Total No. of Printed Pages : 21

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

A

SET-Y

M.Phil./Ph.D./URS-EE-2020

SUBJECT : Statistics

10005

Sr. No. ....

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

Roll No. (in figures)________________ (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. ***Candidates are required to attempt any 75 questions out of the given 100 multiple choice questions of 4/3 marks each. No credit will be given for more than 75 correct responses.***
2. The candidates ***must return*** the question booklet 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 & 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 booklet itself. Answers ***must not*** be ticked in the question booklet.
6. ***There will be no negative marking. Each correct answer will be awarded 4/3 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 booklet. Complaints, if any, regarding misprinting etc. will not be entertained* ***30*** *minutes after starting of the examination.*

1. If for any distribution, mean > median > mode, then the distribution is called :

(1) negatively skewed (2) positively skewed

(3) symmetric (4) None of these

2. If two variables are independent, then the correlation between them is :

(1) −1 (2) 1

(3) between −1 and 1 (4) zero

3. Regression equations of two variables X and Y are as follows :

$$3X + 2Y - 26 = 0 \text{ and } 6X + Y - 31 = 0,$$

then the coefficient of correlation between X and Y is :

(1) 0.5 (2) 0.76 (3) 0.8 (4) − 0.5

4. If the random variables X, Y and Z have the means $\mu_x = 3$, $\mu_y = 5$ and $\mu_z = 2$, variances $\sigma_x^2 = 8$, $\sigma_y^2 = 12$ and $\sigma_z^2 = 18$ and Cov$(X, Y) = 1$, Cov $(X, Z) = -3$ and Cov $(Y, Z) = 2$, then the Cov of $U = X + 4Y +.2Z$ and $V = 3X - Y - Z$ is :

(1) 54 (2) −76 (3) 95 (4) None of these

5. For a distribution, the four central moments were obtained as :

$\mu_1 = 0$, $\mu_2 = 0.933$, $\mu_3 = 0$ and $\mu_4 = 2.533$,

then the distribution is :

(1) Platykurtic (2) Mesokurtic

(3) Leptokurtic (4) None of these

6. A random sample of 27 pairs of observations from a normal population gave $r = 0.6$. If $t_{0.05}$ for 25 d. f. = 2.06, then r is :

(1) Significant (2) In-significant

(3) Least significant (4) None of these

7. Regression equation of X on Y for the following data :

X	1	2	3	4	5
Y	3	4	5	6	7

is given by :

(1) $Y = 2.5 - X$ (2) $X = 1.5 + 5Y$ (3) $Y = 2 + X$ (4) $X = 2 + Y$

8. A student obtained the following two regression equations for a set of data based on two variables

$6X - 15Y = 21, 21X + 14Y = 56$, then :

(1) Equations are not correctly obtained

(2) Equations are correctly obtained

(3) Equations have no solutions

(4) None of these

9. The probability mass function of a random variable X is as follows :

X	0	1	2	3	4	5
$f(x)$	k^2	$k/4$	$5k/2$	$k/4$	$2k^2$	k^2

then the value of k is :

(1) 1/2 (2) 1/3 (3) 1/4 (4) 4

10. Let $X \sim N(8, 25)$, then standard normal variate (SNV) will be :

(1) $Z = \frac{X-8}{25}$ (2) $Z = \frac{X-2}{5}$

(3) $Z = \frac{X-8}{10}$ (4) $Z = \frac{X-8}{5}$

11. If a Binomial variate (X) is distributed with mean 4 and variance 3, then X is distributed as :

(1) $N(4, 16)$ (2) $B(4, 1/4)$

(3) $B(1/4, 16)$ (4) $B(16, 1/4)$

12. If a random variable X has the following p.d.f.

$$f(x;\mu,\sigma^2)=\frac{1}{3\sqrt{2\pi}}e^{-\frac{(x-6)^2}{18}},\mu,\sigma^2>0\text{, then we have :}$$

(1) $X \sim N(3, 9)$ (2) $X \sim N(6, 3)$

(3) $X \sim N(6, 9)$ (4) $X \sim N(3, 6)$

13. If moment generating function of a distribution is $e^{6t+\frac{1}{4}t^2}$, then standard deviation of the distribution is :

(1) 1/2 (2) 2

(3) 4 (4) 6

14. A random variable X has a mean 8 and variance 9 and an unknown probability distribution, then $P(-4 < x < 20)$ is :

(1) less than 1/4 (2) more than 15/16

(3) less than 15/16 (4) None of these

15. A medical doctor wants to reduce blood sugar level of all his patients by altering their diet. He finds that the mean sugar level of all patients is 180 with a standard deviation of 18. Nine of his patients start dieting and the mean of the sample is observed to be 175. What is the standard error of the mean ?

(1) 2 (2) 4 (3) 6 (4) None of these

16. The fact that the sampling distribution of sample means can be approximated by a normal probability distribution whenever the sample size is large is based on the :

(1) central limit theorem

(2) fact that we have tables of areas for the normal distribution

(3) assumption that the population has a normal distribution

(4) None of these alternatives is correct

17. As the sample size increases, the variability among the sample means :

(1) increases

(2) decreases

(3) remains the same

(4) depends upon the specific population being sampled

18. Let $Y1 < Y2 < Y3 < Y4$ denote the order statistics of a random sample of size 4 from a distribution having p.d.f. $f(x) = \begin{cases} 2x & , \quad 0 < x < 1 \\ 0 & , \quad \text{elsewhere} \end{cases}$, then $P\left(\frac{1}{2} < Y_3\right)$ is equal :

(1) $\frac{145}{256}$

(2) $\frac{243}{456}$

(3) $\frac{213}{356}$

(4) $\frac{243}{256}$

19. A property of a point estimator that occurs whenever larger sample sizes tend to provide point estimates closer to the population parameter, is known as :

(1) efficiency

(2) unbiased sampling

(3) consistency

(4) relative estimation

20. The hospital period, in days, for patients following treatment for a certain type of kidney disorder is a random variable $Y = X + 4$ where X has the density function $f(x) = \begin{cases} \frac{(32)}{(x+4)^3} & ; \quad x > 0 \\ 0 & ; \quad \text{elsewhere} \end{cases}$, then the p.d.f. of random variable Y is :

(1) $g(y) = \begin{cases} \frac{(32)}{(y)^3} & ; \quad y > 4 \\ 0 & ; \quad \text{elsewhere} \end{cases}$

(2) $g(y) = \begin{cases} \frac{(32)}{(y+4)^3} & ; \quad y > 4 \\ 0 & ; \quad \text{elsewhere} \end{cases}$

(3) $g(y) = \begin{cases} \frac{(16)}{(y)^2} & ; \quad y > 4 \\ 0 & ; \quad \text{elsewhere} \end{cases}$

(4) $g(y) = \begin{cases} \frac{(4)}{(y+4)^3} & ; \quad y > 0 \\ 0 & ; \quad \text{elsewhere} \end{cases}$

21. If $f(x,y)=\begin{cases}\frac{x(1+3y^2)}{4} & ; \quad 0<x<2, 0<y<1 \\ 0 & ; \quad \text{elsewhere}\end{cases}$, then :

(1) $E(XY) > E(X) . E(Y)$

(2) $E(XY) < E(X) . E(Y)$

(3) $E(XY) = E(X) . E(Y)$

(4) $E(XY) = E(X) + E(Y)$

22. Which of the following statements is ***true*** ?

(1) Unbaised estimator is always efficient

(2) Consistent estimator is always unbiased

(3) Unbaised estimator is always consistent

(4) MLE is always a function of sufficient statistics

23. Suppose 10 rats are used in a biomedical study where they are injected with cancer cells and then given a cancer drug that is designed to increase their survival rate. The survival times following exponential distribution are 14, 17, 27, 18, 12, 8, 22, 13, 19 and 12, then M.L.E. of the mean survival time is :

(1) 14.5 (2) 16.2 (3) 18 (4) 20

24. A random sample is taken from $B(5, p)$ population to test $H_0 : p = 1/2$ against $H_1 : p = 0,7$, it is decided that we reject H_0 when $X \geq 3$, then the power of test is approximately equal to :

(1) 0.5 (2) 0.75 (3) 0.84 (4) None of these

25. If a hypothesis H_0 is rejected at .01 level of significance, then it :

(1) will be accepted at 0.05 level of significance

(2) may not be rejected at .10 level of significance

(3) will be rejected at .10 level of significance

(4) None of these

26. Given $\sigma = 6$, $\mu = 25$, sample mean = 23 and the degree of precession required is 99%, ($Z = 2.58$) the sample size required is approximately equal to :

(1) 50 (2) 60 (3) 70 (4) 80

27. Let X be the number of offspring of a bacteria with p.m.f.

$P(X = x) = \frac{1}{4}\left(\frac{3}{4}\right)^k$, $k = 0, 1, 2, \ldots\ldots$ the $E(X)$ is equal to :

(1) 3 (2) 2 (3) 1 (4) 4

28. The variance of the stratified sampling mean ($\bar{Y}_{st}$) is :

(1) $\sum_{h=1}^{L}\left(\frac{1}{N_h}-\frac{1}{n_h}\right)W_h^2\ S_h^2$

(2) $\sum_{h=1}^{L}\left(\frac{1}{n_h}-\frac{1}{N_h}\right)W_h^2\ S_h$

(3) $\sum_{h=1}^{L}\left(\frac{1}{n_h}-\frac{1}{N_h}\right)W_h\ S_h^2$

(4) $\sum_{h=1}^{L}\left(\frac{1}{n_h}-\frac{1}{N_h}\right)W_h^2\ S_h^2$

29. In a SRSWOR, if $\bar{y} = 50$, $n = 100$, $N = 500$, then the estimated population total is :

(1) 250 (2) 500 (3) 2500 (4) 25000

30. In SRS, the bais of the ratio estimator $\hat{R}$ is given :

(1) $B(\hat{R}) = \frac{\text{cov}(\hat{R}, \bar{x})}{\bar{X}}$

(2) $B(\hat{R}) = \frac{\text{cov}(\hat{R}, \bar{x})}{\bar{Y}}$

(3) $\frac{\text{cov}(\hat{R}, \bar{y})}{\bar{Y}}$

(4) None of these

31. In systematic sampling, if the population size is 200 and the selected sample size is 40, then the sampling interval is :

(1) 3 (2) 4 (3) 3 (4) None of these

32. A sample of 16 items from an infinite population having standard deviation 4. The standard error of sampling distribution of mean is :

(1) 1 (2) 5 (3) 10 (4) 40

33. The Mahalanobis distance of an observation $x = (x_1, x_2, x_3, \ldots\ldots, x_N)^T$ from a set of observations with mean $\mu = (\mu_1, \mu_2, \mu_3, \mu_N)^T$ and covariance matrix S is defined as :

(1) $\sqrt{(x-\mu)^T S^{-1}(x-\mu)}$ (2) $(x-\mu)^T \sigma^{-1}(x-\mu)$

(3) $(x-\mu)^T S^{-1}(x-\mu)^2$ (4) None of these

34. For large n, Hotelling's T^2 statistic $(\bar{x}-\mu_0)^T S^{-1}(\bar{x}-\mu_0)$ is distributed as :

(1) t_{n-2} (2) $F_{n-p,p}$ (3) X_p^2 (4) None of these

35. If we have two sets of variables, $x_1, x_2, \ldots\ldots, x_n$ and $y_1, y_2 \ldots\ldots, y_m$ and there are correlations among the variables, then canonical correlation analysis will enable us to find linear combinations of the x's and the y's which have .... correlation with each other.

(1) minimum (2) maximum

(3) zero (4) None of these

36. Scree plot is associated with :

(1) Discriminant Analysis (2) Canonical Correlation

(3) Principle Component Analysis (4) None of these

37. Given that $E[X + 4] = 10$ and $E[X + 4]^2 = 116$, then Var(X) is equal to :

(1) 4 (2) 8

(3) 12 (4) 16

38. Three varieties A, B, C of wheat are tested in a RBD with 4 replications. Then the degrees of freedom for error will be :

(1) 4 (2) 5

(3) 6 (4) 12

39. Relative efficiency of LSD over RBD when m rows are taken as blocks is given by :

(1) $\dfrac{\text{MSC}+(m-1)\text{MSR}}{m\text{MSE}}$ (2) $\dfrac{\text{MSR}+(m-1)\text{MSE}}{m\text{MSE}}$

(3) $\dfrac{\text{MSC}+(m-1)\text{MSE}}{m\text{MSE}}$ (4) None of these

40. The method of confounding is a device to reduce the size of :

(1) Experiment (2) Blocks

(3) Replication (4) Treatments

41. The geometric mean of Laspeyer's and Paache's indices is :

(1) Bowley's Ideal Index (2) Fisher's Index

(3) Chain Index (4) Marshal and Edgeworth's Index

42. Seasonal variations repeat with :

(1) one year (2) two years

(3) five years (4) None of the Treatments

43. A good index number is one that satisfies :

(1) Circular Test (2) Time Reversal Test

(3) Factor Reversal Test (4) All the above Tests

44. Vital rates are customarily expressed as :

(1) per ten thousand (2) per thousand

(3) percentages (4) None of these

45. The trend is determined by :

(1) Link Relative Method

(2) Ratio to Trend Method

(3) Ratio-to-Moving Method

(4) None of these

46. Fertility rate provides an adequate basis for :

(1) population growth

(2) family planning

(3) checking the infant mortality

(4) None of these

47. Time Reversal Test is satisfied when :

(1) $P_{01} \times P_{10} = 0$ (2) $P_{01} \times P_{10} = 1$

(3) $P_{01} \times P_{10} < 1$ (4) None of the above

48. In the following replicate of a 2^3 factorial experiment in blocks of 4 plots involving three fertilizer N, P and K :

Block 1	Np	npk	(1)	K
Block 2	P	n	Pk	Nk

then the confounded factor is :

(1) NPK (2) NK

(3) NP (4) None of the above

49. For a certain experiment laid out in an LSD with four treatments with SST = 10.035, SSB = 22.25, SSC = 45.25, TSS = 86.33 and $F_{0.05}(3,6) = 4.76$, then $H_0 : t_1 = t_2 = t_3 = t_4$:

(1) is rejected (2) is accepted

(3) may be rejected (4) None of these

50. In a railway marshalling yard, goods trains arrive at a rate of 30 trains per day. Assuming that the inter-arrival time follows an exponential distribution and the service time distribution is also exponential with an average of 36 minutes, then the expected queue size of the trains is :

(1) 1 (2) 2 (3) 3 (4) 4

Instruction : Consider the following Markov Chain with tpm :

$$P = \begin{pmatrix} 0 & 1 & 0 \\ 1/2 & 0 & 1/2 \\ 0 & 1 & 0 \end{pmatrix}$$ and answer the question no. **51** to **54 :**

51. The Markov Chain is periodic with period :

(1) 1 (2) 2 (3) 3 (4) 4

52. State 1 is :

(1) persistent (2) transient

(3) transient null (4) transient non-null

53. The Markov Chain is :

(1) irreducible (2) reducible

(3) closed (4) None of these

54. Which of the following is ***true*** ?

(1) $p = p^2$ (2) $p = p^3$

(3) $p = p^0$ (4) $p = p^4$

55. Number of basic feasible solution in a transportation problem with 4 origins and 3 destinations is :

(1) 3 (2) 4 (3) 5 (4) 6

56. The following game problem with the payoff matrix :

	Strategies of Player B			
Strategies of Player A		I	II	III
	I	1	–1	3
	II	3	5	–3
	III	6	2	–2

The above problem can be solved using :

(1) Graphical method (2) Rule of Dominance

(3) MinMax Principle (4) Simplex Method

57. For what values of K, the game with the following payoff matrix is strictly determinable ?

	Strategies of Player B			
Strategies of Player A		I	II	III
	I	K	6	2
	II	–1	K	–7
	III	–2	4	K

(1) $K \geq 0$ (2) $1 \leq K \leq 2$

(3) $-1 \leq K \leq 2$ (4) None of these

58. If a Primal Problem (Maximization) has optimal value equal to 60, then the optimal value of the corresponding dual can be :

(1) 55 (2) 59 (3) 61 (4) None of these

59. A solution to an LPP is said to be degenerate if one of the :

(1) basic variables is zero (2) non-basic variables is zero

(3) basic variables is positive (4) non-basic variables positive

60. The following assignment problem pertains to the time taken by the programmers to develop different programmes :

	Programmers		
Programmes	A	B	C
I	120	100	80
II	80	90	110
III	110	140	120

Then the total minimum time required for developing the said programmes is

(1) 280 (2) 290 (3) 300 (4) None of these

61. A branching process is called subcritical if the mean of the off springs (m) is :

(1) zero (2) more than 1

(3) less than 1 (4) None of these

62. If the mean of the off springs (m) is less than 1, then the probability of extinction is :

(1) zero (2) 1

(3) between 0 and 1 (4) None of these

63. Which of the following is ***not*** a stochastic matrix ?

(1) $\begin{pmatrix} 0 & 1 \\ -1 & 1 \end{pmatrix}$ (2) $\begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}$

(3) $\begin{pmatrix} 1/2 & 1/2 \\ 1 & 0 \end{pmatrix}$ (4) $\begin{pmatrix} 1/2 & 1/2 \\ 1/2 & 1/2 \end{pmatrix}$

64. The Eigen values of a matrix $A = \begin{pmatrix} 3 & 2 \\ 2 & 3 \end{pmatrix}$ are 5 and 1. The Eigen values of A^2 are :

(1) 25 and 1 (2) 10 and 2

(3) 1 and 1/5 (4) None of these

65. If Chi-square distribution has 12 degree of free, then the variance of the distribution is :

(1) 24 (2) 12

(3) 6 (4) None of these

66. Local control in experimental designs is meant to :

(1) reduce experiential error

(2) increase the efficiency of the design

(3) to form homogeneous blocks

(4) all the above None of the above

67. If net reproduction rate is greater than 1, then it will result :

(1) no increase in population (2) decrease in population

(3) exponential increase in population (4) increase in population

68. Given the following LPP :

Max : $Z = x_1 + 2x_2 + 3x_3$

Sub to

$$x_1 + 5x_2 + 4x_3 \leq 10$$

$$x_1 + 6x_2 + 8x_3 \leq 15$$

$$x_1, x_2, x_3 \geq 0$$

then which of the following may be a basic feasible to the above problem :

(1) $x_1 = 1,\ x_2 = 1,\ x_3 = 2$ (2) $x_1 = 1,\ x_2 = 5,\ x_3 = 0$

(3) $x_1 = 4,\ x_2 = 2,\ x_3 = -1$ (4) None of these

69. Let $X_i \sim N(\mu, \sigma^2)$, $i = 1, 2, 3, 4$, then an unbiased estimator of μ is :

(1) $\frac{X1 + X2 + X3 - X4}{3}$

(2) $\frac{2(X1 + X2) + X3 + X4}{6}$

(3) $\frac{3X + X2 + X3 - X4}{3}$

(4) None of these

70. Who is known as the Father of LPP ?

(1) R. A. Fisher

(2) C. R. Rao

(3) Hotelling T

(4) G. B. Dantzig

71. Given the following LPP

Max : $Z = 4x_1 + 8x_2$

Sub to

$$2x_1 + 2x_2 \geq 15$$

$$x_1 + x_2 = 15$$

$$x_1, x_2 \geq 0$$

then number of artificial variables to be introduced is :

(1) 1

(2) 2

(3) 3

(4) 4

72. The value of the following game :

Strategies of Player A	Strategies of Player B	I	II	III
	I	−1	2	−2
	II	6	4	−6
	III	6	4	−2

(1) −2

(2) 0

(3) 1

(4) 2

73. A saddle point of the game exists if :

(1) MinMax = Maxmin (2) MinMax > Maxmin

(3) MinMax < Maxmin (4) None of these

74. Assignment Problem is solved using :

(1) Rule of Dominace (2) North West Corner Rule

(3) Hungarian Method (4) None of these

75. If an LPP has 3 variables and 4 constraints, then its corresponding dual problem will have :

(1) 2 constrains (2) 3 constraints

(3) 4 constraints (4) None of these

76. The dimension of the subspace $W = \{(x, y, z) | x + y + z = 0\}$ of R^3 is :

(1) 1 (2) 3

(3) 2 (4) 0

77. Let B and C denote the subsets of a vector space V, then which of the following statements is ***correct*** ?

(1) If $B \subseteq C$ and C spans V, then B spans V.

(2) If $B \subseteq C$ and C is independent, then B is independent.

(3) If $B \subseteq C$, then span(C) =span(B).

(4) If $B \subseteq C$ and C is dependent, then B is dependent.

78. If the sum of two eigen values and trace of 3 × 3 matrix are equal, then the value of $|A|$ is :

(1) 1 (2) −1

(3) i (4) 0

79. The matnx $A = \begin{bmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{bmatrix}$, $\theta \in R$ has real eigen values if and only if :

(1) $\theta = n\pi$ for some integer n

(2) $\theta = 2n\pi + \frac{\pi}{2}$ for some integer n

(3) There is no restriction on θ

(4) $\theta = 2n\pi + \frac{\pi}{4}$ for some integer n

80. A linear transformation $y = Ax$ is said to be orthogonal if the matrix A is :

(1) Orthonormal

(2) Orthogonal

(3) Symmetric

(4) Singular

81. The index and signature of the quadratic form $10x_1^2 + 2x_2^2 + 5x_3^2 + 6x_2x_3 - 10x_3x_1 - 4x_1x_2$ are :

(1) 3 and 3 respectively

(2) 2 and 2 respectively

(3) 1 and 2 respectively

(4) 2 and 1 respectively

82. The sequence $x_n = \ln(2n^3 + 2) - \ln(5n^3 + 2n^2 + 4)$ converges to :

(1) 0

(2) $-\ln\frac{2}{5}$

(3) $\ln\frac{2}{5}$

(4) $\frac{2}{5}$

83. Every bounded subset of R^2 is :

(1) Compact

(2) Connected

(3) Totally Bounded

(4) Complete

84. A bounded function $f : [a, b] \to R$ may not Riemann Integrable for which of the following condition ?

(1) f is continuous

(2) f is monotone

(3) Measure of point of discontinuity of f is zero

(4) f has uncountable point of discontinuity

85. A sequence s_n is said to be bounded if :

(1) there exists a number λ such that $|s_n| < A$ for all $n \in N$

(2) there exists a real number p such that $|s_n| < p$ for all $n \in N$

(3) there exists a positive real number k such that $|s_n| < k$ for all $n \in N$

(4) there exists a positive real number m such that $|s_n| < m$ for some $n \in N$

86. The set of all limit points of the set $S = \left\{\frac{1}{m} + \frac{1}{n}, m, n \in N\right\}$ is :

(1) ϕ

(2) 0

(3) $\left\{\frac{1}{m} \cup \{0\}, m \in N\right\}$

(4) None of these

87. Which of these functions is ***not*** uniformly continuous on (0, 1) ?

(1) $\frac{1}{x^2}$

(2) $\frac{\sin x}{x}$

(3) $\sin x$

(4) $f(x) = 1$ for $x \in (0, 1)$, $f(0) = f(1) = 0$

88. An analytic function with constant modulus is :

(1) Zero

(2) A constant

(3) Identity map

(4) None of the above

89. Radius of convergence R of the power series $\sum_{n=1}^{\infty} \frac{(z-5)^n}{n^n}$ is :

(1) $R = 0$

(2) $R = \infty$

(3) $R = 1$

(4) $R = 5$

94.

90. Consider the function $f(z) = e^{\frac{3}{z}}$. Then $z = 0$ is :

(1) A pole

(2) A removable singularity

(3) An essential singularity

(4) None of the above

91. $F(z)$ is a function of the complex variable $z = x + iy$ given by $F(z) = iz + kRe(z) + iIm(z)$. For what value of k will $F(z)$ satisfy Cauchy-Riemann Equations ?

(1) 0 (2) 1

(3) −1 (4) y

92. Suppose f and g are entire functions and $g(z) \neq 0$ for all $z \in C$. If $|f(z)| \leq |g(z)|$, then we conclude that :

(1) $f(z) \neq 0$ for all $z \in C$

(2) f is a constant function

(3) $f(0) = 0$

(4) For some $c \in C, f(z) = c.g(z)$

93. Let C be the circle of radius 2 with centre at origin in a complex plane, oriented in the anti-clockwise direction. Then the integral $\oint_C \frac{dz}{(z-1)^2}$ equal to :

(1) 0 (2) 1

(3) $\frac{1}{2\pi i}$ (4) $2\pi i$

94. In which of the following method, we approximate the curve of solution by the tangent in each interval ?

(1) Euler's method

(2) Picard's method

(3) Newton's method

(4) Runge-Kutta's method

95. The Newton-Raphson method formula for finding the square root of a real number R from the equation $x^2 - R = 0$ is :

(1) $x_{i+1} = \frac{x_i}{2}$

(2) $x_{i+1} = \frac{3x_i}{2}$

(3) $x_{i+1} = \frac{1}{2}\left(x_i + \frac{R}{x_i}\right)$

(4) $x_{i+1} = \frac{1}{2}\left(3x_i - \frac{R}{x_i}\right)$

96. In Regula-Falsi method, the first approximation is given by :

(1) $\frac{af(a)-bf(b)}{f(b)-f(a)}$

(2) $\frac{af(b)-bf(a)}{f(b)-f(a)}$

(3) $\frac{af(a)-bf(b)}{f(a)-f(b)}$

(4) $\frac{af(b)-bf(a)}{f(a)-f(b)}$

97. The real root of the equation $5x - 2\cos x - 1$ (upto 2 decimal accuracy) is :

(1) 0.44

(2) 0.56

(3) 0.52

(4) 0.54

98. Consider an ordinary differential equation $\frac{dx}{dt} = 4t + 4$. If $x = x_0$ at $t = 0$, the increment in x calculated using Runge-Kutta fourth order multi-step method with a step size of $\Delta t = 0.2$ is :

(1) 0.22

(2) 0.44

(3) 0.66

(4) 0.88

99. The integral $\int_1^3 \frac{1}{x} dx$ when calculated by using Simpson's $\frac{1}{3}$ rule on two equal sub-intervals each of length 1, equals :

(1) 1.000 (2) 1.098

(3) 1.111 (4) 1.120

100. The theorem that states" Every bounded sequence has a limit point" is :

(1) Cauchy's theorem (2) Bolzano- Weierstrass Theorem

(3) Lagrange's Theorem (4) None of the above

Total No. of Printed Pages : 21

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

B

SET-Y

M.Phil./Ph.D./URS-EE-2020

SUBJECT : Statistics

10002

Sr. No. ....

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

Roll No. (in figures)_________________ (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. ***Candidates are required to attempt any 75 questions out of the given 100 multiple choice questions of 4/3 marks each. No credit will be given for more than 75 correct responses.***
2. The candidates ***must return*** the question booklet 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 & 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 booklet itself. Answers ***must not*** be ticked in the question booklet.
6. ***There will be no negative marking. Each correct answer will be awarded 4/3 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 booklet. Complaints, if any, regarding misprinting etc. will not be entertained* ***30*** *minutes after starting of the examination.*

1. Given the following LPP

Max : $Z = 4x_1 + 8x_2$

Sub to

$$2x_1 + 2x_2 \geq 15$$

$$x_1 + x_2 = 15$$

$$x_1, x_2 \geq 0$$

then number of artificial variables to be introduced is :

(1) 1 (2) 2 (3) 3 (4) 4

2. The value of the following game :

		Strategies of Player B		
		I	II	III
Strategies of Player A	I	–1	2	–2
	II	6	4	–6
	III	6	4	–2

(1) –2 (2) 0 (3) 1 (4) 2

3. A saddle point of the game exists if :

(1) MinMax = Maxmin (2) MinMax > Maxmin

(3) MinMax < Maxmin (4) None of these

4. Assignment Problem is solved using :

(1) Rule of Dominace (2) North West Corner Rule

(3) Hungarian Method (4) None of these

5. If an LPP has 3 variables and 4 constraints, then its corresponding dual problem will have :

(1) 2 constrains (2) 3 constraints

(3) 4 constraints (4) None of these

6. The dimension of the subspace $W = \{(x, y, z) | x + y + z = 0\}$ of R^3 is :

(1) 1 (2) 3

(3) 2 (4) 0

7. Let B and C denote the subsets of a vector space V, then which of the following statements is ***correct*** ?

(1) If $B \subseteq C$ and C spans V, then B spans V.

(2) If $B \subseteq C$ and C is independent, then B is independent.

(3) If $B \subseteq C$, then span(C) =span(B).

(4) If $B \subseteq C$ and C is dependent, then B is dependent.

8. If the sum of two eigen values and trace of 3×3 matrix are equal, then the value of $|A|$ is :

(1) 1 (2) −1

(3) i (4) 0

9. The matnx $A = \begin{bmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{bmatrix}$, $\theta \in R$ has real eigen values if and only if :

(1) $\theta = n\pi$ for some integer n (2) $\theta = 2n\pi + \frac{\pi}{2}$ for some integer n

(3) There is no restriction on θ (4) $\theta = 2n\pi + \frac{\pi}{4}$ for some integer n

10. A linear transformation $y = Ax$ is said to be orthogonal if the matrix A is :

(1) Orthonormal (2) Orthogonal

(3) Symmetric (4) Singular

Instruction : Consider the following Markov Chain with tpm :

$$P = \begin{pmatrix} 0 & 1 & 0 \\ 1/2 & 0 & 1/2 \\ 0 & 1 & 0 \end{pmatrix}$$ and answer the question no. **11** to **14 :**

11. The Markov Chain is periodic with period :

(1) 1 (2) 2 (3) 3 (4) 4

12. State 1 is :

(1) persistent (2) transient

(3) transient null (4) transient non-null

13. The Markov Chain is :

(1) irreducible (2) reducible

(3) closed (4) None of these

14. Which of the following is ***true*** ?

(1) $p = p^2$ (2) $p = p^3$ (3) $p = p^0$ (4) $p = p^4$

15. Number of basic feasible solution in a transportation problem with 4 origins and 3 destinations is :

(1) 3 (2) 4 (3) 5 (4) 6

16. The following game problem with the payoff matrix :

		Strategies of Player B		
		I	II	III
Strategies of Player A	I	1	–1	3
	II	3	5	–3
	III	6	2	–2

The above problem can be solved using :

(1) Graphical method (2) Rule of Dominance

(3) MinMax Principle (4) Simplex Method

17. For what values of K, the game with the following payoff matrix is strictly determinable ?

Strategies of Player B				
Strategies of Player A		I	II	III
	I	K	6	2
	II	–1	K	–7
	III	–2	4	K

(1) $K \geq 0$ (2) $1 \leq K \leq 2$

(3) $-1 \leq K \leq 2$ (4) None of these

18. If a Primal Problem (Maximization) has optimal value equal to 60, then the optimal value of the corresponding dual can be :

(1) 55 (2) 59 (3) 61 (4) None of these

19. A solution to an LPP is said to be degenerate if one of the :

(1) basic variables is zero (2) non-basic variables is zero

(3) basic variables is positive (4) non-basic variables positive

20. The following assignment problem pertains to the time taken by the programmers to develop different programmes :

Programmers			
Programmes	A	B	C
I	120	100	80
II	80	90	110
III	110	140	120

Then the total minimum time required for developing the said programmes is

(1) 280 (2) 290 (3) 300 (4) None of these

21. In systematic sampling, if the population size is 200 and the selected sample size is 40, then the sampling interval is :

(1) 3 (2) 4 (3) 3 (4) None of these

22. A sample of 16 items from an infinite population having standard deviation 4. The standard error of sampling distribution of mean is :

(1) 1 (2) 5 (3) 10 (4) 40

23. The Mahalanobis distance of an observation $x = (x_1, x_2, x_3, \ldots\ldots, x_N)^T$ from a set of observations with mean $\mu = (\mu_1, \mu_2, \mu_3, \mu_N)^T$ and covariance matrix S is defined as :

(1) $\sqrt{(x-\mu)^T S^{-1}(x-\mu)}$ (2) $(x-\mu)^T \sigma^{-1}(x-\mu)$

(3) $(x-\mu)^T S^{-1}(x-\mu)^2$ (4) None of these

24. For large n, Hotelling's T^2 statistic $(\bar{x}-\mu_0)^T S^{-1}(\bar{x}-\mu_0)$ is distributed as :

(1) t_{n-2} (2) $F_{n-p,p}$ (3) X_p^2 (4) None of these

25. If we have two sets of variables, $x_1, x_2, \ldots\ldots, x_n$ and $y_1, y_2, \ldots\ldots, y_m$ and there are correlations among the variables, then canonical correlation analysis will enable us to find linear combinations of the x's and the y's which have .... correlation with each other.

(1) minimum (2) maximum

(3) zero (4) None of these

26. Scree plot is associated with :

(1) Discriminant Analysis (2) Canonical Correlation

(3) Principle Component Analysis (4) None of these

27. Given that $E[X + 4] = 10$ and $E[X + 4]^2 = 116$, then Var(X) is equal to :

(1) 4 (2) 8

(3) 12 (4) 16

28. Three varieties A, B, C of wheat are tested in a RBD with 4 replications. Then the degrees of freedom for error will be :

(1) 4 (2) 5

(3) 6 (4) 12

29. Relative efficiency of LSD over RBD when m rows are taken as blocks is given by :

(1) $\frac{\text{MSC}+(m-1)\text{MSR}}{m\text{MSE}}$ (2) $\frac{\text{MSR}+(m-1)\text{MSE}}{m\text{MSE}}$

(3) $\frac{\text{MSC}+(m-1)\text{MSE}}{m\text{MSE}}$ (4) None of these

30. The method of confounding is a device to reduce the size of :

(1) Experiment (2) Blocks

(3) Replication (4) Treatments

31. If a Binomial variate (X) is distributed with mean 4 and variance 3, then X is distributed as :

(1) $N(4, 16)$ (2) $B(4, 1/4)$

(3) $B(1/4, 16)$ (4) $B(16, 1/4)$

32. If a random variable X has the following p.d.f.

$$f(x; \mu, \sigma^2) = \frac{1}{3\sqrt{2\pi}} e^{\frac{(x-6)^2}{18}}, \mu, \sigma^2 > 0, \text{ then we have :}$$

(1) $X \sim N(3, 9)$ (2) $X \sim N(6, 3)$

(3) $X \sim N(6, 9)$ (4) $X \sim N(3, 6)$

33. If moment generating function of a distribution is $e^{6t+\frac{1}{4}t^2}$, then standard deviation of the distribution is :

(1) 1/2 (2) 2

(3) 4 (4) 6

34. A random variable X has a mean 8 and variance 9 and an unknown probability distribution, then $P(-4 < x < 20)$ is :

(1) less than 1/4 (2) more than 15/16

(3) less than 15/16 (4) None of these

35. A medical doctor wants to reduce blood sugar level of all his patients by altering their diet. He finds that the mean sugar level of all patients is 180 with a standard deviation of 18. Nine of his patients start dieting and the mean of the sample is observed to be 175. What is the standard error of the mean ?

(1) 2 (2) 4 (3) 6. (4) None of these

36. The fact that the sampling distribution of sample means can be approximated by a normal probability distribution whenever the sample size is large is based on the :

(1) central limit theorem

(2) fact that we have tables of areas for the normal distribution

(3) assumption that the population has a normal distribution

(4) None of these alternatives is correct

37. As the sample size increases, the variability among the sample means :

(1) increases

(2) decreases

(3) remains the same

(4) depends upon the specific population being sampled

38. Let $Y1 < Y2 < Y3 < Y4$ denote the order statistics of a random sample of size 4 from a distribution having p.d.f. $f(x) = \begin{cases} 2x & , \quad 0 < x < 1 \\ 0 & , \quad \text{elsewhere} \end{cases}$, then $P\left(\frac{1}{2} < Y_3\right)$ is equal :

(1) $\frac{145}{256}$

(2) $\frac{243}{456}$

(3) $\frac{213}{356}$

(4) $\frac{243}{256}$

39. A property of a point estimator that occurs whenever larger sample sizes tend to provide point estimates closer to the population parameter, is known as :

(1) efficiency

(2) unbiased sampling

(3) consistency

(4) relative estimation

40. The hospital period, in days, for patients following treatment for a certain type of kidney disorder is a random variable $Y = X + 4$ where X has the density function $f(x) = \begin{cases} \frac{(32)}{(x+4)^3} & ; \quad x > 0 \\ 0 & ; \quad \text{elsewhere} \end{cases}$, then the p.d.f. of random variable Y is :

(1) $g(y) = \begin{cases} \frac{(32)}{(y)^3} & ; \quad y > 4 \\ 0 & ; \quad \text{elsewhere} \end{cases}$

(2) $g(y) = \begin{cases} \frac{(32)}{(y+4)^3} & ; \quad y > 4 \\ 0 & ; \quad \text{elsewhere} \end{cases}$

(3) $g(y) = \begin{cases} \frac{(16)}{(y)^2} & ; \quad y > 4 \\ 0 & ; \quad \text{elsewhere} \end{cases}$

(4) $g(y) = \begin{cases} \frac{(4)}{(y+4)^3} & ; \quad y > 0 \\ 0 & ; \quad \text{elsewhere} \end{cases}$

41. $F(z)$ is a function of the complex variable $z = x + iy$ given by $F(z) = iz + kRe(z) + iIm(z)$. For what value of k will $F(z)$ satisfy Cauchy-Riemann Equations ?

(1) 0

(2) 1

(3) −1

(4) y

42. Suppose f and g are entire functions and $g(z) \neq 0$ for all $z \in C$. If $|f(z)| \leq |g(z)|$, then we conclude that :

(1) $f(z) \neq 0$ for all $z \in C$

(2) f is a constant function

(3) $f(0) = 0$

(4) For some $c \in C, f(z) = c.g(z)$

43. Let C be the circle of radius 2 with centre at origin in a complex plane, oriented in the anti-clockwise direction. Then the integral $\oint_C \frac{dz}{(z-1)^2}$ equal to :

(1) 0 (2) 1

(3) $\frac{1}{2\pi i}$ (4) $2\pi i$

44. In which of the following method, we approximate the curve of solution by the tangent in each interval ?

(1) Euler's method (2) Picard's method

(3) Newton's method (4) Runge-Kutta's method

45. The Newton-Raphson method formula for finding the square root of a real number R from the equation $x^2 - R = 0$ is :

(1) $x_{i+1} = \frac{x_i}{2}$ (2) $x_{i+1} = \frac{3x_i}{2}$

(3) $x_{i+1} = \frac{1}{2}\left(x_i + \frac{R}{x_i}\right)$ (4) $x_{i+1} = \frac{1}{2}\left(3x_i - \frac{R}{x_i}\right)$

46. In Regula-Falsi method, the first approximation is given by :

(1) $\frac{af(a)-bf(b)}{f(b)-f(a)}$

(2) $\frac{af(b)-bf(a)}{f(b)-f(a)}$

(3) $\frac{af(a)-bf(b)}{f(a)-f(b)}$

(4) $\frac{af(b)-bf(a)}{f(a)-f(b)}$

47. The real root of the equation $5x - 2\cos x - 1$ (upto 2 decimal accuracy) is :

(1) 0.44

(2) 0.56

(3) 0.52

(4) 0.54

48. Consider an ordinary differential equation $\frac{dx}{dt} = 4t + 4$. If $x = x_0$ at $t = 0$, the increment in x calculated using Runge-Kutta fourth order multi-step method with a step size of $\Delta t = 0.2$ is :

(1) 0.22

(2) 0.44

(3) 0.66

(4) 0.88

49. The integral $\int_1^3 \frac{1}{x}\,dx$ when calculated by using Simpson's $\frac{1}{3}$ rule on two equal sub-intervals each of length 1, equals :

(1) 1.000

(2) 1.098

(3) 1.111

(4) 1.120

50. The theorem that states" Every bounded sequence has a limit point" is :

(1) Cauchy's theorem

(2) Bolzano- Weierstrass Theorem

(3) Lagrange's Theorem

(4) None of the above

51. A branching process is called subcritical if the mean of the off springs (m) is :

(1) zero

(2) more than 1

(3) less than 1

(4) None of these

52. If the mean of the off springs (m) is less than 1, then the probability of extinction is :

(1) zero (2) 1

(3) between 0 and 1 (4) None of these

53. Which of the following is ***not*** a stochastic matrix ?

(1) $\begin{pmatrix} 0 & 1 \\ -1 & 1 \end{pmatrix}$ (2) $\begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}$

(3) $\begin{pmatrix} 1/2 & 1/2 \\ 1 & 0 \end{pmatrix}$ (4) $\begin{pmatrix} 1/2 & 1/2 \\ 1/2 & 1/2 \end{pmatrix}$

54. The Eigen values of a matrix $A = \begin{pmatrix} 3 & 2 \\ 2 & 3 \end{pmatrix}$ are 5 and 1. The Eigen values of A^2 are :

(1) 25 and 1 (2) 10 and 2

(3) 1 and 1/5 (4) None of these

55. If Chi-square distribution has 12 degree of free, then the variance of the distribution is :

(1) 24 (2) 12

(3) 6 (4) None of these

56. Local control in experimental designs is meant to :

(1) reduce experiential error

(2) increase the efficiency of the design

(3) to form homogeneous blocks

(4) all the above None of the above

57. If net reproduction rate is greater than 1, then it will result :

(1) no increase in population (2) decrease in population

(3) exponential increase in population (4) increase in population

58. Given the following LPP :

Max : $Z = x_1 + 2x_2 + 3x_3$

Sub to

$$x_1 + 5x_2 + 4x_3 \le 10$$
$$x_1 + 6x_2 + 8x_3 \le 15$$
$$x_1, x_2, x_3 \ge 0$$

then which of the following may be a basic feasible to the above problem :

(1) $x_1 = 1,\ x_2 = 1,\ x_3 = 2$
(2) $x_1 = 1,\ x_2 = 5,\ x_3 = 0$
(3) $x_1 = 4,\ x_2 = 2,\ x_3 = -1$
(4) None of these

59. Let $X_i \sim N(\mu, \sigma^2)$, $i = 1, 2, 3, 4$, then an unbiased estimator of μ is :

(1) $\frac{X1 + X2 + X3 - X4}{3}$
(2) $\frac{2(X1 + X2) + X3 + X4}{6}$
(3) $\frac{3X + X2 + X3 - X4}{3}$
(4) None of these

60. Who is known as the Father of LPP ?

(1) R. A. Fisher
(2) C. R. Rao
(3) Hotelling T
(4) G. B. Dantzig

61. The index and signature of the quadratic form $10x_1^2 + 2x_2^2 + 5x_3^2 + 6x_2x_3 - 10x_3x_1 - 4x_1x_2$ are :

(1) 3 and 3 respectively
(2) 2 and 2 respectively
(3) 1 and 2 respectively
(4) 2 and 1 respectively

62. The sequence $x_n = \ln(2n^3 + 2) - \ln(5n^3 + 2n^2 + 4)$ converges to :

(1) 0
(2) $-\ln\frac{2}{5}$
(3) $\ln\frac{2}{5}$
(4) $\frac{2}{5}$

63. Every bounded subset of R^2 is :

(1) Compact (2) Connected

(3) Totally Bounded (4) Complete

64. A bounded function f : $[a, b] \rightarrow R$ may not Riemann Integrable for which of the following condition ?

(1) f is continuous

(2) f is monotone

(3) Measure of point of discontinuity of f is zero

(4) f has uncountable point of discontinuity

65. A sequence s_n is said to be bounded if :

(1) there exists a number λ such that $|s_n| < A$ for all $n \in N$

(2) there exists a real number p such that $|s_n| < p$ for all $n \in N$

(3) there exists a positive real number k such that $|s_n| < k$ for all $n \in N$

(4) there exists a positive real number m such that $|s_n| < m$ for some $n \in N$

66. The set of all limit points of the set $S = \left\{\frac{1}{m} + \frac{1}{n}, m, n \in N\right\}$ is :

(1) ϕ (2) 0

(3) $\left\{\frac{1}{m} \cup \{0\}, m \in N\right\}$ (4) None of these

67. Which of these functions is ***not*** uniformly continuous on (0, 1) ?

(1) $\frac{1}{x^2}$ (2) $\frac{\sin x}{x}$

(3) $\sin x$ (4) $f(x) = 1$ for $x \in (0, 1), f(0) = f(1) = 0$

68. An analytic function with constant modulus is :

(1) Zero (2) A constant

(3) Identity map (4) None of the above

69. Radius of convergence R of the power series $\sum_{n=1}^{\infty} \frac{(z-5)^n}{n^n}$ is :

(1) $R = 0$ (2) $R = \infty$

(3) $R = 1$ (4) $R = 5$

70. Consider the function $f(z) = e^{\frac{3}{z}}$. Then $z = 0$ is :

(1) A pole

(2) A removable singularity

(3) An essential singularity

(4) None of the above

71. The geometric mean of Laspeyer's and Paache's indices is :

(1) Bowley's Ideal Index

(2) Fisher's Index

(3) Chain Index

(4) Marshal and Edgeworth's Index

72. Seasonal variations repeat with :

(1) one year (2) two years

(3) five years (4) None of the Treatments

73. A good index number is one that satisfies :

(1) Circular Test (2) Time Reversal Test

(3) Factor Reversal Test (4) All the above Tests

74. Vital rates are customarily expressed as :

(1) per ten thousand (2) per thousand

(3) percentages (4) None of these

75. The trend is determined by :

(1) Link Relative Method

(2) Ratio to Trend Method

(3) Ratio-to-Moving Method

(4) None of these

76. Fertility rate provides an adequate basis for :

(1) population growth

(2) family planning

(3) checking the infant mortality

(4) None of these

77. Time Reversal Test is satisfied when :

(1) $P_{01} \times P_{10} = 0$ (2) $P_{01} \times P_{10} = 1$

(3) $P_{01} \times P_{10} < 1$ (4) None of the above

78. In the following replicate of a 2^3 factorial experiment in blocks of 4 plots involving three fertilizer *N*, *P* and *K* :

Block 1	Np	npk	(1)	K
Block 2	P	n	Pk	Nk

then the confounded factor is :

(1) NPK (2) NK

(3) NP (4) None of the above

79. For a certain experiment laid out in an LSD with four treatments with SST = 10.035, SSB = 22.25, SSC = 45.25, TSS = 86.33 and $F_{0.05}(3,6) = 4.76$, then $H_0 : t_1 = t_2 = t_3 = t_4$:

(1) is rejected (2) is accepted

(3) may be rejected (4) None of these

80. In a railway marshalling yard, goods trains arrive at a rate of 30 trains per day. Assuming that the inter-arrival time follows an exponential distribution and the service time distribution is also exponential with an average of 36 minutes, then the expected queue size of the trains is :

(1) 1 (2) 2 (3) 3 (4) 4

81. If $f(x,y)=\begin{cases}\frac{x(1+3y^2)}{4} & ; \quad 0<x<2, 0<y<1 \\ 0 & ; \quad \text{elsewhere}\end{cases}$, then :

(1) $E(XY) > E(X) \,.\, E(Y)$ (2) $E(XY) < E(X) \,.\, E(Y)$

(3) $E(XY) = E(X) \,.\, E(Y)$ (4) $E(XY) = E(X) + E(Y)$

82. Which of the following statements is ***true*** ?

(1) Unbaised estimator is always efficient

(2) Consistent estimator is always unbiased

(3) Unbaised estimator is always consistent

(4) MLE is always a function of sufficient statistics

83. Suppose 10 rats are used in a biomedical study where they are injected with cancer cells and then given a cancer drug that is designed to increase their survival rate. The survival times following exponential distribution are 14, 17, 27, 18, 12, 8, 22, 13, 19 and 12, then M.L.E. of the mean survival time is :

(1) 14.5 (2) 16.2 (3) 18 (4) 20

84. A random sample is taken from $B(5, p)$ population to test $H_0 : p = 1/2$ against $H_1 : p = 0{,}7$, it is decided that we reject H_0 when $X \geq 3$, then the power of test is approximately equal to :

(1) 0.5 (2) 0.75 (3) 0.84 (4) None of these

85. If a hypothesis H_0 is rejected at .01 level of significance, then it :

(1) will be accepted at 0.05 level of significance

(2) may not be rejected at .10 level of significance

(3) will be rejected at .10 level of significance

(4) None of these

86. Given $\sigma = 6$, $\mu = 25$, sample mean = 23 and the degree of precession required is 99%, ($Z = 2.58$) the sample size required is approximately equal to :

(1) 50 (2) 60 (3) 70 (4) 80

87. Let X be the number of offspring of a bacteria with p.m.f.

$P(X = x) = \frac{1}{4}\left(\frac{3}{4}\right)^k$, $k = 0, 1, 2, \ldots$.. the $E(X)$ is equal to :

(1) 3 (2) 2 (3) 1 (4) 4

88. The variance of the stratified sampling mean ($\bar{Y}_{st}$) is :

(1) $\sum_{h=1}^{L}\left(\frac{1}{N_h} - \frac{1}{n_h}\right)W_h^2\, S_h^2$

(2) $\sum_{h=1}^{L}\left(\frac{1}{n_h} - \frac{1}{N_h}\right)W_h^2\, S_h$

(3) $\sum_{h=1}^{L}\left(\frac{1}{n_h} - \frac{1}{N_h}\right)W_h\, S_h^2$

(4) $\sum_{h=1}^{L}\left(\frac{1}{n_h} - \frac{1}{N_h}\right)W_h^2\, S_h^2$

89. In a SRSWOR, if $\bar{y} = 50$, $n = 100$, $N = 500$, then the estimated population total is :

(1) 250 (2) 500 (3) 2500 (4) 25000

90. In [redacted]RS, the bais of the ratio estimator $\hat{R}$ is given :

(1) $B(\hat{R}) = \frac{\text{cov}(\hat{R}, \bar{x})}{\bar{X}}$

(2) $B(\hat{R}) = \frac{\text{cov}(\hat{R}, \bar{x})}{\bar{Y}}$

(3) $\frac{\text{cov}(\hat{R}, \bar{y})}{\bar{Y}}$

(4) None of these

91. If for any distribution, mean > median > mode, then the distribution is called :

(1) negatively skewed

(2) positively skewed

(3) symmetric

(4) None of these

92. If two variables are independent, then the correlation between them is :

(1) -1

(2) 1

(3) between -1 and 1

(4) zero

9%,

93. Regression equations of two variables X and Y are as follows :

$$3X + 2Y - 26 = 0 \text{ and } 6X + Y - 31 = 0,$$

then the coefficient of correlation between X and Y is :

(1) 0.5 (2) 0.76 (3) 0.8 (4) – 0.5

94. If the random variables X, Y and Z have the means $\mu_x = 3$, $\mu_y = 5$ and $\mu_z = 2$, variances $\sigma_x^2 = 8$, $\sigma_y^2 = 12$ and $\sigma_z^2 = 18$ and $Cov(X, Y) = 1$, $Cov(X, Z) = -3$ and $Cov(Y, Z) = 2$, then the Cov of $U = X + 4Y + 2Z$ and $V = 3X - Y - Z$ is :

(1) 54 (2) −76 (3) 95 (4) None of these

95. For a distribution, the four central moments were obtained as :

$\mu_1 = 0$, $\mu_2 = 0.933$, $\mu_3 = 0$ and $\mu_4 = 2.533$,

then the distribution is :

(1) Platykurtic (2) Mesokurtic

(3) Leptokurtic (4) None of these

96. A random sample of 27 pairs of observations from a normal population gave $r = 0.6$. If $t_{0.05}$ for 25 d. f. = 2.06, then r is :

(1) Significant (2) In-significant

(3) Least significant (4) None of these

97. Regression equation of X on Y for the following data :

X	1	2	3	4	5
Y	3	4	5	6	7

is given by :

(1) $Y = 2.5 - X$ (2) $X = 1.5 + 5Y$

(3) $Y = 2 + X$ (4) $X = 2 + Y$

98. A student obtained the following two regression equations for a set of data based on two variables

$6X - 15Y = 21, 21X + 14Y = 56$, then :

(1) Equations are not correctly obtained

(2) Equations are correctly obtained

(3) Equations have no solutions

(4) None of these

99. The probability mass function of a random variable X is as follows :

X	0	1	2	3	4	5
$f(x)$	k^2	$k/4$	$5\,k/2$	$k/4$	$2k^2$	k^2

then the value of k is :

(1) 1/2 (2) 1/3 (3) 1/4 (4) 4

100. Let $X \sim N(8, 25)$, then standard normal variate (SNV) will be :

(1) $Z = \frac{X-8}{25}$ (2) $Z = \frac{X-2}{5}$

(3) $Z = \frac{X-8}{10}$ (4) $Z = \frac{X-8}{5}$

Total No. of Printed Pages : 21

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

C

SET-Y

M.Phil./Ph.D./URS-EE-2020

SUBJECT : Statistics

10007

Sr. No. ....

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

Roll No. (in figures)______________ (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. ***Candidates are required to attempt any 75 questions out of the given 100 multiple choice questions of 4/3 marks each. No credit will be given for more than 75 correct responses.***
2. The candidates ***must return*** the question booklet 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 & 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 booklet itself. Answers ***must not*** be ticked in the question booklet.
6. ***There will be no negative marking. Each correct answer will be awarded 4/3 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 booklet. Complaints, if any, regarding misprinting etc. will not be entertained* ***30*** *minutes after starting of the examination.*

1. The geometric mean of Laspeyer's and Paache's indices is :

(1) Bowley's Ideal Index

(2) Fisher's Index

(3) Chain Index

(4) Marshal and Edgeworth's Index

2. Seasonal variations repeat with :

(1) one year (2) two years

(3) five years (4) None of the Treatments

3. A good index number is one that satisfies :

(1) Circular Test (2) Time Reversal Test

(3) Factor Reversal Test (4) All the above Tests

4. Vital rates are customarily expressed as :

(1) per ten thousand (2) per thousand

(3) percentages (4) None of these

5. The trend is determined by :

(1) Link Relative Method

(2) Ratio to Trend Method

(3) Ratio-to-Moving Method

(4) None of these

6. Fertility rate provides an adequate basis for :

(1) population growth

(2) family planning

(3) checking the infant mortality

(4) None of these

7. Time Reversal Test is satisfied when :

(1) $P_{01} \times P_{10} = 0$

(2) $P_{01} \times P_{10} = 1$

(3) $P_{01} \times P_{10} < 1$

(4) None of the above

8. In the following replicate of a 2^3 factorial experiment in blocks of 4 plots involving three fertilizer N, P and K :

Block 1	Np	npk	(1)	K
Block 2	P	n	Pk	Nk

then the confounded factor is :

(1) NPK

(2) NK

(3) NP

(4) None of the above

9. For a certain experiment laid out in an LSD with four treatments with SST = 10.035, SSB = 22.25, SSC = 45.25, TSS = 86.33 and $F_{0.05}(3,6) = 4.76$, then $H_0 : t_1 = t_2 = t_3 = t_4$:

(1) is rejected

(2) is accepted

(3) may be rejected

(4) None of these

10. In a railway marshalling yard, goods trains arrive at a rate of 30 trains per day. Assuming that the inter-arrival time follows an exponential distribution and the service time distribution is also exponential with an average of 36 minutes, then the expected queue size of the trains is :

(1) 1 (2) 2 (3) 3 (4) 4

11. If $f(x,y)=\begin{cases}\frac{x(1+3y^2)}{4} & ; \quad 0<x<2, 0<y<1 \\ 0 & ; \quad \text{elsewhere}\end{cases}$, then :

(1) $E(XY) > E(X) . E(Y)$ (2) $E(XY) < E(X) . E(Y)$

(3) $E(XY) = E(X) . E(Y)$ (4) $E(XY) = E(X) + E(Y)$

12. Which of the following statements is ***true*** ?

(1) Unbaised estimator is always efficient

(2) Consistent estimator is always unbiased

(3) Unbaised estimator is always consistent

(4) MLE is always a function of sufficient statistics

13. Suppose 10 rats are used in a biomedical study where they are injected with cancer cells and then given a cancer drug that is designed to increase their survival rate. The survival times following exponential distribution are 14, 17, 27, 18, 12, 8, 22, 13, 19 and 12, then M.L.E. of the mean survival time is :

(1) 14.5 (2) 16.2 (3) 18 (4) 20

14. A random sample is taken from $B(5, p)$ population to test $H_0 : p = 1/2$ against $H_1 : p = 0,7$, it is decided that we reject H_0 when $X \geq 3$, then the power of test is approximately equal to :

(1) 0.5 (2) 0.75 (3) 0.84 (4) None of these

15. If a hypothesis H_0 is rejected at .01 level of significance, then it :

(1) will be accepted at 0.05 level of significance

(2) may not be rejected at .10 level of significance

(3) will be rejected at .10 level of significance

(4) None of these

16. Given $\sigma = 6$, $\mu = 25$, sample mean = 23 and the degree of precession required is 99%, ($Z = 2.58$) the sample size required is approximately equal to :

(1) 50 (2) 60 (3) 70 (4) 80

17. Let X be the number of offspring of a bacteria with p.m.f.

$P(X = x) = \frac{1}{4}\left(\frac{3}{4}\right)^k$, $k = 0, 1, 2, \ldots..$ the $E(X)$ is equal to :

(1) 3 (2) 2 (3) 1 (4) 4

18. The variance of the stratified sampling mean ($\bar{Y}_{st}$) is :

(1) $\sum_{h=1}\left(\frac{1}{N_h} - \frac{1}{n_h}\right)W_h^2\ S_h^2$

(2) $\sum_{h=1}^{L}\left(\frac{1}{n_h} - \frac{1}{N_h}\right)W_h^2\ S_h$

(3) $\sum_{h=1}^{L}\left(\frac{1}{n_h} - \frac{1}{N_h}\right)W_h\ S_h^2$

(4) $\sum_{h=1}^{L}\left(\frac{1}{n_h} - \frac{1}{N_h}\right)W_h^2\ S_h^2$

19. In a SRSWOR, if $\bar{y} = 50$, $n = 100$, $N = 500$, then the estimated population total is :

(1) 250 (2) 500 (3) 2500 (4) 25000

20. In SRS, the bais of the ratio estimator $\hat{R}$ is given :

(1) $B(\hat{R}) = \frac{\text{cov}(\hat{R}, \bar{x})}{\bar{X}}$

(2) $B(\hat{R}) = \frac{\text{cov}(\hat{R}, \bar{x})}{\bar{Y}}$

(3) $\frac{\text{cov}(\hat{R}, \bar{y})}{\bar{Y}}$

(4) None of these

21. If for any distribution, mean > median > mode, then the distribution is called :

(1) negatively skewed
(2) positively skewed
(3) symmetric
(4) None of these

22. If two variables are independent, then the correlation between them is :

(1) −1
(2) 1
(3) between −1 and 1
(4) zero

23. Regression equations of two variables X and Y are as follows :

$$3X + 2Y - 26 = 0 \text{ and } 6X + Y - 31 = 0,$$

then the coefficient of correlation between X and Y is :

(1) 0.5
(2) 0.76
(3) 0.8
(4) − 0.5

24. If the random variables X, Y and Z have the means $\mu_x = 3$, $\mu_y = 5$ and $\mu_z = 2$, variances $\sigma_x^2 = 8$, $\sigma_y^2 = 12$ and $\sigma_z^2 = 18$ and Cov$(X, Y) = 1$, Cov $(X, Z) = -3$ and Cov $(Y, Z) = 2$, then the Cov of $U = X + 4Y +.2Z$ and $V = 3X - Y - Z$ is :

(1) 54
(2) −76
(3) 95
(4) None of these

25. For a distribution, the four central moments were obtained as :

$\mu_1 = 0$, $\mu_2 = 0.933$, $\mu_3 = 0$ and $\mu_4 = 2.533$,

then the distribution is :

(1) Platykurtic
(2) Mesokurtic
(3) Leptokurtic
(4) None of these

26. A random sample of 27 pairs of observations from a normal population gave $r = 0.6$. If $t_{0.05}$ *f*or 25 d. f. = 2.06, then r is :

(1) Significant
(2) In-significant
(3) Least significant
(4) None of these

27. Regression equation of X on Y for the following data :

X	1	2	3	4	5
Y	3	4	5	6	7

is given by :

(1) $Y = 2.5 - X$ (2) $X = 1.5 + 5Y$ (3) $Y = 2 + X$ (4) $X = 2 + Y$

28. A student obtained the following two regression equations for a set of data based on two variables

$6X - 15Y = 21, 21X + 14Y = 56$, then :

(1) Equations are not correctly obtained

(2) Equations are correctly obtained

(3) Equations have no solutions

(4) None of these

29. The probability mass function of a random variable X is as follows :

X	0	1	2	3	4	5
$f(x)$	k^2	$k/4$	$5k/2$	$k/4$	$2k^2$	k^2

then the value of k is :

(1) 1/2 (2) 1/3 (3) 1/4 (4) 4

30. Let $X \sim N(8, 25)$, then standard normal variate (SNV) will be :

(1) $Z = \frac{X-8}{25}$ (2) $Z = \frac{X-2}{5}$

(3) $Z = \frac{X-8}{10}$ (4) $Z = \frac{X-8}{5}$

31. The index and signature of the quadratic form $10x_1^2 + 2x_2^2 + 5x_3^2 + 6x_2x_3 - 10x_3x_1 - 4x_1x_2$ are :

(1) 3 and 3 respectively (2) 2 and 2 respectively

(3) 1 and 2 respectively (4) 2 and 1 respectively

32. The sequence $x_n = \ln(2n^3 + 2) - \ln(5n^3 + 2n^2 + 4)$ converges to :

(1) 0 (2) $-\ln\frac{2}{5}$ (3) $\ln\frac{2}{5}$ (4) $\frac{2}{5}$

33. Every bounded subset of R^2 is :

(1) Compact (2) Connected

(3) Totally Bounded (4) Complete

34. A bounded function $f : [a, b] \rightarrow R$ may not Riemann Integrable for which of the following condition ?

(1) f is continuous

(2) f is monotone

(3) Measure of point of discontinuity of f is zero

(4) f has uncountable point of discontinuity

35. A sequence s_n is said to be bounded if :

(1) there exists a number λ such that $|s_n| < A$ for all $n \in N$

(2) there exists a real number p such that $|s_n| < p$ for all $n \in N$

(3) there exists a positive real number k such that $|s_n| < k$ for all $n \in N$

(4) there exists a positive real number m such that $|s_n| < m$ for some $n \in N$

36. The set of all limit points of the set $S = \left\{\frac{1}{m} + \frac{1}{n}, m, n \in N\right\}$ is :

(1) ϕ (2) 0

(3) $\left\{\frac{1}{m} \cup \{0\}, m \in N\right\}$ (4) None of these

37. Which of these functions is ***not*** uniformly continuous on (0, 1) ?

(1) $\frac{1}{x^2}$

(2) $\frac{\sin x}{x}$

(3) $\sin x$

(4) $f(x) = 1$ for $x \in (0, 1), f(0) = f(1) = 0$

38. An analytic function with constant modulus is :

(1) Zero

(2) A constant

(3) Identity map

(4) None of the above

39. Radius of convergence R of the power series $\sum_{n=1}^{\infty} \frac{(z-5)^n}{n^n}$ is :

(1) $R = 0$

(2) $R = \infty$

(3) $R = 1$

(4) $R = 5$

40. Consider the function $f(z) = e^{\frac{3}{z}}$. Then $z = 0$ is :

(1) A pole

(2) A removable singularity

(3) An essential singularity

(4) None of the above

41. A branching process is called subcritical if the mean of the off springs (m) is :

(1) zero

(2) more than 1

(3) less than 1

(4) None of these

42. If the mean of the off springs (m) is less than 1, then the probability of extinction is :

(1) zero

(2) 1

(3) between 0 and 1

(4) None of these

43. Which of the following is ***not*** a stochastic matrix ?

(1) $\begin{pmatrix} 0 & 1 \\ -1 & 1 \end{pmatrix}$

(2) $\begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}$

(3) $\begin{pmatrix} 1/2 & 1/2 \\ 1 & 0 \end{pmatrix}$

(4) $\begin{pmatrix} 1/2 & 1/2 \\ 1/2 & 1/2 \end{pmatrix}$

44. The Eigen values of a matrix $A = \begin{pmatrix} 3 & 2 \\ 2 & 3 \end{pmatrix}$ are 5 and 1. The Eigen values of A^2 are :

(1) 25 and 1

(2) 10 and 2

(3) 1 and 1/5

(4) None of these

45. If Chi-square distribution has 12 degree of free, then the variance of the distribution is :

(1) 24

(2) 12

(3) 6

(4) None of these

46. Local control in experimental designs is meant to :

(1) reduce experiential error

(2) increase the efficiency of the design

(3) to form homogeneous blocks

(4) all the above None of the above

47. If net reproduction rate is greater than 1, then it will result :

(1) no increase in population

(2) decrease in population

(3) exponential increase in population

(4) increase in population

48. Given the following LPP :

Max : $Z = x_1 + 2x_2 + 3x_3$

Sub to

$$x_1 + 5x_2 + 4x_3 \leq 10$$
$$x_1 + 6x_2 + 8x_3 \leq 15$$
$$x_1, x_2, x_3 \geq 0$$

then which of the following may be a basic feasible to the above problem :

(1) $x_1 = 1,\ x_2 = 1,\ x_3 = 2$

(2) $x_1 = 1,\ x_2 = 5,\ x_3 = 0$

(3) $x_1 = 4,\ x_2 = 2,\ x_3 = -1$

(4) None of these

49. Let $X_i \sim N(\mu, \sigma^2)$, $i = 1, 2, 3, 4$, then an unbiased estimator of μ is :

(1) $\frac{X1 + X2 + X3 - X4}{3}$

(2) $\frac{2(X1 + X2) + X3 + X4}{6}$

(3) $\frac{3X + X2 + X3 - X4}{3}$

(4) None of these

50. Who is known as the Father of LPP ?

(1) R. A. Fisher

(2) C. R. Rao

(3) Hotelling T

(4) G. B. Dantzig

51. In systematic sampling, if the population size is 200 and the selected sample size is 40, then the sampling interval is :

(1) 3 (2) 4 (3) 3 (4) None of these

52. A sample of 16 items from an infinite population having standard deviation 4. The standard error of sampling distribution of mean is :

(1) 1 (2) 5 (3) 10 (4) 40

53. The Mahalanobis distance of an observation $x = (x_1, x_2, x_3, \ldots\ldots, x_N)^T$ from a set of observations with mean $\mu = (\mu_1, \mu_2, \mu_3, \mu_N)^T$ and covariance matrix S is defined as :

(1) $\sqrt{(x-\mu)^T S^{-1}(x-\mu)}$
(2) $(x-\mu)^T \sigma^{-1}(x-\mu)$
(3) $(x-\mu)^T S^{-1}(x-\mu)^2$
(4) None of these

54. For large n, Hotelling's T^2statistic $(\bar{x}-\mu_0)^T S^{-1}(\bar{x}-\mu_0)$ is distributed as :

(1) t_{n-2}
(2) $F_{n-p,p}$
(3) X_p^2
(4) None of these

55. If we have two sets of variables, $x_1, x_2, \ldots\ldots, x_n$ and $y_1, y_2. \ldots\ldots, y_m$ and there are correlations among the variables, then canonical correlation analysis will enable us to find linear combinations of the x's and the y's which have .... correlation with each other.

(1) minimum
(2) maximum
(3) zero
(4) None of these

56. Scree plot is associated with :

(1) Discriminant Analysis
(2) Canonical Correlation
(3) Principle Component Analysis
(4) None of these

57. Given that $E[X + 4] = 10$ and $E[X + 4]^2 = 116$, then Var(X) is equal to :

(1) 4
(2) 8
(3) 12
(4) 16

58. Three varieties A, B, C of wheat are tested in a RBD with 4 replications. Then the degrees of freedom for error will be :

(1) 4
(2) 5
(3) 6
(4) 12

59. Relative efficiency of LSD over RBD when m rows are taken as blocks is given by :

(1) $\dfrac{\text{MSC} + (m-1)\text{MSR}}{m\text{MSE}}$

(2) $\dfrac{\text{MSR} + (m-1)\text{MSE}}{m\text{MSE}}$

(3) $\dfrac{\text{MSC} + (m-1)\text{MSE}}{m\text{MSE}}$

(4) None of these

60. The method of confounding is a device to reduce the size of :

(1) Experiment

(2) Blocks

(3) Replication

(4) Treatments

61. Given the following LPP

Max : $Z = 4x_1 + 8x_2$

Sub to

$$2x_1 + 2x_2 \geq 15$$

$$x_1 + x_2 = 15$$

$$x_1, x_2 \geq 0$$

then number of artificial variables to be introduced is :

(1) 1 (2) 2 (3) 3 (4) 4

62. The value of the following game :

		Strategies of Player B		
		I	II	III
Strategies of Player A	I	–1	2	–2
	II	6	4	–6
	III	6	4	–2

(1) –2 (2) 0 (3) 1 (4) 2

63. A saddle point of the game exists if :

(1) MinMax = Maxmin (2) MinMax > Maxmin

(3) MinMax < Maxmin (4) None of these

64. Assignment Problem is solved using :

(1) Rule of Dominace (2) North West Corner Rule

(3) Hungarian Method (4) None of these

65. If an LPP has 3 variables and 4 constraints, then its corresponding dual problem will have :

(1) 2 constrains (2) 3 constraints

(3) 4 constraints (4) None of these

66. The dimension of the subspace $W = \{(x, y, z) | x + y + z = 0\}$ of R^3 is :

(1) 1 (2) 3

(3) 2 (4) 0

67. Let B and C denote the subsets of a vector space V, then which of the following statements is ***correct*** ?

(1) If $B \subseteq C$ and C spans V, then B spans V.

(2) If $B \subseteq C$ and C is independent, then B is independent.

(3) If $B \subseteq C$, then span(C) =span(B).

(4) If $B \subseteq C$ and C is dependent, then B is dependent.

68. If the sum of two eigen values and trace of 3×3 matrix are equal, then the value of $|A|$ is :

(1) 1 (2) –1

(3) i (4) 0

69. The matnx $A = \begin{bmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{bmatrix}$, $\theta \in R$ has real eigen values if and only if :

(1) $\theta = n\pi$ for some integer n

(2) $\theta = 2n\pi + \frac{\pi}{2}$ for some integer n

(3) There is no restriction on θ

(4) $\theta = 2n\pi + \frac{\pi}{4}$ for some integer n

70. A linear transformation $y = Ax$ is said to be orthogonal if the matrix A is :

(1) Orthonormal

(2) Orthogonal

(3) Symmetric

(4) Singular

71. $F(z)$ is a function of the complex variable $z = x + iy$ given by $F(z) = iz + kRe(z) + iIm(z)$. For what value of k will $F(z)$ satisfy Cauchy-Riemann Equations ?

(1) 0

(2) 1

(3) –1

(4) y

72. Suppose f and g are entire functions and $g(z) \neq 0$ for all $z \in C$. If $|f(z)| \leq |g(z)|$, then we conclude that :

(1) $f(z) \neq 0$ for all $z \in C$

(2) f is a constant function

(3) $f(0) = 0$

(4) For some $c \in C, f(z) = c.g(z)$

73. Let C be the circle of radius 2 with centre at origin in a complex plane, oriented in the anti-clockwise direction. Then the integral $\oint_C \frac{dz}{(z-1)^2}$ equal to :

(1) 0

(2) 1

(3) $\frac{1}{2\pi i}$

(4) $2\pi i$

74. In which of the following method, we approximate the curve of solution by the tangent in each interval ?

(1) Euler's method (2) Picard's method

(3) Newton's method (4) Runge-Kutta's method

75. The Newton-Raphson method formula for finding the square root of a real number R from the equation $x^2 - R = 0$ is :

(1) $x_{i+1} = \frac{x_i}{2}$ (2) $x_{i+1} = \frac{3x_i}{2}$

(3) $x_{i+1} = \frac{1}{2}\left(x_i + \frac{R}{x_i}\right)$ (4) $x_{i+1} = \frac{1}{2}\left(3x_i - \frac{R}{x_i}\right)$

76. In Regula-Falsi method, the first approximation is given by :

(1) $\frac{af(a) - bf(b)}{f(b) - f(a)}$ (2) $\frac{af(b) - bf(a)}{f(b) - f(a)}$

(3) $\frac{af(a) - bf(b)}{f(a) - f(b)}$ (4) $\frac{af(b) - bf(a)}{f(a) - f(b)}$

77. The real root of the equation $5x - 2\cos x - 1$ (upto 2 decimal accuracy) is :

(1) 0.44 (2) 0.56

(3) 0.52 (4) 0.54

78. Consider an ordinary differential equation $\frac{dx}{dt} = 4t + 4$. If $x = x_0$ at $t = 0$, the increment in x calculated using Runge-Kutta fourth order multi-step method with a step size of $\Delta t = 0.2$ is :

(1) 0.22 (2) 0.44

(3) 0.66 (4) 0.88

79. The integral $\int_1^3 \frac{1}{x} dx$ when calculated by using Simpson's $\frac{1}{3}$ rule on two equal sub-intervals each of length 1, equals :

(1) 1.000
(2) 1.098
(3) 1.111
(4) 1.120

80. The theorem that states" Every bounded sequence has a limit point" is :

(1) Cauchy's theorem
(2) Bolzano- Weierstrass Theorem
(3) Lagrange's Theorem
(4) None of the above

81. If a Binomial variate (X) is distributed with mean 4 and variance 3, then X is distributed as :

(1) $N(4, 16)$
(2) $B(4, 1/4)$
(3) $B(1/4, 16)$
(4) $B(16, 1/4)$

82. If a random variable X has the following p.d.f.

$$f(x; \mu, \sigma^2) = \frac{1}{3\sqrt{2\pi}} e^{\frac{(x-6)^2}{18}}, \mu, \sigma^2 > 0, \text{ then we have :}$$

(1) $X \sim N(3, 9)$
(2) $X \sim N(6, 3)$
(3) $X \sim N(6, 9)$
(4) $X \sim N(3, 6)$

83. If moment generating function of a distribution is $e^{6t+\frac{1}{4}t^2}$, then standard deviation of the distribution is :

(1) 1/2
(2) 2
(3) 4
(4) 6

84. A random variable X has a mean 8 and variance 9 and an unknown probability distribution, then $P(-4 < x < 20)$ is :

(1) less than 1/4
(2) more than 15/16
(3) less than 15/16
(4) None of these

85. A medical doctor wants to reduce blood sugar level of all his patients by altering their diet. He finds that the mean sugar level of all patients is 180 with a standard deviation of 18. Nine of his patients start dieting and the mean of the sample is observed to be 175. What is the standard error of the mean ?

(1) 2 (2) 4 (3) 6 (4) None of these

86. The fact that the sampling distribution of sample means can be approximated by a normal probability distribution whenever the sample size is large is based on the :

(1) central limit theorem

(2) fact that we have tables of areas for the normal distribution

(3) assumption that the population has a normal distribution

(4) None of these alternatives is correct

87. As the sample size increases, the variability among the sample means :

(1) increases

(2) decreases

(3) remains the same

(4) depends upon the specific population being sampled

88. Let $Y1 < Y2 < Y3 < Y4$ denote the order statistics of a random sample of size 4 from a distribution having p.d.f. $f(x) = \begin{cases} 2x & , \quad 0 < x < 1 \\ 0 & , \quad \text{elsewhere} \end{cases}$, then $P\left(\frac{1}{2} < Y_3\right)$ is equal :

(1) $\frac{145}{256}$ (2) $\frac{243}{456}$

(3) $\frac{213}{356}$ (4) $\frac{243}{256}$

89. A property of a point estimator that occurs whenever larger sample sizes tend to provide point estimates closer to the population parameter, is known as :

(1) efficiency
(2) unbiased sampling
(3) consistency
(4) relative estimation

90. The hospital period, in days, for patients following treatment for a certain type of kidney disorder is a random variable $Y = X + 4$ where X has the density function

$$f(x) = \begin{cases} \frac{(32)}{(x+4)^3} & ; \quad x > 0 \\ 0 & ; \quad \text{elsewhere} \end{cases}$$

, then the p.d.f. of random variable Y is :

(1) $g(y) = \begin{cases} \frac{(32)}{(y)^3} & ; \quad y > 4 \\ 0 & ; \quad \text{elsewhere} \end{cases}$

(2) $g(y) = \begin{cases} \frac{(32)}{(y+4)^3} & ; \quad y > 4 \\ 0 & ; \quad \text{elsewhere} \end{cases}$

(3) $g(y) = \begin{cases} \frac{(16)}{(y)^2} & ; \quad y > 4 \\ 0 & ; \quad \text{elsewhere} \end{cases}$

(4) $g(y) = \begin{cases} \frac{(4)}{(y+4)^3} & ; \quad y > 0 \\ 0 & ; \quad \text{elsewhere} \end{cases}$

Instruction : Consider the following Markov Chain with tpm :

$$P = \begin{pmatrix} 0 & 1 & 0 \\ 1/2 & 0 & 1/2 \\ 0 & 1 & 0 \end{pmatrix}$$

and answer the question no. **91** to **94 :**

91. The Markov Chain is periodic with period :

(1) 1
(2) 2
(3) 3
(4) 4

92. State 1 is :

(1) persistent
(2) transient
(3) transient null
(4) transient non-null

93. The Markov Chain is :

(1) irreducible
(2) reducible
(3) closed
(4) None of these

94. Which of the following is ***true*** ?

(1) $p = p^2$ (2) $p = p^3$

(3) $p = p^0$ (4) $p = p^4$

95. Number of basic feasible solution in a transportation problem with 4 origins and 3 destinations is :

(1) 3 (2) 4 (3) 5 (4) 6

96. The following game problem with the payoff matrix :

		Strategies of Player B		
Strategies of Player A		I	II	III
	I	1	–1	3
	II	3	5	–3
	III	6	2	–2

The above problem can be solved using :

(1) Graphical method (2) Rule of Dominance

(3) MinMax Principle (4) Simplex Method

97. For what values of K, the game with the following payoff matrix is strictly determinable ?

		Strategies of Player B		
Strategies of Player A		I	II	III
	I	K	6	2
	II	–1	K	–7
	III	–2	4	K

(1) $K \geq 0$ (2) $1 \leq K \leq 2$

(3) $-1 \leq K \leq 2$ (4) None of these

98. If a Primal Problem (Maximization) has optimal value equal to 60, then the optimal value of the corresponding dual can be :

(1) 55 (2) 59 (3) 61 (4) None of these

99. A solution to an LPP is said to be degenerate if one of the :

(1) basic variables is zero

(2) non-basic variables is zero

(3) basic variables is positive

(4) non-basic variables positive

100. The following assignment problem pertains to the time taken by the programmers to develop different programmes :

	Programmers		
Programmes	A	B	C
I	120	100	80
II	80	90	110
III	110	140	120

Then the total minimum time required for developing the said programmes is

(1) 280 (2) 290 (3) 300 (4) None of these

Total No. of Printed Pages : 21

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

D

SET-Y

M.Phil./Ph.D./URS-EE-2020

SUBJECT : Statistics

10008

Sr. No. ....

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

Roll No. (in figures)________________ (in words) ________________________________

Name ________________________ Father's Name ________________________

Mother's Name ________________________ Date of Examination ________________________

________________________ (Signature of the Candidate) ________________________ (Signature of the Invigilator)

SEAL

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

1. ***Candidates are required to attempt any 75 questions out of the given 100 multiple choice questions of 4/3 marks each. No credit will be given for more than 75 correct responses.***
2. The candidates ***must return*** the question booklet 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 & 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 booklet itself. Answers ***must not*** be ticked in the question booklet.
6. ***There will be no negative marking. Each correct answer will be awarded 4/3 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 booklet. Complaints, if any, regarding misprinting etc. will not be entertained* **30** *minutes after starting of the examination.*

1. If a Binomial variate (X) is distributed with mean 4 and variance 3, then X is distributed as :

(1) $N(4, 16)$
(2) $B(4, 1/4)$
(3) $B(1/4, 16)$
(4) $B(16, 1/4)$

2. If a random variable X has the following p.d.f.

$$f(x; \mu, \sigma^2) = \frac{1}{3\sqrt{2\pi}} e^{\frac{(x-6)^2}{18}}, \mu, \sigma^2 > 0, \text{ then we have :}$$

(1) $X \sim N(3, 9)$
(2) $X \sim N(6, 3)$
(3) $X \sim N(6, 9)$
(4) $X \sim N(3, 6)$

3. If moment generating function of a distribution is $e^{6t+\frac{1}{4}t^2}$, then standard deviation of the distribution is :

(1) 1/2
(2) 2
(3) 4
(4) 6

4. A random variable X has a mean 8 and variance 9 and an unknown probability distribution, then $P(-4 < x < 20)$ is :

(1) less than 1/4
(2) more than 15/16
(3) less than 15/16
(4) None of these

5. A medical doctor wants to reduce blood sugar level of all his patients by altering their diet. He finds that the mean sugar level of all patients is 180 with a standard deviation of 18. Nine of his patients start dieting and the mean of the sample is observed to be 175. What is the standard error of the mean ?

(1) 2
(2) 4
(3) 6
(4) None of these

6. The fact that the sampling distribution of sample means can be approximated by a normal probability distribution whenever the sample size is large is based on the :

(1) central limit theorem

(2) fact that we have tables of areas for the normal distribution

(3) assumption that the population has a normal distribution

(4) None of these alternatives is correct

7. As the sample size increases, the variability among the sample means :

(1) increases

(2) decreases

(3) remains the same

(4) depends upon the specific population being sampled

8. Let $Y1 < Y2 < Y3 < Y4$ denote the order statistics of a random sample of size 4 from a distribution having p.d.f. $f(x) = \begin{cases} 2x & , \quad 0 < x < 1 \\ 0 & , \quad \text{elsewhere} \end{cases}$, then $P\left(\frac{1}{2} < Y_3\right)$ is equal :

(1) $\frac{145}{256}$

(2) $\frac{243}{456}$

(3) $\frac{213}{356}$

(4) $\frac{243}{256}$

9. A property of a point estimator that occurs whenever larger sample sizes tend to provide point estimates closer to the population parameter, is known as :

(1) efficiency

(2) unbiased sampling

(3) consistency

(4) relative estimation

10. The hospital period, in days, for patients following treatment for a certain type of kidney disorder is a random variable $Y = X + 4$ where X has the density function $f(x) = \begin{cases} \dfrac{(32)}{(x+4)^3} & ; \quad x > 0 \\ 0 & ; \quad \text{elsewhere} \end{cases}$, then the p.d.f. of random variable Y is :

(1) $g(y) = \begin{cases} \dfrac{(32)}{(y)^3} & ; \quad y > 4 \\ 0 & ; \quad \text{elsewhere} \end{cases}$

(2) $g(y) = \begin{cases} \dfrac{(32)}{(y+4)^3} & ; \quad y > 4 \\ 0 & ; \quad \text{elsewhere} \end{cases}$

(3) $g(y) = \begin{cases} \dfrac{(16)}{(y)^2} & ; \quad y > 4 \\ 0 & ; \quad \text{elsewhere} \end{cases}$

(4) $g(y) = \begin{cases} \dfrac{(4)}{(y+4)^3} & ; \quad y > 0 \\ 0 & ; \quad \text{elsewhere} \end{cases}$

11. $F(z)$ is a function of the complex variable $z = x + iy$ given by $F(z) = iz + kRe(z) + iIm(z)$. For what value of k will $F(z)$ satisfy Cauchy-Riemann Equations ?

(1) 0

(2) 1

(3) -1

(4) y

12. Suppose f and g are entire functions and $g(z) \neq 0$ for all $z \in C$. If $|f(z)| \leq |g(z)|$, then we conclude that :

(1) $f(z) \neq 0$ for all $z \in C$

(2) f is a constant function

(3) $f(0) = 0$

(4) For some $c \in C, f(z) = c.g(z)$

13. Let C be the circle of radius 2 with centre at origin in a complex plane, oriented in the anti-clockwise direction. Then the integral $\oint_C \dfrac{dz}{(z-1)^2}$ equal to :

(1) 0

(2) 1

(3) $\dfrac{1}{2\pi i}$

(4) $2\pi i$

14. In which of the following method, we approximate the curve of solution by the tangent in each interval ?

(1) Euler's method
(2) Picard's method
(3) Newton's method
(4) Runge-Kutta's method

15. The Newton-Raphson method formula for finding the square root of a real number R from the equation $x^2 - R = 0$ is :

(1) $x_{i+1} = \frac{x_i}{2}$
(2) $x_{i+1} = \frac{3x_i}{2}$
(3) $x_{i+1} = \frac{1}{2}\left(x_i + \frac{R}{x_i}\right)$
(4) $x_{i+1} = \frac{1}{2}\left(3x_i - \frac{R}{x_i}\right)$

16. In Regula-Falsi method, the first approximation is given by :

(1) $\frac{af(a) - bf(b)}{f(b) - f(a)}$
(2) $\frac{af(b) - bf(a)}{f(b) - f(a)}$
(3) $\frac{af(a) - bf(b)}{f(a) - f(b)}$
(4) $\frac{af(b) - bf(a)}{f(a) - f(b)}$

17. The real root of the equation $5x - 2 \cos x - 1$ (upto 2 decimal accuracy) is :

(1) 0.44
(2) 0.56
(3) 0.52
(4) 0.54

18. Consider an ordinary differential equation $\frac{dx}{dt} = 4t + 4$. If $x = x_0$ at $t = 0$, the increment in x calculated using Runge-Kutta fourth order multi-step method with a step size of $\Delta t = 0.2$ is :

(1) 0.22
(2) 0.44
(3) 0.66
(4) 0.88

19. The integral $\int_1^3 \frac{1}{x} dx$ when calculated by using Simpson's $\frac{1}{3}$ rule on two equal sub-intervals each of length 1, equals :

(1) 1.000 (2) 1.098

(3) 1.111 (4) 1.120

20. The theorem that states" Every bounded sequence has a limit point" is :

(1) Cauchy's theorem

(2) Bolzano- Weierstrass Theorem

(3) Lagrange's Theorem

(4) None of the above

21. Given the following LPP

Max : $Z = 4x_1 + 8x_2$

Sub to

$$2x_1 + 2x_2 \geq 15$$

$$x_1 + x_2 = 15$$

$$x_1, x_2 \geq 0$$

then number of artificial variables to be introduced is :

(1) 1 (2) 2 (3) 3 (4) 4

22. The value of the following game :

		Strategies of Player B		
		I	II	III
Strategies of Player A	I	–1	2	–2
	II	6	4	–6
	III	6	4	–2

(1) –2 (2) 0 (3) 1 (4) 2

23. A saddle point of the game exists if :

(1) MinMax = Maxmin (2) MinMax > Maxmin

(3) MinMax < Maxmin (4) None of these

24. Assignment Problem is solved using :

(1) Rule of Dominace (2) North West Corner Rule

(3) Hungarian Method (4) None of these

25. If an LPP has 3 variables and 4 constraints, then its corresponding dual problem will have :

(1) 2 constrains (2) 3 constraints

(3) 4 constraints (4) None of these

26. The dimension of the subspace $W = \{(x, y, z) | x + y + z = 0\}$ of R^3 is :

(1) 1 (2) 3

(3) 2 (4) 0

27. Let B and C denote the subsets of a vector space V, then which of the following statements is ***correct*** ?

(1) If $B \subseteq C$ and C spans V, then B spans V.

(2) If $B \subseteq C$ and C is independent, then B is independent.

(3) If $B \subseteq C$, then span(C) =span(B).

(4) If $B \subseteq C$ and C is dependent, then B is dependent.

28. If the sum of two eigen values and trace of 3×3 matrix are equal, then the value of $|A|$ is :

(1) 1 (2) −1

(3) i (4) 0

29. The matnx $A = \begin{bmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{bmatrix}$, $\theta \in R$ has real eigen values if and only if :

(1) $\theta = n\pi$ for some integer n

(2) $\theta = 2n\pi + \dfrac{\pi}{2}$ for some integer n

(3) There is no restriction on θ

(4) $\theta = 2n\pi + \dfrac{\pi}{4}$ for some integer n

30. A linear transformation $y = Ax$ is said to be orthogonal if the matrix A is :

(1) Orthonormal

(2) Orthogonal

(3) Symmetric

(4) Singular

Instruction : Consider the following Markov Chain with tpm :

$$P = \begin{pmatrix} 0 & 1 & 0 \\ 1/2 & 0 & 1/2 \\ 0 & 1 & 0 \end{pmatrix}$$ and answer the question no. **31** to **34 :**

31. The Markov Chain is periodic with period :

(1) 1 (2) 2 (3) 3 (4) 4

32. State 1 is :

(1) persistent

(2) transient

(3) transient null

(4) transient non-null

33. The Markov Chain is :

(1) irreducible

(2) reducible

(3) closed

(4) None of these

34. Which of the following is ***true*** ?

(1) $p = p^2$

(2) $p = p^3$

(3) $p = p^0$

(4) $p = p^4$

35. Number of basic feasible solution in a transportation problem with 4 origins and 3 destinations is :

(1) 3 (2) 4 (3) 5 (4) 6

36. The following game problem with the payoff matrix :

	Strategies of Player B			
		I	II	III
Strategies of Player A	I	1	–1	3
	II	3	5	–3
	III	6	2	–2

The above problem can be solved using :

(1) Graphical method
(2) Rule of Dominance
(3) MinMax Principle
(4) Simplex Method

37. For what values of K, the game with the following payoff matrix is strictly determinable ?

	Strategies of Player B			
		I	II	III
Strategies of Player A	I	K	6	2
	II	–1	K	–7
	III	–2	4	K

(1) $K \geq 0$
(2) $1 \leq K \leq 2$
(3) $-1 \leq K \leq 2$
(4) None of these

38. If a Primal Problem (Maximization) has optimal value equal to 60, then the optimal value of the corresponding dual can be :

(1) 55
(2) 59
(3) 61
(4) None of these

39. A solution to an LPP is said to be degenerate if one of the :

(1) basic variables is zero
(2) non-basic variables is zero
(3) basic variables is positive
(4) non-basic variables positive

40. The following assignment problem pertains to the time taken by the programmers to develop different programmes :

Programmers			
Programmes	A	B	C
I	120	100	80
II	80	90	110
III	110	140	120

Then the total minimum time required for developing the said programmes is

(1) 280 (2) 290 (3) 300 (4) None of these

41. In systematic sampling, if the population size is 200 and the selected sample size is 40, then the sampling interval is :

(1) 3 (2) 4 (3) 3 (4) None of these

42. A sample of 16 items from an infinite population having standard deviation 4. The standard error of sampling distribution of mean is :

(1) 1 (2) 5 (3) 10 (4) 40

43. The Mahalanobis distance of an observation $x = (x_1, x_2, x_3, \ldots.., x_N)^T$ from a set of observations with mean $\mu = (\mu_1, \mu_2, \mu_3, \mu_N)^T$ and covariance matrix S is defined as :

(1) $\sqrt{(x-\mu)^T S^{-1}(x-\mu)}$ (2) $(x-\mu)^T \sigma^{-1}(x-\mu)$

(3) $(x-\mu)^T S^{-1}(x-\mu)^2$ (4) None of these

44. For large n, Hotelling's T^2 statistic $(\bar{x}-\mu_0)^T S^{-1}(\bar{x}-\mu_0)$ is distributed as :

(1) t_{n-2} (2) $F_{n-p,p}$ (3) X_p^2 (4) None of these

45. If we have two sets of variables, x_1, x_2, ..., x_n and y_1, y_2. ......, y_m and there are correlations among the variables, then canonical correlation analysis will enable us to find linear combinations of the x's and the y's which have .... correlation with each other.

(1) minimum (2) maximum

(3) zero (4) None of these

46. Scree plot is associated with :

(1) Discriminant Analysis (2) Canonical Correlation

(3) Principle Component Analysis (4) None of these

47. Given that $E[X + 4] = 10$ and $E[X + 4]^2 = 116$, then $\text{Var}(X)$ is equal to :

(1) 4 (2) 8

(3) 12 (4) 16

48. Three varieties A, B, C of wheat are tested in a RBD with 4 replications. Then the degrees of freedom for error will be :

(1) [redacted] (2) 5

(3) 6 (4) 12

49. Relative efficiency of LSD over RBD when m rows are taken as blocks is given by :

(1) $\dfrac{\text{MSC} + (m-1)\text{MSR}}{m\text{MSE}}$ (2) $\dfrac{\text{MSR} + (m-1)\text{MSE}}{m\text{MSE}}$

(3) $\dfrac{\text{MSC} + (m-1)\text{MSE}}{m\text{MSE}}$ (4) None of these

50. The method of confounding is a device to reduce the size of :

(1) Experiment (2) Blocks

(3) Replication (4) Treatments

51. If $f(x,y)=\begin{cases}\frac{x(1+3y^2)}{4} & ; \quad 0<x<2, 0<y<1 \\ 0 & ; \quad \text{elsewhere}\end{cases}$, then :

(1) $E(XY) > E(X) . E(Y)$ (2) $E(XY) < E(X) . E(Y)$

(3) $E(XY) = E(X) . E(Y)$ (4) $E(XY) = E(X) + E(Y)$

52. Which of the following statements is ***true*** ?

(1) Unbaised estimator is always efficient

(2) Consistent estimator is always unbiased

(3) Unbaised estimator is always consistent

(4) MLE is always a function of sufficient statistics

53. Suppose 10 rats are used in a biomedical study where they are injected with cancer cells and then given a cancer drug that is designed to increase their survival rate. The survival times following exponential distribution are 14, 17, 27, 18, 12, 8, 22, 13, 19 and 12, then M.L.E. of the mean survival time is :

(1) 14.5 (2) 16.2 (3) 18 (4) 20

54. A random sample is taken from $B(5, p)$ population to test $H_0 : p = 1/2$ against $H_1 : p = 0,7$, it is decided that we reject H_0 when $X \geq 3$, then the power of test is approximately equal to :

(1) 0.5 (2) 0.75 (3) 0.84 (4) None of these

55. If a hypothesis H_0 is rejected at .01 level of significance, then it :

(1) will be accepted at 0.05 level of significance

(2) may not be rejected at .10 level of significance

(3) will be rejected at .10 level of significance

(4) None of these

56. Given $\sigma = 6$, $\mu = 25$, sample mean = 23 and the degree of precession required is 99%, ($Z = 2.58$) the sample size required is approximately equal to :

(1) 50 (2) 60 (3) 70 (4) 80

57. Let X be the number of offspring of a bacteria with p.m.f.

$P(X = x) = \frac{1}{4}\left(\frac{3}{4}\right)^k$, $k = 0, 1, 2, \ldots\ldots$ the $E(X)$ is equal to :

(1) 3 (2) 2 (3) 1 (4) 4

58. The variance of the stratified sampling mean ($\bar{Y}_{st}$) is :

(1) $\sum_{h=1}^{L}\left(\frac{1}{N_h}-\frac{1}{n_h}\right)W_h^2\ S_h^2$

(2) $\sum_{h=1}^{L}\left(\frac{1}{n_h}-\frac{1}{N_h}\right)W_h^2\ S_h$

(3) $\sum_{h=1}^{L}\left(\frac{1}{n_h}-\frac{1}{N_h}\right)W_h\ S_h^2$

(4) $\sum_{h=1}^{L}\left(\frac{1}{n_h}-\frac{1}{N_h}\right)W_h^2\ S_h^2$

59. In a SRSWOR, if $\bar{y} = 50$, $n = 100$, $N = 500$, then the estimated population total is :

(1) 250 (2) 500 (3) 2500 (4) 25000

60. In SRS, the bais of the ratio estimator $\hat{R}$ is given :

(1) $B(\hat{R}) = \frac{\text{cov}(\hat{R}, \bar{x})}{\bar{X}}$

(2) $B(\hat{R}) = \frac{\text{cov}(\hat{R}, \bar{x})}{\bar{Y}}$

(3) $\frac{\text{cov}(\hat{R}, \bar{y})}{\bar{Y}}$

(4) None of these

61. The geometric mean of Laspeyer's and Paache's indices is :

(1) Bowley's Ideal Index (2) Fisher's Index

(3) Chain Index (4) Marshal and Edgeworth's Index

62. Seasonal variations repeat with :

(1) one year (2) two years

(3) five years (4) None of the Treatments

63. A good index number is one that satisfies :

(1) Circular Test (2) Time Reversal Test

(3) Factor Reversal Test (4) All the above Tests

64. Vital rates are customarily expressed as :

(1) per ten thousand (2) per thousand

(3) percentages (4) None of these

65. The trend is determined by :

(1) Link Relative Method

(2) Ratio to Trend Method

(3) Ratio-to-Moving Method

(4) None of these

66. Fertility rate provides an adequate basis for :

(1) population growth

(2) family planning

(3) checking the infant mortality

(4) None of these

67. Time Reversal Test is satisfied when :

(1) $P_{01} \times P_{10} = 0$ (2) $P_{01} \times P_{10} = 1$

(3) $P_{01} \times P_{10} < 1$ (4) None of the above

68. In the following replicate of a 2^3 factorial experiment in blocks of 4 plots involving three fertilizer N, P and K :

Block 1	Np	npk	(1)	K
Block 2	P	n	Pk	Nk

then the confounded factor is :

(1) NPK (2) NK

(3) NP (4) None of the above

69. For a certain experiment laid out in an LSD with four treatments with SST = 10.035, SSB = 22.25, SSC = 45.25, TSS = 86.33 and $F_{0.05}(3,6) = 4.76$, then $H_0 : t_1 = t_2 = t_3 = t_4$:

(1) is rejected (2) is accepted

(3) may be rejected (4) None of these

70. In a railway marshalling yard, goods trains arrive at a rate of 30 trains per day. Assuming that the inter-arrival time follows an exponential distribution and the service time distribution is also exponential with an average of 36 minutes, then the expected queue size of the trains is :

(1) 1 (2) 2 (3) 3 (4) 4

71. A branching process is called subcritical if the mean of the off springs (m) is :

(1) zero (2) more than 1

(3) less than 1 (4) None of these

72. If the mean of the off springs (m) is less than 1, then the probability of extinction is :

(1) zero (2) 1

(3) between 0 and 1 (4) None of these

73. Which of the following is ***not*** a stochastic matrix ?

(1) $\begin{pmatrix} 0 & 1 \\ -1 & 1 \end{pmatrix}$

(2) $\begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}$

(3) $\begin{pmatrix} 1/2 & 1/2 \\ 1 & 0 \end{pmatrix}$

(4) $\begin{pmatrix} 1/2 & 1/2 \\ 1/2 & 1/2 \end{pmatrix}$

74. The Eigen values of a matrix $A = \begin{pmatrix} 3 & 2 \\ 2 & 3 \end{pmatrix}$ are 5 and 1. The Eigen values of A^2 are :

(1) 25 and 1

(2) 10 and 2

(3) 1 and 1/5

(4) None of these

75. If Chi-square distribution has 12 degree of free, then the variance of the distribution is :

(1) 24

(2) 12

(3) 6

(4) None of these

76. Local control in experimental designs is meant to :

(1) reduce experiential error

(2) increase the efficiency of the design

(3) to form homogeneous blocks

(4) all the above None of the above

77. If net reproduction rate is greater than 1, then it will result :

(1) no increase in population

(2) decrease in population

(3) exponential increase in population

(4) increase in population

78. Given the following LPP :

Max : $Z = x_1 + 2x_2 + 3x_3$

Sub to

$$x_1 + 5x_2 + 4x_3 \le 10$$

$$x_1 + 6x_2 + 8x_3 \le 15$$

$$x_1, x_2, x_3 \ge 0$$

then which of the following may be a basic feasible to the above problem :

(1) $x_1 = 1,\ x_2 = 1,\ x_3 = 2$

(2) $x_1 = 1,\ x_2 = 5,\ x_3 = 0$

(3) $x_1 = 4,\ x_2 = 2,\ x_3 = -1$

(4) None of these

79. Let $X_i \sim N(\mu, \sigma^2)$, $i = 1, 2, 3, 4$, then an unbiased estimator of μ is :

(1) $\frac{X1 + X2 + X3 - X4}{3}$

(2) $\frac{2(X1 + X2) + X3 + X4}{6}$

(3) $\frac{3X + X2 + X3 - X4}{3}$

(4) None of these

80. Who is known as the Father of LPP ?

(1) R. A. Fisher

(2) C. R. Rao

(3) Hotelling T

(4) G. B. Dantzig

81. If for any distribution, mean > median > mode, then the distribution is called :

(1) negatively skewed

(2) positively skewed

(3) symmetric

(4) None of these

82. If two variables are independent, then the correlation between them is :

(1) -1

(2) 1

(3) between -1 and 1

(4) zero

83. Regression equations of two variables X and Y are as follows :

$$3X + 2Y - 26 = 0 \text{ and } 6X + Y - 31 = 0,$$

then the coefficient of correlation between X and Y is :

(1) 0.5 (2) 0.76 (3) 0.8 (4) -0.5

84. If the random variables X, Y and Z have the means $\mu_x = 3$, $\mu_y = 5$ and $\mu_z = 2$, variances $\sigma_x^2 = 8$, $\sigma_y^2 = 12$ and $\sigma_z^2 = 18$ and Cov(X, Y) = 1, Cov (X, Z) = -3 and Cov (Y, Z) = 2, then the Cov of $U = X + 4Y + 2Z$ and $V = 3X - Y - Z$ is :

(1) 54 (2) -76 (3) 95 (4) None of these

85. For a distribution, the four central moments were obtained as :

$\mu_1 = 0$, $\mu_2 = 0.933$, $\mu_3 = 0$ and $\mu_4 = 2.533$,

then the distribution is :

(1) Platykurtic (2) Mesokurtic

(3) Leptokurtic (4) None of these

86. A random sample of 27 pairs of observations from a normal population gave $r = 0.6$. If $t_{0.05}$ for 25 d. f. = 2.06, then r is :

(1) Significant (2) In-significant

(3) Least significant (4) None of these

87. Regression equation of X on Y for the following data :

X	1	2	3	4	5
Y	3	4	5	6	7

is given by :

(1) $Y = 2.5 - X$ (2) $X = 1.5 + 5Y$

(3) $Y = 2 + X$ (4) $X = 2 + Y$

88. A student obtained the following two regression equations for a set of data based on two variables

$6X - 15Y = 21, 21X + 14Y = 56$, then :

(1) Equations are not correctly obtained

(2) Equations are correctly obtained

(3) Equations have no solutions

(4) None of these

89. The probability mass function of a random variable X is as follows :

X	0	1	2	3	4	5
$f(x)$	k^2	$k/4$	$5k/2$	$k/4$	$2k^2$	k^2

then the value of k is :

(1) 1/2 (2) 1/3 (3) 1/4 (4) 4

90. Let $X \sim N(8, 25)$, then standard normal variate (SNV) will be :

(1) $Z = \frac{X-8}{25}$ (2) $Z = \frac{X-2}{5}$

(3) $Z = \frac{X-8}{10}$ (4) $Z = \frac{X-8}{5}$

91. The index and signature of the quadratic form $10x_1^2 + 2x_2^2 + 5x_3^2 + 6x_2x_3 - 10x_3x_1 - 4x_1x_2$ are :

(1) 3 and 3 respectively

(2) 2 and 2 respectively

(3) 1 and 2 respectively

(4) 2 and 1 respectively

92. The sequence $x_n = \ln(2n^3 + 2) - \ln(5n^3 + 2n^2 + 4)$ converges to :

(1) 0 (2) $-\ln\frac{2}{5}$ (3) $\ln\frac{2}{5}$ (4) $\frac{2}{5}$

93. Every bounded subset of R^2 is :

(1) Compact (2) Connected

(3) Totally Bounded (4) Complete

94. A bounded function $f : [a, b] \to R$ may not Riemann Integrable for which of the following condition ?

(1) f is continuous

(2) f is monotone

(3) Measure of point of discontinuity of f is zero

(4) f has uncountable point of discontinuity

95. A sequence s_n is said to be bounded if :

(1) there exists a number λ such that $|s_n| < A$ for all $n \in N$

(2) there exists a real number p such that $|s_n| < p$ for all $n \in N$

(3) there exists a positive real number k such that $|s_n| < k$ for all $n \in N$

(4) there exists a positive real number m such that $|s_n| < m$ for some $n \in N$

96. The set of all limit points of the set $S = \left\{\frac{1}{m} + \frac{1}{n}, m, n \in N\right\}$ is :

(1) ϕ (2) 0

(3) $\left\{\frac{1}{m} \cup \{0\}, m \in N\right\}$ (4) None of these

97. Which of these functions is ***not*** uniformly continuous on (0, 1) ?

(1) $\frac{1}{x^2}$

(2) $\frac{\sin x}{x}$

(3) $\sin x$

(4) $f(x) = 1$ for $x \in (0, 1), f(0) = f(1) = 0$

98. An analytic function with constant modulus is :

(1) Zero

(2) A constant

(3) Identity map

(4) None of the above

99. Radius of convergence R of the power series $\sum_{n=1}^{\infty} \frac{(z-5)^n}{n^n}$ is :

(1) $R = 0$

(2) $R = \infty$

(3) $R = 1$

(4) $R = 5$

100. Consider the function $f(z) = e^{\frac{3}{z}}$. Then $z = 0$ is :

(1) A pole

(2) A removable singularity

(3) An essential singularity

(4) None of the above

M.Phil | Ph.D | URS Statistics (1)

Answer Keys

Sr. No.	Code- A	Code- B	Code- C	Code- D
1.	B	B	B	D
2.	D	A	A	B
3.	D	A	D	A
4.	B	C	B	B
5.	A	B	D	C
6.	A	C	B	A
7.	C	B	B	B
8.	A	D	C	D
9.	C	A	B	C
10.	D	B	C	A
11.	D	B	C	B
12.	B	A	D	D
13.	A	A	B	A
14.	B	B	C	A
15.	C	D	C	C
16.	A	D	B	B
17.	B	C	A	D
18.	D	C	D	D
19.	C	A	D	C
20.	A	A	A	B
21.	C	D	B	B
22.	D	A	D	A
23.	B	A	D	A
24.	C	C	B	C
25.	C	B	A	B
26.	B	C	A	C
27.	A	D	C	B
28.	D	C	A	D
29.	D	C	C	A
30.	A	B	D	B
31.	D	D	B	B
32.	A	B	C	A
33.	A	A	C	A
34.	C	B	D	B
35.	B	C	C	D
36.	C	A	C	D
37.	D	B	A	C
38.	C	D	B	C
39.	C	C	B	A
40.	B	A	C	A
41.	B	B	C	D
42.	A	D	B	A
43.	D	A	A	A
44.	B	A	A	C
45.	D	C	B	B
46.	B	B	D	C

Priti Gupta

29/12/2020

M. Phil | Ph.D | URS Statistics

47.	B	D	D	D
48.	C	D	D	C
49.	B	C	B	C
50.	C	B	D	B
51.	B	C	D	C
52.	A	B	A	D
53.	A	A	A	B
54.	B	A	C	C
55.	D	B	B	C
56.	D	D	C	B
57.	C	D	D	A
58.	C	D	C	D
59.	A	B	C	D
60.	A	D	B	A
61.	C	B	B	B
62.	B	C	A	A
63.	A	C	A	D
64.	A	D	C	B
65.	B	C	B	D
66.	D	C	C	B
67.	D	A	B	B
68.	D	B	D	C
69.	B	B	A	B
70.	D	C	B	C
71.	B	B	B	C
72.	A	A	D	B
73.	A	D	A	A
74.	C	B	A	A
75.	B	D	C	B
76.	C	B	B	D
77.	B	B	D	D
78.	D	C	D	D
79.	A	B	C	B
80.	B	C	B	D
81.	B	C	D	B
82.	C	D	B	D
83.	C	B	A	D
84.	D	C	B	B
85.	C	C	C	A
86.	C	B	A	A
87.	A	A	B	C
88.	B	D	D	A
89.	B	D	C	C
90.	C	A	A	D
91.	B	B	B	B
92.	D	D	A	C
93.	A	D	A	C
94.	A	B	B	D
95.	C	A	D	C

Shm 29/12/2020 Priti Mehta

M.Phil | Ph.D | URS Statistics

96.	B	A	D	C
97.	D	C	C	A
98.	D	A	C	B
99.	C	C	A	B
100.	B	D	A	C

[illegible signature] 29/12/2020 Priti Dutta.