (2) Non-return of questionnaire by the respondents (3) Refusal to give information (4) All of these
73.	Which of the following is an example of a non-random sampling technique ? (1) Purposive (2) Quota (3) Convenience (4) All of these
74.	Sample survey is advantageous over census because it (1) is less costly (2) has greater scope (3) both (1) and (2) (4) none of these

Question No.	Questions
75.	Which of these does not match with others (1) Harvit-Thompson estimator (2) Murthy unordered estimator (3) Des Raj ordered estimator (4) Rao, Hartley and Chochran estimator
76.	Infant mortality rate is defined as the number of deaths under one year of age in a year : (1) Per 1000 live births (2) Per 1000 population (3) Per 1000 women (4) None of these
77.	Which of the following is not a method of collecting vital statistics : (1) Census Method (2) Analytical Method (3) Registration Method (4) None of these
78.	Total fertility rate is derived from : (1) Age specific birth rate (2) Gross reproduction rate (3) Net reproductive rate (4) None of these

Question No.	Questions
79.	The formula $\frac{\sum p_{0i} q_{1i}}{\sum p_{0i} q_{0i}} \times 100$ represents (1) Fisher's Index (2) Kelly's Index (3) Paasche's Index (4) None of these
80.	Fertility refers to : (1) Actual bearing of children (2) Capacity to bear the child (3) Average No. of live birth per woman in the year (4) None of these
81.	The mean and variance of a chi-square distribution with degrees of freedom 4 are (1) 8 and 4 respectively (2) 4 and 8 respectively (3) 4 and 4 respectively (4) 8 and 8 respectively
82.	If $X \sim N(\mu, \sigma^2)$, the points of inflexion of normal curve are : (1) $\mu \pm 2\sigma$ (2) $\sigma \pm 2\mu$ (3) $\mu \pm \sigma$ (4) None of these
83.	If X is a Poisson variates with P (X = 1) = P (X = 2), then mean of the Poisson variate is equal to (1) 1 (2) 2 (3) 3 (4) 4

Question No.	Questions
84.	Which of the following relation is true for the F-distribution : (1) $F_\alpha(n_1, n_2) = 1/F_\alpha(n_2, n_1)$ (2) $F_\alpha(n_1, n_2) = F_{1-\alpha}(n_2, n_1)$ (3) $F_\alpha(n_1, n_2) = 1/F_{1-\alpha}(n_2, n_1)$ (4) None of the above
85.	Which of the following true is case of MGF of a random variable X (1) MGF may not exist (2) If exists MGF is unique (3) Both (1) and (2) are true (4) None of these
86.	If $X_1, X_2, \ldots\ldots X_N$ is a random sample from a multivariate distribution with mean vector μ and covariance matrix Σ, then distribution of sample mean vector $\overline{X}$ is : (1) $N(\mu, \Sigma)$ (2) $N(\mu, N\Sigma)$ (3) $N(\mu, \Sigma/N)$ (4) None of these
87.	If $X_1, X_2, \ldots\ldots X_N$ is a random sample from a p-variate normal distribution with mean vector μ and covariance matrix Σ, then MLE of Σ is given by : (1) $\frac{1}{N}\sum_{\alpha=1}^{N}(X_\alpha - \overline{X})^t(X_\alpha - \overline{X})$ (2) $\frac{1}{N+1}\sum_{\alpha=1}^{N}(X_\alpha - \overline{X})(X_\alpha - \overline{X})^t$ (3) $\frac{1}{N-1}\sum_{\alpha=1}^{N}(X_\alpha - \overline{X})^t(X_\alpha - \overline{X})$ (4) None of these

Question No.	Questions
88.	If X has p-variate normal distribution with mean vector 0 and covariance matrix Σ and $\lvert\Sigma\rvert > 0$, then with usual notations the joint pdf can be written as the product of marginal pdfs of $X_1 : q \times 1$ and $X_2 : (p-q) \times 1$ if and only if (1) $\Sigma_{12} = 0$ (2) $\Sigma_{11} = 0$ (3) $\Sigma_{22} = 0$ (4) None of these
89.	Let $X_1, X_2, \ldots, X_N$ be a random sample from a p-variate normal distribution with mean vector μ and covariance matrix Σ, then which of the following is true (1) (N – 1) S has Wishart Distribution (2) Sample mean and S are independent (3) Sample mean is distributed as $N_p(\mu, \Sigma/N)$ (4) All of these
90.	If $Y_1, Y_2, \ldots, Y_n$ dentote the principal components based on correlation matrix (R) and $\lambda_1 > \lambda_2, \ldots > \lambda_p$ are eigenvalues of R, then which of the following is true (1) $\text{tr}(\Sigma) = \sum_{i=1}^{p} \text{Var}(Y_i)$ (2) $\sum_{i=1}^{p} \lambda_i = \sum_{i=1}^{p} \text{Var}(Y_i)$ (3) $\text{Var}(Y_p) = p$ (4) All of the above

Question No.	Questions
91.	If a random variable X has pdf $f(x) = kx(1-x)$, $0 \le x \le 1$ then value of the constant k is : (1) $\frac{1}{2}$ (2) 2 (3) 4 (4) 6
92.	Mean of the random variable X having pdf $f(x) = 6x^3(4-x)^2$, $0 \le x \le 4$ is. (1) 9/14 (2) 14/9 (3) 9/20 (4) None of these
93.	If F (x) denote the distribution function of a continuous random variable X then which one is not true (1) $F(-\infty) = 0$ (2) $F(\infty) = 1$ (3) F (x) is left continuous (4) None of these
94.	If X and Y are independent random variables, then (1) $E(XY) < E(X) \cdot E(Y)$ (2) $E(XY) > E(X) \cdot E(Y)$ (3) $E(XY) = E(X) \cdot E(Y)$ (4) None of these
95.	The skewness of a binomial distribution having probability of success $p = 1/2$ is (1) -1 (2) 0 (3) 1 (4) None of these

Question No.	Questions
96.	The variance of a distribution having M.G.F. $M(t) = \left(\frac{1}{2} + \frac{1}{2}e^t\right)^4$ is (1) 2 (2) 3/2 (3) 2/3 (4) None of these
97.	M.G.F. of Poisson distribution is (1) $M(t) = e^{\lambda(e^t - 1)}$ (2) $M(t) = e^{-\lambda(e^t - 1)}$ (3) $M(t) = e^{-\lambda e^t + 1}$ (4) $M(t) = e^{-\lambda e^t - 1}$
98.	If X is uniformly distributed over the interval [0, 1] then Var (X) is (1) 5/12 (2) 1/3 (3) 1/12 (4) 3/12
99.	If X and Y are random variables such that their expectations exist and $P(X \leq Y) = 1$, then (1) $E(X) \geq E(Y)$ (2) $E(X) \leq E(Y)$ (3) $E(X) = E(Y)$ (4) None of these
100.	Level of significance is equal to the probability of (1) Not committing Type-I error (2) Committing Type-II error (3) Not committing Type-II error (4) None of the above

Key of Entrance test of PHD/URS Statistics 2021-22				
	A	B	C	D
1	4	1	2	4
2	1	3	4	4
3	3	4	4	1
4	3	1	3	3
5	2	3	1	1
6	4	3	1	3
7	1	1	1	3
8	3	2	1	2
9	2	1	4	1
10	4	2	1	1
11	1	3	2	2
12	3	4	3	2
13	4	2	2	3
14	1	4	3	2
15	3	1	3	3
16	3	3	3	3
17	1	1	4	1
18	2	1	1	1
19	1	4	4	3
20	2	4	4	4
21	2	4	4	3
22	3	4	1	3
23	2	1	3	1
24	3	3	3	4
25	3	1	2	3
26	3	3	4	2
27	4	3	1	4
28	1	2	3	4
29	4	1	2	1
30	4	1	4	2
31	3	2	3	1
32	3	2	4	3
33	1	3	2	4
34	4	2	4	1
35	3	3	1	3
36	2	3	3	3
37	4	1	1	1
38	4	1	1	2
39	1	3	4	1
40	2	4	4	2
41	2	3	4	3
42	4	3	1	4
43	4	1	1	2
44	3	4	4	4
45	1	3	3	1
46	1	2	1	3
47	1	4	3	1
48	1	4	1	1
49	4	1	2	4
50	1	2	3	4
51	2	2	3	4
52	2	3	3	1

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53	3	2	1	1
54	2	3	4	4
55	3	3	3	3
56	3	3	2	1
57	1	4	4	3
58	1	1	4	1
59	3	4	1	2
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64	4	3	3	1
65	3	1	1	1
66	1	1	3	2
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85	1	2	3	3
86	2	4	3	3
87	3	1	1	4
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93	2	1	3	3
94	4	1	2	3
95	1	1	3	2
96	3	2	3	4
97	1	3	1	1
98	1	1	1	3
99	4	3	3	2
100	4	2	4	4

11/2/2022
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11/2/2022