	Tota	al No. of Printed Pages : 17
(DO NOT OPEN THIS QU	JESTION BOOKLET BEFOR ARE ASKED TO DO SO) PHD-EE-2023-24 Statistics	RE TIME OR UNTIL YOU SET-Y 10009 Sr. No.
Time : 1¼ Hours	Max. Marks : 100	Total Questions : 100
Roll No. (in figures)	(in words)	
Name	Date of Birth	
Father's Name	Mother's Name	
Date of Examination		
		1
(Signature of the Candidate)		(Signature of the Invigilator)

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

SEAI

1. All questions are compulsory.

- 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 shall be got uploaded on the University Website immediately after the conduct of Entrance Examination. Candidates may raise valid objection/complaint if any, with regard to discrepancy in the question booklet/answer key within 24 hours of uploading the same on the University Website. The complaint be sent by the students to the Controller of Examinations by hand or through email. 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 one full mark. Cutting, erasing, overwriting and more than one answer in OMR Answer-Sheet will be treated as incorrect answer.
- 7. Use only Black or Blue Ball Point Pen of good quality in the OMR Answer-Sheet.
- 8. Before answering the questions, the candidates should ensure that they have been supplied correct and complete booklet. Complaints, if any, regarding misprinting etc. will not be entertained 30 minutes after starting of the examination.

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10/11	. The mea	an of Bino	mial distribution B	(<i>n</i> , <i>p</i>) is :	event A and event B	
	(1) <i>np</i>		(2) $np - 1$	(3) $np - 2$	(4) np - 3	nr
2	Given th	hat $E[X + 4]$	[4] = 10 and E[X + 4]	$(4)^2 = 116$, then Va	r[X] is equal to :	
	(1) 4		(2) 8 zi notind	(3) 12	(4) 16	10. TI
3	f(x) = $f(x) = f(x)$	be a constant $ax, a, a, ax + 3a.$	ontinuous random $0 \le x \le 1$ $1 \le x \le 2$ $2 \le x \le 3$	n variable with	Probability Density	Function
		0,4 1	- x>3			
	Then the	e value of '	a' is given by :			
	(1) 0.4		(2) 0.5	(3) 0.3	(4) 0.1	
4	Let 'X' $f(x) = \begin{cases} \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\$	be a co ax, a, -ax + 3a, 0,	$\begin{array}{l} \text{ontinuous random} \\ 0 \le x \le 1 \\ 1 \le x \le 2 \\ 2 \le x \le 3 \\ x > 3 \end{array}$	variable with	Probability Density	Function
	Then the	value of l	$P(X \le 1.5)$ is given	by:	a nonudru.	
	(1) 0.5		(2) 0.81	(3) 0.19	(1) (4) 0.17	
5.	The mon (1) $e^{\lambda}(e^{\lambda})$	ment gener $e^t - 1$)	ating function of P (2) $e^t(e^{\lambda}-1)$	Poisson Distribution (3) $e^t - 1$	on is: (4) $e^{\lambda}(1-e^{t})$	
6	Which o	f the follow	wing is the median	of the exponentia	l distribution with para	meter λ ?
	(1) λ		(2) $-\lambda^{-1}$	(3) λ^{-1}	(4) λ^{-2}	
7.	The Qua	rtile Devia	tion of the normal	distribution is :		
	(1) Q. D	$0.=\frac{2}{4}\sigma$	(2) Q. D. = $\frac{2}{3}\sigma$	(3) Q. D. $=\frac{2}{5}$	σ (4) Q. D. = $\frac{3}{4}\sigma$	16, 5
8.	If A and $(1) P(\overline{A})$	<i>B</i> are two is $P(\overline{B})$	independent events	s, then $P(\overline{A} \cap \overline{B})$ (2) $1 - P(A \cup A)$) is equal to : (B)	
	(3) [1-	P(A)][1 -	P(B)]	(4) All of the	above	
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:	9. If event A probability	and event <i>B</i> has occ P(A B) is equal to :	urred and it is known	that $P(B) = 1$, the condition	al
	(1) P(A)	(2) P(B)	(3) One	(4) Zero	
10	. The recurre	ence formula for geome	etric distribution is give	n by ·	
	(1) $p(x+i)$	= qp(x+i)	(2) $p(x) = qp(x)$	(+ i)	
	(3) $p(x+i)$	= qp(x)	(4) $p(x) = p(x + x)$	(i)	
11	. The correct	relationship between A	A.M, G.M., and H.M. is	$f(x) = \begin{cases} a_x \\ a_y \\ a$	
	(1) A.M.=	G.M.= H.M.	(2) $G.M. \geq A.M$	(.>HM	
	(3) H.M. ≥	G.M. ≥ A.M.	(4) A.M. \geq G.M	$I > H M^{old} > old mod T$	
12.	Average wa of wages is	ges of workers of facto 110. The coefficients o	ory are Rs. 550 per mor f variation is :	nth and the standard deviation	1
	(1) 30%	(2) 15%	(3) 500%	(4) 20%	
13.	If the mode of distribution i	of a frequency distribu s :	tion is 16 and its mean	is 16, then the median of the	
-	(1) 0	(2) 16	(3) 32	Then the value of P() 8 (4)	
14.	If Quartile d quartile is 5.	eviation of a set of o What is the value of the	bservations is given a e third quartile ?	is 6.4 and the value of first	
	(1) 12	(2) 15.3	(3) 17.8	(4) 20.2	
15.	For a leptoku	rtic frequency curve, th	e measures of kurtosis	Which of the follow	
	(1) 0		A A A A A A A A A A A A A A A A A A A	18 : λ (1)	
10		(2) -3 ai nome	(3) less than 1	(4) greater than 3	
16.	Standard error	of the sample correlat	ion coefficient 'r' is bas	sed on 'n' paired values is :	
	(1) $\frac{1+r^2}{\sqrt{n}}$	$(2) \frac{1+r^2}{n}$	$(3) \frac{1-r^2}{\sqrt{n}}$	$(4) \frac{1+r^2}{\sqrt{n-1}}$	
				(1) $(1 - P(A))[1 - I]$	
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17. Given the following set of equations : " I also a set of equations and the set of th

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$$x_1 + 4x_2 - x_3 = 3$$

$$5x_1 + 2x_2 + 3x_3 = 4$$

The basic feasible solution involving x_1 and x_2 is :

$$(1) \left(\frac{5}{9}, \frac{11}{18}, 0\right) \qquad (2) \left(\frac{5}{9}, 0, 0\right) \qquad (3) \left(0, \frac{11}{18}, 0\right) \qquad (4) \left(\frac{2}{9}, 0, \frac{3}{14}\right)$$

18. The range of a partial correlation coefficient is : (1) 0 to ∞ (2) = ∞ to ∞ (2) 0

(1) $0 \text{ to } \infty$ (2) $-\infty \text{ to } \infty$ (3) 0 to 1

(4) -1 to 1

3

- 19. The term regression was introduced by :
 - (1) Sir Francis Galton
 - (3) Karl Pearson
- 20. If Regression Equations are :

$$6y = 5x + 90$$

$$15x = 8y + 30$$

(2) R.A. Fisher

(4) P.C. Mahalanobis

And the variance of x = 4, then the correlation coefficient between 'x' and 'y' is : (1) 0.45 (2) 0.67 (3) 0.78 (4) 0.88

- 21. The pgf of a certain distribution is given as :
 - $P(s) = 3s^2 2s + 6$

What is the mean of this distribution ?

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

22. The relation between student's -t and F-distribution is :

(1)
$$F_{1,1} = t_n^2$$
 (2) $F_{n,1} = t_1^2$ (3) $F_{1,n} = t_\infty^2$ (4) $F_{1,n} = t_n^2$

23. The minimum variance unbiased estimator of θ^2 based on a sample of size 'n' from $N(\theta 1)$ is :

(1) $\overline{X}^2 - 1/n$ (3) $\sum (X_i - \overline{X}^2)/n$ (2) $\overline{X}^2 + 1/n$ (4) $\sum (X_i - \overline{X}^2)/(n-1)$

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The Bayes estimator of a parameter under squared error loss function is : 24.

- (1) Posterior mean (2) Posterior median
- (4) Posterior variance (3) Posterior mode
- The decision criteria in SPRT depends on the function of : 25.
 - (1) Type I error (2) Type II error
 - (3) Both type I and type II error (4) Neither Type I nor Type II error
- What is an unbiased estimator of θ for the distribution $f(x, \theta) = \theta e^{-\theta} x, x \ge 0$? 26.

(1)
$$\frac{(n-1)\overline{X}}{n}$$
 (2) $\frac{(n-1)}{n\overline{X}}$

Given a random sample : 27.

$$f(x,\theta) = \frac{2}{\alpha^2} (\alpha - x), \ 0 < x < \alpha$$

What is the MLE of α ?

(1) X

(2) 2X (3) $\frac{X^2}{2}$ And the variance of x = 4, then the correlation coefficient between x and y is:

(3) $\frac{\overline{X}}{n-1}$ (4) $\frac{1}{(n-1)\overline{X}}$

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

- For a particular hypothesis test, the probabilities of type I and type II errors are 28. respectively, 0.05 and 0.09. The power of the test is :
 - (1) 0.95 (3) 0.86 (4) 0.91 (2) 0.14
- A random sample of 100 articles are taken from a batch of 2000 articles shows that the 29. average diameter of the articles is 0.354 and a standard deviation 0.048. What is the 95% confidence interval for the average diameter of the batch?

(1)	(0.2934,0.4235)	(2)	(0.3448,0.3632)
(3)	(0.3021,0.3824)	(4)	(0.3923,0.4212)

Which of the following is *true*? 30.

- (1) Unbiased estimator is always efficient.
- (2) Consistent estimator is always unbiased.
- (3) Unbiased estimator is always consistent.
- (4) MLE is always a function of sufficient statistic.

31. In SRSWOR, if $\bar{y} = 50$, n = 100, N = 500, then the estimated population total is : (1) 250(2) 500 (3) 25000 (4) 2500 Headquarters of Field Operations Division of NSSO are located at : 32. (1) New Delhi (2) Kolkata (3) Bombay (4) Chennai The variance of stratified sampling mean \overline{Y}_{st} is : 33. (1) $\sum_{h=1}^{L} \left(\frac{1}{N_h} - \frac{1}{n_h} \right) W_h^2 S_h^2$ (2) $\sum_{h=1}^{L} \left(\frac{1}{n_h} - \frac{1}{N_h} \right) W_h^2 S_h^2$ (3) $\sum_{h=1}^{L} \left(\frac{1}{N_{h}} - \frac{1}{n_{h}}\right) S_{h}^{2^{*}}$ (4) $\sum_{h=1}^{L} \left(\frac{1}{n_{h}} - \frac{1}{N_{h}}\right) W_{h}^{2} S_{h}^{2}$ In simple random sampling, the biased of ratio estimator is unbiased if : 34. (1) They are independent (2) They are uncorrelated (3) They are correlated (4) They are dependent Wishart distribution (σ^2, n) follows : 35. (1) $\sigma^2 \chi^2$ distribution (2) $N(0, \sigma^2)$ distribution (3) $\frac{e^{-n}\sigma^2}{n}$ distribution (4) Beta distribution (1) $P_{01} = P_{10} = 1$ Hotelling T^2 can be approximated to statistic 'F' with usual notation as test criteria 36. following the inequality for rejection as : Weight in Laspeyro's price index to (1) $T^2 > F_{p,n-p;\alpha}f$ or n > p(2) $T^2 < F_{p,n-p;\alpha} f$ or n > p(3) $T^2 > \frac{n-1}{n-p} F_{p,n-p;\alpha} f \text{ or } n > p$ (4) $T^2 > \frac{n-p}{n-1} F_{p,n-p;\alpha} f \text{ or } n > p$

- A measure of association between a discriminant function and a set of dummy 37. variables that define the group membership is known as :
 - (1) Multivariate Correlation (2) Multicollinearity

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- (3) Canonical Correlation
- (4) Biserial Correlation

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	38.	The ratio of number of replications required information is :	nired in CRD and RBD for the same amount of
		(1) 3:2 (2) 5:3	(3) 5:4 (4) 3:5
	39.	In a Randomised Block Design, we alway	avs have :
		(1) Number of blocks = Number of trea	tments
		(2) Number of blocks > Number of treat	timents
		(3) Number of blocks < Number of trea	tments
		(4) All of the above	All and All an
		(+) All of the above	
	40.	The additional effect gained due to cor as :	nbined effect of two or more factors is known
		(1) Main Effect	(2) Interaction Effect
		(3) Either (1) or (2)	(4) Neither (1) or (2)
	41.	For a standard $n \times n$ Latin Square, how with the same standard ?	many different Latin squares can be obtained
•		(1) $n!(n-2)!$	(2) $(n-1)!(n-2)!$ indicate rade V
		(2) $N(0, \sigma^2)$ distribute: (1 - n) !n (C)	(4) $n! (n + 1)!$ monomials y to (1)
	42.	The condition for the time reversal test t	o hold good with usual notations is :
		(1) $P_{01} \times P_{10} = 1$	(2) $P_{10} \times P_{01} = 0$
		(3) $P_{01}/P_{10} = 1$	(4) $P_{01} + P_{10} = 1$
	43.	Weight in Laspeyre's price index numbe	r is known as
		(1) Quantity during the current year	
		(2) Quantity in the base year	
		(3) Price during the current year	
		(4) Price in the base year	
		discriminant habition and a set of d	37. A measure of association hetween a
	44.	$(1) 1720 \qquad (2) 1000$	started for first time in :
		(1) 1720 (2) 1886	(3) 1969 (4) 1946
		and an and a state of the state	
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- (1) Time Reversal Test (2) Circular Test (1)
- (3) Factor Reversal Test (4) Unit Test device bit approximation (4)
- 46. If l_x is the number of persons living at the age 'x' and ' L_x ' the number of persons living in the mid of 'x' and '(x + 1)' years, then the relation between l_x and L_x is :
 - (1) $L_x = \frac{1}{2}(l_x + l_{x+1})$ (2) $L_x = \left(\frac{x}{2} + l_x\right)$ (3) $L_x = l_{x+\frac{1}{2}}$ (4) $L_x = l_{x+\frac{3}{2}}$
- 47. Fertility rates mainly depend on :
 - (1) Total female population
 - (2) Total population
 - (3) Female population of child bearing age
 - (4) Number of newly born babies
- **48.** If the quantity demanded of a commodity is unresponsive to change in prices, then the demand of that commodity is :
 - (1) Perfectly Inelastic and a lange of (2) Elastic a bolton i elder where double
 - (3) Unit Elastic (4) Inelastic
- 49. The elasticity for the demand of the durable goods is : non-period and the durable goods is :
 - (1) Zero
 - (3) Greater than unity

- (2) Equal to unity(4) Less than Unity
- 50. Consider the following matrix :

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

If P is a stochastic matrix, then which of the following is not true ?

- (1) P is Ergodic
- (3) P is not Regular

- (2) P is Regular
- (4) Both (1) and (3) 100 1

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51. Service time in queueing theory is usually assumed to follow :

- (1) Poisson Distribution (2) Erlang Distribution
- (3) Exponential Distribution (4) Normal Distribution

52. For MIMI1 queueing system, the expected number of customers in systems are :

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(1) $L_{S} = \left(\frac{\lambda}{\mu - \lambda}\right)$ (2) $L_{S} = \left(\frac{\lambda - \mu}{\lambda}\right)$ (3) $L_{S} = \left(\frac{\mu}{\mu - \lambda}\right)$ (4) $L_{S} = \left(\frac{\mu - \lambda}{\lambda}\right)$

53. Which of the following relationships is *not* true ? (1) $W_S = W_q + \frac{1}{\mu}$ (2) $L_S = \lambda W_S$ (3) $L_S = L_q + \frac{1}{\lambda}$ (4) $L_q = \lambda W_q$

54. Maximize $Z = 10 x_1 + 25 x_2$, subject to $0 \le x_1 \le 3, 0 \le x_2 \le 3, x_1 + x_2 \le 5$ (1) 80 at (3, 2)(2) 75 at (0,3)(3) 30 at (3,0)(4) 95 at (2,3)

55. Which variable is added for the less than or equal to type of constraint ?

(1) Slack (2) Surplus (3) Artificial (4) Basic

If P is a stochastic matrix then which of

56. The convex combination of two points $\bar{x}_1, \bar{x}_2 \in X$ is referred as :

- (1) $(1-\lambda)\bar{x}_1 + \lambda\bar{x}_2, 0 \le \lambda \le 1$
- (2) $(1 \lambda)\bar{x}_1 + \lambda\bar{x}_2$, λ is any real number
- (3) $\bar{x}_1 + \lambda \bar{x}_2, 0 \le \lambda \le 1$
- (4) $\lambda \bar{x}_1 + \lambda \bar{x}_2$, λ is any real number

57. The assignment problem is :

(1) non-linear programming problem

(2) dynamic programming problem

(3) integer linear programming problem

(4) integer non-linear programming problem

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58.	The order of Convergence of Secant Me	thod is : Anodi xituam manaza a i A II88
	(1) 2.4 (2) 2 2 3 3 2 3	(3) 1.62 (4) 1
59.	If $f(0) = 3$, $f(1) = 5$, $f(3) = 21$, then the Newton divided difference interpolation	e unique polynomials of degree 2 or less using will be :
	(1) $2x^2 + 2x + 1$	(2) $2x^2 - 3x + 1$
	(3) $2x^2 + 3$	(4) $x^2 + 3x - 2$
60.	The third difference of a cubic $\Delta^3 y$ func	tion are :
	(1) Constant	(2) Not constant
	(3) Variables	(4) None of the above
61.	Let 'f' be a non-constant entire function for 'f' for each $z \in \mathfrak{C}$?	. Which of the following properties is possible
	(1) Re $f(z) = Im f(z)$	(2) $ f(z) < 1$
	(3) $Im(z) < 0$	(4) $f(z) \neq 0$
62.	Let 'f' and 'g' be mesomorphic function of has a pole of order 'm' at $z = 0$, then $g(f(x)) = 0$.	on (c. If 'f' has a zero of order 'k' at $z = a$ and z z) has :
	(1) a zero of order km at $z = a$	
i them,	(2) a pole of order km at $z = a$	70. If X and Y are standard normal variate
	(3) a zero of order $ k - m $ at $z = a$	
	(4) a pole of order $ k-m $ at $z = a$	
63	The set of vectors $\mathbf{Y}_{1} = (2 \ 1 \ 4) \ \mathbf{Y}_{2} = (2 \ 1 \ 4)$	$ \begin{array}{c} 1 \\ -3 \\ -2 \\ -3 \\ -2 \\ -3 \\ -2 \\ -2 \\ -3 \\ -2 \\ -2$
	(1) Linearly dependent	(2) Linearly independent
	(3) Both of them	(4) None of these
days. 2		
64. gmod 1	Let a be 2×2 with Det(A) = 1 & Trace((1) 7 (2) 8	A) = 3, then Trace(A^2) is : (3) 9 (4) 10
65.	If A is (2×2) matrix over IR with Det(A	+ I = 1 + Det (A), then we can conclude that :
	(1) $Det(A) = 0$ (2) $A = 0$	(3) $Tr(A) = 0$ (4) A is non-singular

If A is a square matrix, then A + A', AA' and A'A are : 66. (1) Symmetric (2) Skew Symmetric (3) Hermitian (4) Skew Hermitian 67. If $\lim_{n \to \infty} a_n^{1/n} = \lim_{n \to \infty} \frac{a_{n+1}}{a_n}$ provided limit on RHS exists. This result is known as : (1) Cauchy 1st Theorem on Limits (2) Cauchy 2nd Theorem on Limits (3) Squeeze Principle (4) Leibnitz' Rule $\lim_{n \to \infty} \left(1 + \frac{1}{n} \right)^n \text{ is :}$ 68. (1) 1 (2) 0 (3) e (4) 2 Consider the sequence $a_n = \left(1 + (-1)^n \frac{1}{n}\right)^n$ then : 69. (1) $\lim_{n \to \infty} \operatorname{Sup}(a_n) = \lim_{n \to \infty} \operatorname{Inf}(a_n) = 1$ (2) $\lim_{n \to \infty} \operatorname{Sup}(a_n) = \lim_{n \to \infty} \operatorname{Inf}(a_n) = e$ (3) $\lim_{n \to \infty} \operatorname{Sup}(a_n) = \lim_{n \to \infty} \operatorname{Inf}(a_n) = \frac{1}{e}$ (4) $\lim_{n \to \infty} \operatorname{Sup}(a_n) = e, \lim_{n \to \infty} \operatorname{Inf}(a_n) = \frac{1}{e}$ 70. If X and Y are standard normal variates with correlation coefficient ' ρ ' between them, then the correlation coefficient between X^2 and Y^2 is : (3) ρ (4) √p (2) ρ^2 (1) $2\rho - 1$ 71. If the random variables X, Y and Z have the means $\mu_x = 5$, $\mu_y = 7$ and $\mu_z = 4$; $\sigma_X^2 = 10$, $\sigma_Y^2 = 14$ and $\sigma_Z^2 = 20$; Cov(X, Y) = 1, Cov (X, Z) = 3 and Cov(Y, Z) = 2, then what is the covariance of U = X + 4Y + 2Z and V = 3X - Y - Z? (2) 82 (3) -82 (1) - 76(4) 76 72. Neelam has appeared in an examination which follows multiple choice questions, each having five possible answers. The probability that she knows an answer is 0.75. If she does not know an answer, she will guess, with the conditional probability 1/5 of being correct. The conditional probability that Neelam knows the answer, given that she gives the correct answer is :

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(1) 0.25 (2) 0.80 (3) 0.90 (4) 0.94

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73. A drunkard takes a forward step with probability 'p' and a backward step with probability 'q'. After taking 11 steps, the probability that he is the one step away from the starting point is :

(1) $p^6 + q^6$ (2) $2(p^6 + q^5)$ (3) $462 p^6 q^5$ (4) $462 p^5 q^5$

74. For the sequence $\{X_n\}$ of independent random variables the following are defined :

$$P(X_k = \pm 2^k) = 2^{-(2k+1)}; P(X_k = 0) = 1 - 2^{-2k}$$

Which of the following are not correct(s) ?

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- (a) WLLN holds because $E(X_k) = 0$ and $\lim_{n \to \infty} \frac{B_n}{n^2} \to 0$ where $B_n = \operatorname{Var}\left(\sum_{i=1}^n X_i\right)$
- (b) Weak law of large numbers holds by Khinchin's theorem because $E(X_k)$ is finite.

(c) WLLN holds since X_k are identically distributed.

Select the correct answer using code given below :

- (1) (b) and (c) only (2) (a) and (b) only
- (3) (a) and (c) only (4) (a), (b) and (c) only
- **75.** If σ_X^2 , σ_Y^2 and σ_{X-Y}^2 are the variances of X, Y and X Y respectively, then what is the coefficient of correlation between 'X' and 'Y' ?
 - (1) $\frac{\sigma_X^2 + \sigma_Y^2 \sigma_{X-Y}^2}{2\sigma_X \sigma_Y}$ (2) $\frac{\sigma_X^2 + \sigma_Y^2}{2\sigma_X \sigma_Y}$ (3) $\frac{\sigma_X^2 + \sigma_Y^2 \sigma_{X+Y}^2}{2\sigma_X \sigma_Y}$ (4) $\frac{\sigma_X^2 \sigma_Y^2}{2\sigma_X \sigma_Y}$

76. Let X and Y be independent Gamma $G(\alpha_1, \beta)$ and $G(\alpha_2, \beta)$ random variables respectively. Then $\frac{X}{X+Y}$ is distributed as:

(1) $G(\alpha_1 + \alpha_2, \beta)$ (2) $\beta_1(\alpha_1, \alpha_2)$ (3) U(0, 1) (4) $G(\alpha_1, \alpha_2)$

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A 77. The Joint Density Function of 'X' and 'Y' is given by : $f(x, y) = \begin{cases} 2e^{-x}e^{-2y} & 0 < x < \infty, 0 < y < \infty \\ 0 & \text{otherwise} \end{cases}$ (2) 2(p - q)What is the value of P(X < Y)? (1) 1/3 (2) 1/2 (3) 1/4 (4) 1/6 78. For a certain frequency distribution, the numerical computation yields the following : Mean = 62, Median = 65, Coefficient of skewness = -0.3, then the standard deviation is equal to : (2) 30 (3) 90 (1) 10(4) 300 79. Let 'X' be a random variable having Probability Density Function : $f(x) = \begin{cases} x/2 & 0 < x < 1 \\ 1/2 & 1 < x \le 2 \\ (3-x)/3 & 2 < x \le 3 \end{cases}$ (c) W1.1.N bolds since Y are democally distri-Then P(1.5 < X < 2.5 | X > 1) equals to : (1) 3/8(2) 5/8 (3) 1/2 (4) 1/4 80. Let X_1, X_2, \dots, X_n be i.i.d. random variables with $E(X_i) = \mu$ and $E(X_i^2) < \infty$, then the consistent estimator for μ is : (1) $\frac{2i^2}{n(n+1)\sum X_i}$ (2) $\frac{2}{n(n+1)}\sum iX_i$ (3) $\frac{2i}{n(n+1)} \sum X_i$ (4) $\frac{2}{n(n+1)} \sum i^2 X_i$

81. Let Y_1 , Y_2 , Y_3 be uncorrelated observations with common variance σ^2 and expectations given by $(Y_1) = \beta_1$, $E(Y_2) = \beta_2$ and $E(Y_3) = \beta_1 + \beta_2$ where β_1 and β_2 are unknown parameters. The best linear unbiased estimator of $\beta_1 + \beta_2$ is :

(1) $\frac{1}{2}(Y_1+Y_2+Y_3)$ (2) $Y_1 + Y_2$ (3) $\frac{1}{2}(Y_1+Y_2+2Y_3)$ (4) $\frac{1}{2}(Y_1-Y_2-Y_3)$

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The following equation represent a simultaneous equation model : 86.

$$K_1 = \alpha_1 K_2 + \beta_1 Z_1 + u_1$$

$$K_2 = \alpha_2 K_1 + \beta_2 Z_2 + u_2$$

OLS will suffer from simultaneous bias if :

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- (1) u_1 is correlated with Z_1 (2) Z_1 is correlated with Z_2
- (3) K_2 is correlated with u_1 (4) K_1 is correlated with u_1

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- 87. Having known the last census population P_0 and growth rate 'r', the population after 'n' years based on compound interest formula will be :
 - (1) $\hat{P}_t = P_0 (1+r)^n$ (3) $\hat{P}_t = P_0 / (1+r)^n$ (2) $\hat{P}_t = P_0 (1+n)^r$ (4) $\hat{P}_t = P_0 / (1+n)^r$

88. Vital rates are customarily expressed as :

(1) Percentages (2) Per Thousand (3) Per Million (4) Per Trillion

89. Age - Specific mortality rates fail to reveal :

(1) Mortality conditions

(3) Sex Ratio

(2) Age-distribution of persons

(4) All of the above

A

- 90. The relationship between NRR and GRR is :
 - (1) NRR and GRR are usually equal
 - (2) NRR can never exceed GRR
 - (3) NRR is generally greater than GRR
 - (4) None of the above more not transfer been all bluco gatwollot set to the bluce
- 91. Construction of life tables is based on the assumption that :
 - (1) Age specific death rates are constant at all ages.
 - (2) Death rates are uniformly distributed between two birth days.
 - (3) Mortality rates are same for male and female populations.
 - (4) All of the above
- 92. A life table consists of :
 - (1) Seven columns
 - (3) Six columns

- (2) Eight columns
- (4) Nine Columns

/A	
93. King's abridged life tables are based	in the onlershest
(1) Central mortality rate	ee. Consider the integral of : (1 and of the calculation of : (1 and of the calculation o
(2) The number of persons and death	s for central
(3) Both (1) and (2)	s for central age in the interval $\{x, x + n\}$
(4) Neither (1) nor (2)	
94. If Laspeyre's price index number is 32 Fisher's Ideal Index Number is	24 and Paasche's Price Index number is 144 then
(1) 180 (2) 234 95 If a pagetine i	(3) 216 (4) 222
 (1) The solution is optimal (3) The solution is unbounded 	 (2) The solution is infeasible (4) All of the above
96. The maximum number of extreme point. Max Z = cx Subject to	s for a LPP
$Ax = b; x \ge 0$	
Where A is $m \times n$ matrix is equal to :	
(1) $\frac{m!}{n!(m-n)!}$ (2) $\frac{n!}{m!(n-m)!}$	(3) $(m-n)$ (4) mn
97. In a basic feasible solution of an $m \times n$ trallocations is atmost :	ansportation problem, the number of positive
(1) $m + n$ (2) $m + n - 1$ ((3) $m - n$ (4) $m + n = 2$
98. The necessary and sufficient condition for transportation problem is :	or the existence of a feasible solution of a
(1) $\sum a_i = \sum b_j$ (2) $\sum a_i \neq \sum b_j$ (3)	$3) \sum a_i = 0 \qquad (4) \sum b_j = 0$
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Consider the linear programming problem : 99.

Max $Z = 3x_1 + 2x_2$

Subject to

$$x_1 + x_2 \le 4$$
$$x_1 - x_2 \le 2$$
$$x_1, x_2 \ge 0$$

Then its solution is :

- (1) $x_1 = 3$, $x_2 = 1$, Max Z = 11
- (2) $x_1 = 1, x_2 = 3, \text{Max } Z = 10$ (3) $x_1 = 2, x_2 = 1, \text{ Max } Z = 11$ (4) $x_1 = 1, x_2 = 2, \text{ Max } Z = 10$

A

- The probability of living of a person in the age group 'x' to (x + n)' can be obtained by 100. the formula :
 - (1) l_{x+n}/l_x (2) $(l_x l_{x+n})/l_{x+n}$ (2) $(l_x l_{x+n})/l_{x+n}$
 - (3) $(l_x l_{x+n})/l_x$ mode and on (4) l_x/l_{x+n} modes a neutron of (2)

(DO NOT OPEN THIS	Total N QUESTION BOOKLET BEFORE ARE ASKED TO DO SO) PHD-EE-2023-24	o. of Printed Pages : 17 TIME OR UNTIL YOU SET-Y
	Statistics	10006
Time : 1¼ Hours Roll No. (in figures)	Max. Marks : 100	Sr. No
Name Father's Name Date of Examination	Date of Birth Date of Birth	

(Signature of the Candidate)

(Signature of the Invigilator)

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

- 1. All questions are compulsory.
- 2. The candidates *must return* the question booklet as well as OMR Answer-Sheet to the Invigilator concerned before leaving the Examination Hall, failing which a case of use of unfairmeans / 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 shall be got uploaded on the University Website immediately after the conduct of Entrance Examination. Candidates may raise valid objection/complaint if any, with regard to discrepancy in the question booklet/answer key within 24 hours of uploading the same on the University Website. The complaint be sent by the students to the Controller of Examinations by hand or through email. Thereafter, no complaint in any case, will be considered.
- 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 one full mark. Cutting, erasing, overwriting and more than one answer in OMR Answer-Sheet will be treated as incorrect answer.
- 7. Use only Black or Blue Ball Point Pen of good quality in the OMR Answer-Sheet.
- 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. For a standard $n \times n$ Latin Square, how many different Latin squares can be obtained with the same standard?
 - (1) n! (n-2)!(2) (n-1)! (n-2)!(3) n! (n-1)!(4) n! (n+1)!
- 2. The condition for the time reversal test to hold good with usual notations is :
 - (1) $P_{01} \times P_{10} = 1$ (2) $P_{10} \times P_{01} = 0$
 - (3) $P_{01}/P_{10} = 1$ (4) $P_{01} + P_{10} = 1$

3. Weight in Laspeyre's price index number is known as

- (1) Quantity during the current year
- (2) Quantity in the base year
- (3) Price during the current year
- (4) Price in the base year
- 4. In India, the collection of vital statistics started for first time in :
 - (1) 1720 (2) 1886 (3) 1969 (4) 1946

5. Fisher's ideal formula does not satisfy

- (1) Time Reversal Test (2) Circular Test
- (3) Factor Reversal Test
- 6. If l_x is the number of persons living at the age 'x' and ' L_x ' the number of persons living in the mid of 'x' and '(x + 1)' years, then the relation between l_x and L_x is :

(4) Unit Test

- (1) $L_x = \frac{1}{2}(l_x + l_{x+1})$ (2) $L_x = \left(\frac{x}{2} + l_x\right)$ (3) $L_x = l_{x+\frac{1}{2}}$ (4) $L_x = l_{x+\frac{3}{2}}$
- 7. Fertility rates mainly depend on :
 - (1) Total female population
 - (2) Total population
 - (3) Female population of child bearing age
 - (4) Number of newly born babies

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8. If the quantity demanded of a commodity is unresponsive to change in prices, then the demand of that commodity is :

(1)	Perfectly Inelastic	(2) Elastic
(3)	Unit Elastic	(4) Inelastic

- 9. The elasticity for the demand of the durable goods is :
 - (1) Zero (2) Equal to unity
 - (3) Greater than unity (4) Less than Unity
- 10. Consider the following matrix :

D	0	0	1/2	1/2
	0	0	1/2	1/2
P =	1/2	1/2	0	0
	1/2	1/2	0	0

If P is a stochastic matrix, then which of the following is not true ?

- (1) P is Ergodic (2) P is Regular
- (3) P is not Regular
- 11. If the random variables X, Y and Z have the means $\mu_x = 5$, $\mu_y = 7$ and $\mu_z = 4$; $\sigma_X^2 = 10$, $\sigma_Y^2 = 14$ and $\sigma_Z^2 = 20$; Cov(X, Y) = 1, Cov (X, Z) = 3 and Cov(Y, Z) = 2, then what is the covariance of U = X + 4Y + 2Z and V = 3X - Y - Z?

(4) Both (1) and (3)

- (1) -76 (2) 82 (3) -82 (4) 76
- 12. Neelam has appeared in an examination which follows multiple choice questions, each having five possible answers. The probability that she knows an answer is 0.75. If she does not know an answer, she will guess, with the conditional probability 1/5 of being correct. The conditional probability that Neelam knows the answer, given that she gives the correct answer is :
 - (1) 0.25 (2) 0.80 (3) 0.90 (4) 0.94
- 13. A drunkard takes a forward step with probability 'p' and a backward step with probability 'q'. After taking 11 steps, the probability that he is the one step away from the starting point is :
 - (1) $p^6 + q^6$ (2) $2(p^6 + q^5)$ (3) $462 p^6 q^5$ (4) $462 p^5 q^5$

14. For the sequence $\{X_n\}$ of independent random variables the following are defined : $P(X_k = \pm 2^k) = 2^{-(2k+1)}; P(X_k = 0) = 1 - 2^{-2k}$

Which of the following are not correct(s)?

В

- (a) WLLN holds because $E(X_k) = 0$ and $\lim_{n \to \infty} \frac{B_n}{n^2} \to 0$ where $B_n = \operatorname{Var}\left(\sum_{i=1}^n X_i\right)$
- (b) Weak law of large numbers holds by Khinchin's theorem because $E(X_k)$ is finite.

(c) WLLN holds since X_k are identically distributed.

Select the correct answer using code given below :

- (1) (b) and (c) only (2) (a) and (b) only
- (3) (a) and (c) only (4) (a), (b) and (c) only
- **15.** If σ_X^2 , σ_Y^2 and σ_{X-Y}^2 are the variances of X, Y and X Y respectively, then what is the coefficient of correlation between 'X' and 'Y' ?
 - (1) $\frac{\sigma_X^2 + \sigma_Y^2 \sigma_{X-Y}^2}{2\sigma_X \sigma_Y}$ (2) $\frac{\sigma_X^2 + \sigma_Y^2}{2\sigma_X \sigma_Y}$ (3) $\frac{\sigma_X^2 + \sigma_Y^2 \sigma_{X+Y}^2}{2\sigma_X \sigma_Y}$ (4) $\frac{\sigma_X^2 \sigma_Y^2}{2\sigma_X \sigma_Y}$
- **16.** Let 'X' and 'Y' be independent Gamma $G(\alpha_1, \beta)$ and $G(\alpha_2, \beta)$ random variables respectively. Then $\frac{X}{X+Y}$ is distributed as :
 - (1) $G(\alpha_1 + \alpha_2, \beta)$ (2) $\beta_1(\alpha_1, \alpha_2)$
 - (3) U(0, 1) (4) $G(\alpha_1, \alpha_2)$
- 17. The Joint Density Function of 'X' and 'Y' is given by :

$$f(x, y) = \begin{cases} 2e^{-x}e^{-2y} & 0 < x < \infty, 0 < y < \infty \\ 0 & \text{otherwise} \end{cases}$$

What is the value of P(X < Y)?

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

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(4) 1/6

18. For a certain frequency distribution, the numerical computation yields the following :

Mean = 62, Median = 65, Coefficient of skewness = -0.3, then the standard deviation is equal to :

(1) 10 (2) 30 (3) 90 (4) 300

19. Let 'X' be a random variable having Probability Density Function :

 $f(x) = \begin{cases} x/2 & 0 < x < 1 \\ 1/2 & 1 < x \le 2 \\ (3-x)/3 & 2 < x \le 3 \end{cases}$ Then P(1.5 < X < 2.5|X > 1) equals to : (1) 3/8 (2) 5/8 (3) 1/2 (4) 1/4

20. Let X_1, X_2, \dots, X_n be i.i.d. random variables with $E(X_i) = \mu$ and $E(X_i^2) < \infty$, then the consistent estimator for μ is :

(1) $\frac{2i^2}{n(n+1)\sum X_i}$ (2) $\frac{2}{n(n+1)}\sum iX_i$ (3) $\frac{2i}{n(n+1)}\sum X_i$ (4) $\frac{2}{n(n+1)}\sum iX_i$

21. Construction of life tables is based on the assumption that :

(1) Age - specific death rates are constant at all ages.

(2) Death rates are uniformly distributed between two birth days.

(3) Mortality rates are same for male and female populations.

(4) All of the above

22. A life table consists of :

- (1) Seven columns
- (3) Six columns

- (2) Eight columns
- (4) Nine Columns

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B

King's abridged life tables are based in the calculation of : 23.

- (1) Central mortality rate
- (2) The number of persons and deaths for central age in the interval $\{x, x + n\}$
- (3) Both (1) and (2)
- (4) Neither (1) nor (2)
- If Laspeyre's price index number is 324 and Paasche's Price Index number is 144, then 24. Fisher's Ideal Index Number is :
 - (3) 216 (4) 222 (2) 234 (1) 180
- If a negative value appears in the solution values (X_B) column of the simplex table, 25. then:
 - (2) The solution is infeasible (1) The solution is optimal
 - (3) The solution is unbounded
- The maximum number of extreme points for a LPP 26.

Max Z = cx

Subject to

 $Ax = b; x \ge 0$

Where A is $m \times n$ matrix is equal to :

(1) $\frac{m!}{n!(m-n)!}$ (2) $\frac{n!}{m!(n-m)!}$ (3) (m-n) (4) mn

- In a basic feasible solution of an $m \times n$ transportation problem, the number of positive 27. allocations is atmost :
 - (4) m + n 2(2) m + n - 1(3) m - n(1) m + n
- The necessary and sufficient condition for the existence of a feasible solution of a 28. transportation problem is :
 - (1) $\sum a_i = \sum b_j$ (2) $\sum a_i \neq \sum b_j$ (3) $\sum a_i = 0$ (4) $\sum b_j = 0$

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- (4) All of the above

29.

Consider the linear programming problem : $Max \ Z = 3x_1 + 2x_2$

Subject to

 $x_1 + x_2 \le 4$ $x_1 - x_2 \le 2$ $x_1, x_2 \ge 0$

Then its solution is :

- (1) $x_1 = 3$, $x_2 = 1$, Max Z = 11
- (2) $x_1 = 1, x_2 = 3, \text{Max } Z = 10$
- (3) $x_1 = 2, x_2 = 1, \text{Max } Z = 11$
- (4) $x_1 = 1, x_2 = 2, \text{ Max } Z = 10$

The probability of living of a person in the age group 'x' to (x + n)' can be obtained by 30. the formula :

(1) l_{x+n}/l_x (2) $(l_x - l_{x+n})/l_{x+n}$ (3) $(l_x - l_{x+n})/l_x$ (4) l_x / l_{x+n}

The mean of Binomial distribution B(n, p) is : 31.

(2) np - 1(3) np - 2(1) np(4) np - 3Given that E[X + 4] = 10 and $E[X + 4]^2 = 116$, then Var[X] is equal to : 32. (1) 4(2) 8 (3) 12 (4) 16 Let 'X' be a continuous random variable with Probability Density Function 33.

 $0 \le x \le 1$ $f(x) = \begin{cases} a, & 1 \le x \le 2 \\ -ax + 3a, & 2 \le x \le 3 \end{cases}$ x > 30. Then the value of 'a' is given by :

(1) 0.4 (2) 0.5(3) 0.3

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(4) 0.1

Then the value of $P(X \le 1.5)$ is given by : (2) 0.81 (3) 0.19 (4) 0.17 (1) 0.5The moment generating function of Poisson Distribution is : (1) $e^{\lambda}(e^{t}-1)$ (2) $e^{t}(e^{\lambda}-1)$ (3) $e^{t}-1$ (4) $e^{\lambda}(1-e^{t})$ Which of the following is the median of the exponential distribution with parameter λ ? 36. (3) λ^{-1} (2) $-\lambda^{-1}$ (4) λ^{-2} (1) λ The Quartile Deviation of the normal distribution is : (1) Q. D. = $\frac{2}{4}\sigma$ (2) Q. D. = $\frac{2}{3}\sigma$ (3) Q. D. = $\frac{2}{5}\sigma$ (4) Q. D. = $\frac{3}{4}\sigma$ If A and B are two independent events, then $P(\overline{A} \cap \overline{B})$ is equal to : $(2) \quad 1 - P(A \cup B)$ (1) $P(\overline{A})P(\overline{B})$ (4) All of the above (3) [1 - P(A)][1 - P(B)]If event A and event B has occurred and it is known that P(B) = 1, the conditional 39. probability P(A/B) is equal to : (4) Zero (3) One (2) P(B)(1) P(A)The recurrence formula for geometric distribution is given by : (2) p(x) = qp(x + i)(1) p(x+i) = qp(x+i)(4) p(x) = p(x + i)(3) p(x + i) = qp(x)Service time in queueing theory is usually assumed to follow : (2) Erlang Distribution (1) Poisson Distribution (4) Normal Distribution (3) Exponential Distribution P. T. O. PHD-EE-2023-24/(Statistics)(SET-Y)/(B)

34. Let 'X' be a continuous random variable with Probability Density Function

 $0 \le x \le 1$ $f(x) = \begin{cases} a, & 1 \le x \le 2\\ -ax + 3a, & 2 \le x \le 3 \end{cases}$ x > 3

35.

- 37.

38.

- 40.
- 41.

42. For MIMI1 queueing system, the expected number of customers in systems are :

(1) $L_S = \left(\frac{\lambda}{\mu - \lambda}\right)$ (2) $L_S = \left(\frac{\lambda - \mu}{\lambda}\right)$ (3) $L_S = \left(\frac{\mu}{\mu - \lambda}\right)$ (4) $L_S = \left(\frac{\mu - \lambda}{\lambda}\right)$

43. Which of the following relationships is not true?

- (1) $W_S = W_q + \frac{1}{\mu}$ (2) $L_S = \lambda W_S$ (3) $L_S = L_q + \frac{1}{\lambda}$ (4) $L_q = \lambda W_q$
- **44.** Maximize $Z = 10 x_1 + 25 x_2$, subject to $0 \le x_1 \le 3, 0 \le x_2 \le 3, x_1 + x_2 \le 5$ (1) 80 at (3, 2) (2) 75 at (0,3) (3) 30 at (3,0) (4) 95 at (2, 3)

45. Which variable is added for the less than or equal to type of constraint ?

(1) Slack (2) Surplus (3) Artificial (4) Basic

(3) 1.62

(4) 1

46. The convex combination of two points $\bar{x}_1, \bar{x}_2 \in X$ is referred as :

(1)
$$(1-\lambda)\bar{x}_1+\lambda\bar{x}_2, 0 \le \lambda \le 1$$

- (2) $(1 \lambda) \bar{x}_1 + \lambda \bar{x}_2$, λ is any real number
- (3) $\bar{x}_1 + \lambda \bar{x}_2, 0 \le \lambda \le 1$
- (4) $\lambda \bar{x}_1 + \lambda \bar{x}_2$, λ is any real number

47. The assignment problem is :

- (1) non-linear programming problem
- (2) dynamic programming problem
- (3) integer linear programming problem
- (4) integer non-linear programming problem
- 48. The order of Convergence of Secant Method is :

(1) 2.4 (2) 2

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- **49.** If f(0) = 3, f(1) = 5, f(3) = 21, then the unique polynomials of degree 2 or less using Newton divided difference interpolation will be :
 - (1) $2x^2 + 2x + 1$ (2) $2x^2 - 3x + 1$ (3) $2x^2 + 3$ (4) $x^2 + 3x - 2$
- **50.** The third difference of a cubic $\Delta^3 y$ function are :
 - (1) Constant (2) Not constant
 - (3) Variables (4) None of the above
- **51.** Let 'f' be a non-constant entire function. Which of the following properties is possible for 'f' for each $z \in \mathbb{C}$?

(1) Re $f(z) = \text{Im } f(z)$	(2) $ f(z) < 1$
(3) $Im(z) < 0$	(4) $f(z) \neq 0$

- **52.** Let 'f and 'g' be mesomorphic function on (\mathfrak{c} . If 'f' has a zero of order 'k' at z = a and z has a pole of order 'm' at z = 0, then g(f(z)) has :
 - (1) a zero of order km at z = a
 - (2) a pole of order km at z = a
 - (3) a zero of order |k m| at z = a
 - (4) a pole of order $|\mathbf{k} \mathbf{m}|$ at z = a

53. The set of vectors $X_1 = (2, 1, 4), X_2 = (-3, 2, -1), X_3 = (1, -3, -2)$ is :

- (1) Linearly dependent (2) Linearly independent
- (3) Both of them (4) None of these

54. Let a be 2×2 with Det(A) = 1 & Trace(A) = 3, then $Trace(A^2)$ is : (1) 7 (2) 8 (3) 9 (4) 10

55. If A is (2×2) matrix over IR with Det(A + I) = 1 + Det(A), then we can conclude that :

- (1) Det(A) = 0(2) A = 0(3) Tr(A) = 0(4) A is non-singular
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56. If A is a square matrix, then A + A', AA' and A'A are : (1) Symmetric (2) Skew Symmetric (3) Hermitian (4) Skew Hermitian 57. If $\lim_{n \to \infty} a_n^{1/n} = \lim_{n \to \infty} \frac{a_{n+1}}{a_n}$ provided limit on RHS exists. This result is known as : (1) Cauchy 1st Theorem on Limits (2) Cauchy 2nd Theorem on Limits (3) Squeeze Principle (4) Leibnitz' Rule **58.** $\lim_{n \to \infty} \left(1 + \frac{1}{n} \right)^n$ is : (1) 1 (2) 0(3) e (4) 2Consider the sequence $a_n = \left(1 + (-1)^n \frac{1}{n}\right)^n$ then : 59. (1) $\lim_{n \to \infty} \operatorname{Sup}(a_n) = \lim_{n \to \infty} \operatorname{Inf}(a_n) = 1$ (2) $\lim_{n \to \infty} \operatorname{Sup}(a_n) = \lim_{n \to \infty} \operatorname{Inf}(a_n) = e$ (3) $\lim_{n \to \infty} \operatorname{Sup}(a_n) = \lim_{n \to \infty} \operatorname{Inf}(a_n) = \frac{1}{e}$ (4) $\lim_{n \to \infty} \operatorname{Sup}(a_n) = e, \lim_{n \to \infty} \operatorname{Inf}(a_n) = \frac{1}{e}$ If X and Y are standard normal variates with correlation coefficient 'p' between them, 60. then the correlation coefficient between X^2 and Y^2 is : (1) $2\rho - 1$ (2) ρ^2 (3) p (4) √p The pgf of a certain distribution is given as : 61. $P(s) = 3s^2 - 2s + 6$ What is the mean of this distribution ? (1) 2(2) 3 (3) 4 (4) 5 PHD-EE-2023-24/(Statistics)(SET-Y)/(B)

В

- 62. The relation between student's -t and F-distribution is :
- (1) F_{1,1} = t_n²
 (2) F_{n,1} = t₁²
 (3) F_{1,n} = t_∞²
 (4) F_{1,n} = t_n²
 63. The minimum variance unbiased estimator of θ² based on a sample of size 'n' from N(θ 1) is :

 (1) X̄² 1/n
 (2) X̄² + 1/n
 (3) ∑(X_i X̄²)/n
 (4) ∑(X_i X̄²)/(n 1)

 64. The Bayes estimator of a parameter under squared error loss function is :

 (1) Posterior mean
 (2) Posterior median
 - (3) Posterior mode (4) Posterior variance
- 65. The decision criteria in SPRT depends on the function of :
 - (1) Type I error
 - (2) Type II error
 - (3) Both type I and type II error
 - (4) Neither Type I nor Type II error

66. What is an unbiased estimator of θ for the distribution $f(x, \theta) = \theta e^{-\theta} x$, $x \ge 0$?

(1)
$$\frac{(n-1)\overline{X}}{n}$$

(2) $\frac{(n-1)}{n\overline{X}}$
(3) $\frac{\overline{X}}{n-1}$
(4) $\frac{1}{(n-1)\overline{X}}$

67. Given a random sample :

$$f(x,\theta) = \frac{2}{\alpha^2} (\alpha - x), \ 0 < x < \alpha$$

What is the MLE of α ?

(1) X (2) 2X (3)
$$\frac{X^2}{2}$$
 (4) $\frac{X}{2}$

68. For a particular hypothesis test, the probabilities of type I and type II errors are respectively, 0.05 and 0.09. The power of the test is :

(1) 0.95 (2) 0.14 (3) 0.86 (4) 0.91

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		В	
69.	A random sample of 100 articles are taken from a batch of 2000 articles shows that the average diameter of the articles is 0.354 and a standard deviation 0.048. What is the 95% confidence interval for the average diameter of the heteb 2		
	(1) (0.2934 0 4235)		
	(3) (0.3021 0.2824)	(2) (0.3448,0.3632)	
	(0) (0.3021,0.3024)	(4) (0.3923,0.4212)	
70.	Which of the following is true ?		
	(1) Unbiased estimator is always efficier	nt	
	(2) Consistent estimator is always unbias	sed	
	(3) Unbiased estimator is always consist		
	(4) MLE is always a function of sufficient	nt statistic	
	a subject function of sufficience	in statistic.	
71.	The correct relationship between A.M, G	.M., and H.M. is :	
	(1) $A.M.=G.M.=H.M.$	(2) $G.M. \ge A.M. \ge H.M.$	
	(3) $H.M. \ge G.M. \ge A.M.$	(4) $A.M. \ge G.M. \ge H.M$	
72.	Average wages of workers of fostern	P. cco de la construcción de	
	of wages is 110 The coefficients of varies	Rs. 550 per month and the standard deviation	
	(1) 30% (2) 15%	auon is :	
	(1) 50% (2) 15%	(3) 500% (4) 20%	
73.	If the mode of a frequency distribution i distribution is :	s 16 and its mean is 16, then the median of the	
	(1) 0 (2) 16	(3) 32 (4) 8	
74.	If Quartile deviation of a set of obser	vations is given as 6.4 and all a second	
	quartile is 5. What is the value of the thin	rd quartile?	
	(1) 12 (2) 15.3	(3) 17.8	
		(4) 20.2	
15.	5. For a leptokurtic frequency curve, the measures of kurtosis is		
	(1) 0 (2) -3	(3) less than 1 (4) greater than 2	
76.	Standard error of the sample correlation	configuration and a	
	$1+r^2$ r^2	coefficient 'r' is based on 'n' paired values is :	
	(1) $\frac{1+r^2}{\sqrt{n}}$ (2) $\frac{1+r^2}{\sqrt{n}}$	(3) $\frac{1-r^2}{1+r^2}$ (4) $1+r^2$	
	n n	\sqrt{n} (4) $\sqrt{n-1}$	
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77. Given the following set of equations :

B

 $x_1 + 4 x_2 - x_3 = 3$ 5 x₁ + 2 x₂ + 3 x₃ = 4

The basic feasible solution involving x_1 and x_2 is :

$$(1) \left(\frac{5}{9}, \frac{11}{18}, 0\right) \qquad (2) \left(\frac{5}{9}, 0, 0\right) \qquad (3) \left(0, \frac{11}{18}, 0\right) \qquad (4) \left(\frac{2}{9}, 0, \frac{3}{14}\right)$$

78. The range of a partial correlation coefficient is :

- (1) $0 \text{ to } \infty$ (2) $-\infty \text{ to } \infty$ (3) 0 to 1 (4) -1 to 1
- **79.** The term regression was introduced by :
 - (1) Sir Francis Galton (2) R.A. Fisher
 - (3) Karl Pearson

(4) P.C. Mahalanobis

80. If Regression Equations are :

$$6y = 5x + 90$$
$$15x = 8y + 30$$

And the variance of x = 4, then the correlation coefficient between 'x' and 'y' is :

- (1) 0.45 (2) 0.67 (3) 0.78 (4) 0.88
- 81. Let Y_1 , Y_2 , Y_3 be uncorrelated observations with common variance σ^2 and expectations given by $(Y_1) = \beta_1$, $E(Y_2) = \beta_2$ and $E(Y_3) = \beta_1 + \beta_2$ where β_1 and β_2 are unknown parameters. The best linear unbiased estimator of $\beta_1 + \beta_2$ is :
 - (1) $\frac{1}{2}(Y_1 + Y_2 + Y_3)$ (2) $Y_1 + Y_2$ (3) $\frac{1}{2}(Y_1 + Y_2 + 2Y_3)$ (4) $\frac{1}{2}(Y_1 - Y_2 - Y_3)$

82. Under the regulatory conditions, if λ_n is the likelihood ratio, then the asymptotic distribution of $-2\log \lambda_n$ as $n \to \infty$ is:

- (1) Normal distribution
- (3) F-distribution

- (2) Chi square distribution
- (4) T distribution

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83. If the pdf of a random variable 'X' is $f(x, \theta) = 1 - \theta^2$, $0 \le x \le \frac{1}{1 - \theta^2}$ and if we reject

 $H_0: \theta = \frac{1}{2}$ against the alternative $H_1: \theta = \frac{3}{4}$ whenever $x \ge 1$, then what is the power of the test ?

(1) $\frac{15}{16}$ (2) $\frac{1}{2}$ (3) $\frac{7}{16}$ (4) $\frac{9}{16}$

84. If X_1, X_2, \ldots, X_n is a random sample form poisson distribution with parameter ' λ ', then the maximum likelihood estimator of log λ is given by :

(1)
$$e^{\left[\sum_{i=1}^{n} \frac{X_i}{n}\right]}$$
 (2) $\log\left[\sum_{i=1}^{n} \frac{X_i}{n}\right]$ (3) $e^{\left[\sum_{i=1}^{n} X_i\right]}$ (4) $\log\left[\sum_{i=1}^{n} X_i\right]$

85. Which of the following could be used as a test for autocorrelation up to third order ?

- (1) Spearmen Correlation test (2) The Breusch-Goldfrey test
- (3) The Durbin Watson test (4) The Gold-Fled Quandt test
- 86. The following equation represent a simultaneous equation model :

$$K_1 = \alpha_1 K_2 + \beta_1 Z_1 + u_1$$

$$K_2 = \alpha_2 K_1 + \beta_2 Z_2 + u_2$$

OLS will suffer from simultaneous bias if :

- (1) u_1 is correlated with Z_1 (2) Z_1 is correlated with Z_2
- (3) K_2 is correlated with u_1 (4) K_1 is correlated with u_1

87. Having known the last census population ' P_0 ' and growth rate 'r', the population after 'n' years based on compound interest formula will be :

(1) $\hat{P}_{t} = P_{0}(1+r)^{n}$ (2) $\hat{P}_{t} = P_{0}(1+n)^{r}$ (3) $\hat{P}_{t} = P_{0}/(1+r)^{n}$ (4) $\hat{P}_{t} = P_{0}/(1+n)^{r}$

B

Vital rates are customarily expressed as : 88. (2) Per Thousand (1) Percentages (3) Per Million (4) Per Trillion Age - Specific mortality rates fail to reveal : 89. (2) Age-distribution of persons (1) Mortality conditions (3) Sex Ratio (4) All of the above 90. The relationship between NRR and GRR is : (1) NRR and GRR are usually equal (2) NRR can never exceed GRR (3) NRR is generally greater than GRR (4) None of the above In SRSWOR, if $\bar{y} = 50$, n = 100, N = 500, then the estimated population total is : 91. (1) 250(2) 500 (3) 25000 (4) 2500 Headquarters of Field Operations Division of NSSO are located at : 92. (2) Kolkata (3) Bombay (4) Chennai (1) New Delhi The variance of stratified sampling mean \overline{Y}_{st} is : 93. (1) $\sum_{h=1}^{L} \left(\frac{1}{N_{h}} - \frac{1}{n_{h}} \right) W_{h}^{2} S_{h}^{2}$ (2) $\sum_{h=1}^{L} \left(\frac{1}{n_{h}} - \frac{1}{N_{h}} \right) W_{h}^{2} S_{h}^{2}$ (3) $\sum_{h=1}^{L} \left(\frac{1}{N_{h}} - \frac{1}{n_{h}} \right) S_{h}^{2}$ (4) $\sum_{h=1}^{L} \left(\frac{1}{n_{h}} - \frac{1}{N_{h}} \right) W_{h}^{2} S_{h}^{2}$ In simple random sampling, the biased of ratio estimator is unbiased if : 94. (2) They are uncorrelated (1) They are independent (3) They are correlated (4) They are dependent P. T. O. PHD-EE-2023-24/(Statistics)(SET-Y)/(B)

B

95. Wishart distribution (σ^2, n) follows :

(1) $\sigma^2 \chi^2$ distribution (2) $N(0, \sigma^2)$ distribution (3) $\frac{e^{-n}\sigma^2}{n}$ distribution (4) Beta distribution

96. Hotelling T^2 can be approximated to statistic 'F' with usual notation as test criteria following the inequality for rejection as :

(1)
$$T^2 > F_{p,n-p;\alpha}f$$
 or $n > p$ (2) $T^2 < F_{p,n-p;\alpha}f$ or $n > p$

- (3) $T^2 > \frac{n-1}{n-p} F_{p,n-p;\alpha} f \text{ or } n > p$ (4) $T^2 > \frac{n-p}{n-1} F_{p,n-p;\alpha} f \text{ or } n > p$
- 97. A measure of association between a discriminant function and a set of dummy variables that define the group membership is known as :
 - (1) Multivariate Correlation (2) Multicollinearity
 - (3) Canonical Correlation (4) Biserial Correlation

98. The ratio of number of replications required in CRD and RBD for the same amount of information is :

(1) 3:2 (2) 5:3 (3) 5:4 (4) 3:5

99. In a Randomised Block Design, we always have :

- (1) Number of blocks = Number of treatments
- (2) Number of blocks > Number of treatments
- (3) Number of blocks < Number of treatments
- (4) All of the above

100. The additional effect gained due to combined effect of two or more factors is known as :

- (1) Main Effect
- (2) Interaction Effect
- (3) Either (1) or (2)

(4) Neither (1) or (2)

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Total No. of Printed Pages : 17

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Date of Examination		
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1.0	The pgf of a certain distribution is given as : $P(s) = 3 s^2 = 2s \pm 6$
	What is the mean of this distribution ?
	(1) 2 share 0.00 (2) 3 of a montread (3) 4 share 0.01 to (4) 5 motors A
2.	The relation between student's -t and F-distribution is :
	(1) $F_{1,1} = t_n^2$ (2) $F_{n,1} = t_1^2$ (3) $F_{1,n} = t_\infty^2$ (4) $F_{1,n} = t_n^2$
3.	The minimum variance unbiased estimator of θ^2 based on a sample of size 'n' from $N(\theta \ 1)$ is :
	(1) $\bar{X}^2 - 1/n$ (2) $\bar{X}^2 + 1/n$
	(3) $\sum (X_i - \overline{X}^2)/n$ (4) $\sum (X_i - \overline{X}^2)/(n-1)$
4.	The Bayes estimator of a parameter under squared error loss function is :
	(1) Posterior mean (2) Posterior median
	(3) Posterior mode (4) Posterior variance
5	The decision criteria in SPRT depends on the function of : (1) Type I error
	(2) Type II error protocol to reduce being to all include statements (IMIM to To
	(3) Both type I and type II error(4) Neither Type I nor Type II error
	be that difference of β_{μ} and β_{μ}
6.	What is an unbiased estimator of θ for the distribution $f(x, \theta) = \theta e^{-x}, x \ge 0$?
	(1) $\frac{(n-1)\overline{X}}{n}$ (2) $\frac{(n-1)}{n\overline{X}}$ (3) $\frac{\overline{X}}{n-1}$ (4) $\frac{1}{(n-1)\overline{X}}$
7.	Given a random sample :
	$f(x,\theta) = \frac{2}{\alpha^2} (\alpha - x), \ 0 < x < \alpha$

C

What is the MLE of α ? (1) X (2) 2X (3) $\frac{X^2}{2}$ (4) $\frac{X}{2}$

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- 8. For a particular hypothesis test, the probabilities of type I and type II errors are respectively, 0.05 and 0.09. The power of the test is :
 - (1) 0.95 (2) 0.14 (3) 0.86 (4) 0.91
- **9.** A random sample of 100 articles are taken from a batch of 2000 articles shows that the average diameter of the articles is 0.354 and a standard deviation 0.048. What is the 95% confidence interval for the average diameter of the batch ?
 - (1) (0.2934, 0.4235) (2) (0.3448, 0.3632)
 - (3) (0.3021,0.3824)
- (4) (0.3923,0.4212)
- 10. Which of the following is *true*?
 - (1) Unbiased estimator is always efficient.
 - (2) Consistent estimator is always unbiased.
 - (3) Unbiased estimator is always consistent.
 - (4) MLE is always a function of sufficient statistic.
- 11. Service time in queueing theory is usually assumed to follow :
 - (1) Poisson Distribution (2) Erlang Distribution
 - (3) Exponential Distribution (4) Normal Distribution
- 12. For MIMI1 queueing system, the expected number of customers in systems are :
 - (1) $L_{S} = \left(\frac{\lambda}{\mu \lambda}\right)$ (2) $L_{S} = \left(\frac{\lambda - \mu}{\lambda}\right)$ (3) $L_{S} = \left(\frac{\mu}{\mu - \lambda}\right)$ (4) $L_{S} = \left(\frac{\mu - \lambda}{\lambda}\right)$

13. Which of the following relationships is not true ?

(1) $W_S = W_q + \frac{1}{\mu}$ (2) $L_S = \lambda W_S$ (3) $L_S = L_q + \frac{1}{\lambda}$ (4) $L_q = \lambda W_q$

14. Maximize $Z = 10 x_1 + 25 x_2$, subject to $0 \le x_1 \le 3, 0 \le x_2 \le 3, x_1 + x_2 \le 5$ (1) 80 at (3, 2)(2) 75 at (0,3)(3) 30 at (3,0)(4) 95 at (2, 3)

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15.	Whic	ch variable is a	added for the less th	an or equ	al to type	of constrain	t? mobil	19/22
	(1) §	Slack	(2) Surplus	(3) A1	rtificial	(4) Bas	sic	
16.	The o	convex combi	nation of two points	$\overline{x}_1, \overline{x}_2 \in$	≡ X is refe	rred as :		
	(1) ((2) ($(1-\lambda)\bar{x}_{1}+\lambda\bar{x}_{2}$ $(1-\lambda)\bar{x}_{1}+\lambda\bar{x}_{2}$	$_{2}, 0 \leq \lambda \leq 1$ \bar{c}_{2}, λ is any real num	nber				
	(3) 3 (4) 7	$\overline{x}_1 + \lambda \overline{x}_2, 0 \le \\ \lambda \overline{x}_1 + \lambda \overline{x}_2, \lambda \mathrm{i}$	$\lambda \leq 1$ is any real number				If the pdf	.23.
17.	The a	assignment pr	oblem is :					
	(1) r	non-linear pro	gramming problem					
	(2) d	lynamic progr	amming problem					
	(3) i	nteger linear p	programming proble	em		. e		
	(4) i	nteger non-lin	ear programming p	roblem				
18.	The	order of Conv	ergence of Secant N	fethod is	es bootlifs			
	(1) 2	2.4	(2) 2	(3) 1.	62	(4) 1		
19.	If f(0 New	f(1) = 3, f(1) = 5 ton divided di	f(3) = 21, then the fference interpolation	the unique	e polynom	nials of degr	ree 2 or less	using
	(1) 2	$2x^2 + 2x + 1$		(2) 2.	$x^2 - 3x +$	niwellot sd		
	(3) 2	$2x^2 + 3$		(4) x	$x^{2} + 3x - 2$			
20.	The	third difference	the of a cubic $\Delta^3 y$ further set of a cubic $\Delta^3 y$ further	nction are	:			
	(1) (Constant		(2) N	ot constan	t tata constant	The follow	
	(3)	Variables		(4) N	one of the	above		
21.	Let expe are u	Y_1 , Y_2 , Y_3 octations given inknown param	be uncorrelated a by $(Y_1) = \beta_1$, $E(1)$ meters. The best line	observation Y_2 = β_2 ear unbias	ons with and $E(Y_3)$ sed estima	common $ = \beta_1 + \beta_2 $ tor of $\beta_1 + \beta_2$	variance σ where β_1 a β_2 is :	β^2 and and β_2
	(1)	$\frac{1}{2}(Y_1 + Y_2 + Y_3)$	2) September 201	(2) Y_{1}	$Y_1 + Y_2$			
	(3)	$\frac{1}{2}(Y_1+Y_2+2Y_1)$		(4) $\frac{1}{2}$	$(Y_1 - Y_2 - $	Y ₃)auslamoa		

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- Under the regulatory conditions, if λ_n is the likelihood ratio, then the asymptotic 22. distribution of $-2\log \lambda_n$ as $n \to \infty$ is :

 - (1) Normal distribution (2) Chi square distribution
 - (3) F-distribution

- (4) T distribution
- **23.** If the pdf of a random variable 'X' is $f(x, \theta) = 1 \theta^2$, $0 \le x \le \frac{1}{1 \theta^2}$ and if we reject
 - $H_0: \theta = \frac{1}{2}$ against the alternative $H_1: \theta = \frac{3}{4}$ whenever $x \ge 1$, then what is the power of the test ?
 - (1) $\frac{15}{16}$ (2) $\frac{1}{2}$ (3) $\frac{7}{16}$ (4) $\frac{9}{16}$
- 24. If X_1, X_2, \ldots, X_n is a random sample form poisson distribution with parameter ' λ ', then the maximum likelihood estimator of log λ is given by :
 - (1) $e^{\left(\sum_{i=1}^{n} \frac{X_{i}}{n}\right)}$ (2) $\log\left(\sum_{i=1}^{n} \frac{X_{i}}{n}\right)$ (3) $e^{\left(\sum_{i=1}^{n} X_{i}\right)}$ (4) $\log\left(\sum_{i=1}^{n} X_{i}\right)$

25. Which of the following could be used as a test for autocorrelation up to third order ?

- (1) Spearmen Correlation test (2) The Breusch-Goldfrey test
- (3) The Durbin Watson test (4) The Gold-Fled Quandt test
- 26. The following equation represent a simultaneous equation model :

$$K_1 = \alpha_1 K_2 + \beta_1 Z_1 + u_1$$

OLS will suffer from simultaneous bias if :

- (1) u_1 is correlated with Z_1 (2) Z_1 is correlated with Z_2
- (3) K_2 is correlated with u_1 (4) K_1 is correlated with u_1

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27. Having known the last census population ' P_0 ' and growth rate 'r', the population after 'n' years based on compound interest formula will be : (1) $\hat{P}_t = P_0 (1+r)^n$ (2) $\hat{P}_t = P_0 (1+n)^r$ (3) $\hat{P}_t = P_0 / (1+r)^n$ (4) $\hat{P}_t = P_0 / (1+n)^r$ Vital rates are customarily expressed as : 28.

(2) Age-distribution of persons

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of

- (2) Per Thousand (1) Percentages
- (4) Per Trillion (3) Per Million

Age - Specific mortality rates fail to reveal : 29.

- (1) Mortality conditions
- (4) All of the above (3) Sex Ratio

The relationship between NRR and GRR is : 30.

(1) NRR and GRR are usually equal

(2) NRR can never exceed GRR

- (3) NRR is generally greater than GRR
 - (4) None of the above
 - **31.** If the random variables X, Y and Z have the means $\mu_x = 5$, $\mu_y = 7$ and $\mu_z = 4$; $\sigma_X^2 = 10$, $\sigma_Y^2 = 14$ and $\sigma_Z^2 = 20$; Cov(X, Y) = 1, Cov (X, Z) = 3 and Cov(Y, Z) = 2, then what is the covariance of U = X + 4Y + 2Z and V = 3X - Y - Z?
 - (4) 76 (3) - 82(2) 82 (1) - 76
 - 32. Neelam has appeared in an examination which follows multiple choice questions, each having five possible answers. The probability that she knows an answer is 0.75. If she does not know an answer, she will guess, with the conditional probability 1/5 of being correct. The conditional probability that Neelam knows the answer, given that she gives the correct answer is :
 - (4) 0.94 (3) 0.90 (1) 0.25(2) 0.80

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- 33. A drunkard takes a forward step with probability 'p' and a backward step with probability 'q'. After taking 11 steps, the probability that he is the one step away from the starting point is :
 - (2) $2(p^6 + q^5)$ (4) $462 p^5 q^5$ (1) $p^6 + q^6$ (3) 462 $p^6 q^5$

34. For the sequence $\{X_n\}$ of independent random variables the following are defined :

$$P(X_{k} = \pm 2^{k}) = 2^{-(2k+1)}; P(X_{k} = 0) = 1 - 2^{-2k}$$

Which of the following are not correct(s)?

- (a) WLLN holds because $E(X_k) = 0$ and $\lim_{n \to \infty} \frac{B_n}{n^2} \to 0$ where $B_n = \operatorname{Var}\left(\Sigma_{i=1}^n X_i\right)$
- (b) Weak law of large numbers holds by Khinchin's theorem because $E(X_k)$ is finite.

(c) WLLN holds since X_k are identically distributed.

Select the correct answer using code given below :

- (2) (a) and (b) only (1) (b) and (c) only
- (4) (a), (b) and (c) only (3) (a) and (c) only
- **35.** If σ_X^2 , σ_Y^2 and σ_{X-Y}^2 are the variances of X, Y and X Y respectively, then what is the coefficient of correlation between 'X' and 'Y' ?

(1)
$$\frac{\sigma_X^2 + \sigma_Y^2 - \sigma_{X-Y}^2}{2\sigma_X \sigma_Y}$$
(2)
$$\frac{\sigma_X^2 + \sigma_Y^2}{2\sigma_X \sigma_Y}$$
(3)
$$\frac{\sigma_X^2 + \sigma_Y^2 - \sigma_{X+Y}^2}{2\sigma_X \sigma_Y}$$
(4)
$$\frac{\sigma_X^2 - \sigma_Y^2}{2\sigma_X \sigma_Y}$$

36. Let 'X' and 'Y' be independent Gamma $G(\alpha_1, \beta)$ and $G(\alpha_2, \beta)$ random variables having five possible answe respectively. Then $\frac{X}{X+Y}$ is distributed as :

(2) $\beta_1(\alpha_1, \alpha_2)$ (1) $G(\alpha_1 + \alpha_2, \beta)$ (4) $G(\alpha_1, \alpha_2)$ (3) U(0, 1)

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The Joint Density Function of 'X' and 'Y' is given by : $f(x, y) = \begin{cases} 2e^{-x}e^{-2y} & 0 < x < \infty, 0 < y < \infty \\ 0 & \text{otherwise} \end{cases}$

What is the value of P(X < Y)?

(1) 1/3

C

37.

 38. For a certain frequency distribution, the numerical computation yields the following : Mean = 62, Median = 65, Coefficient of skewness = -0.3, then the standard deviation is equal to :

- (1) 10 (2) 30 (3) 90 (4) 300
- 39. Let 'X' be a random variable having Probability Density Function :

$$f(x) = \begin{cases} x/2 & 0 < x < 1 \\ 1/2 & 1 < x \le 2 \\ (3-x)/3 & 2 < x \le 3 \end{cases}$$

Then P(1.5 < X < 2.5|X > 1) equals to :
(1) 3/8 (2) 5/8 (3) 1/2 (4) 1/4

40. Let X_1, X_2, \dots, X_n be i.i.d. random variables with $E(X_i) = \mu$ and $E(X_i^2) < \infty$, then the consistent estimator for μ is :

(1)
$$\frac{2i^2}{n(n+1)\sum X_i}$$

(2) $\frac{2}{n(n+1)}\sum X_i$
(3) $\frac{2i}{n(n+1)}\sum X_i$
(4) $\frac{2}{n(n+1)}\sum i^2 X_i$

41. The correct relationship between A.M, G.M., and H.M. is :

- (1) A.M.=G.M.=H.M. (2) $G.M. \ge A.M. \ge H.M.$

 (3) $H.M. \ge G.M. \ge A.M.$ (4) $A.M. \ge G.M. \ge H.M$
- **42.** Average wages of workers of factory are Rs. 550 per month and the standard deviation of wages is 110. The coefficients of variation is :
 - (1) 30% (2) 15% (3) 500% (4) 20%

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

44. If Quartile deviation of a set of observations

- **43.** If the mode of a frequency distribution is 16 and its mean is 16, then the median of the distribution is :
 - (1) 0 (2) 16 (3) 32 (4) 8
- **44.** If Quartile deviation of a set of observations is given as 6.4 and the value of first quartile is 5. What is the value of the third quartile ?
 - (1) 12 (2) 15.3 (3) 17.8 (4) 20.2

45. For a leptokurtic frequency curve, the measures of kurtosis is :

- (1) 0 (2) -3 (3) less than 1 (4) greater than 3
- 46. Standard error of the sample correlation coefficient 'r' is based on 'n' paired values is :
 - (1) $\frac{1+r^2}{\sqrt{n}}$ (2) $\frac{1+r^2}{n}$ (3) $\frac{1-r^2}{\sqrt{n}}$ (4) $\frac{1+r^2}{\sqrt{n-1}}$

47. Given the following set of equations :

$$x_1 + 4x_2 - x_3 = 3$$

5 x₁ + 2 x₂ + 3 x₃ = 4

The basic feasible solution involving x_1 and x_2 is :

(1) $\left(\frac{5}{9}, \frac{11}{18}, 0\right)$ (2) $\left(\frac{5}{9}, 0, 0\right)$ (3) $\left(0, \frac{11}{18}, 0\right)$ (4) $\left(\frac{2}{9}, 0, \frac{3}{14}\right)$

48. The range of a partial correlation coefficient is :

- (1) $0 \text{ to } \infty$ (2) $-\infty \text{ to } \infty$ (3) 0 to 1 (4) -1 to 1
- 49. The term regression was introduced by :
 - (1) Sir Francis Galton (2) R.A. Fisher
 - (3) Karl Pearson (4) P.C. Mahalanobis

50. If Regression Equations are : 6y = 5x + 9015x = 8y + 30 modulation 15x = 8y + 30And the variance of x = 4, then the correlation coefficient between 'x' and 'y' is : (1) 0.45 (2) 0.67 (3) 0.78 (4) 0.88 **51.** In SRSWOR, if $\overline{y} = 50$, n = 100, N = 500, then the estimated population total is : (1) 250(2) 500 (3) 25000 (4) 2500 Headquarters of Field Operations Division of NSSO are located at : 52. (1) New Delhi (2) Kolkata (3) Bombay (4) Chennai The variance of stratified sampling mean \overline{Y}_{st} is : 53. (1) $\sum_{h=1}^{L} \left(\frac{1}{N_h} - \frac{1}{n_h} \right) W_h^2 S_h^2$ (2) $\sum_{h=1}^{L} \left(\frac{1}{n_h} - \frac{1}{N_h} \right) W_h^2 S_h^2$ (3) $\sum_{h=1}^{L} \left(\frac{1}{N_h} - \frac{1}{n_h} \right) S_h^2$ (4) $\sum_{h=1}^{L} \left(\frac{1}{n_h} - \frac{1}{N_h} \right) W_h^2 S_h^2$ 54. In simple random sampling, the biased of ratio estimator is unbiased if : (1) They are independent (2) They are uncorrelated (3) They are correlated (4) They are dependent **55.** Wishart distribution (σ^2, n) follows : $= \sum_{n=1}^{\infty} |n + \gamma|^2$ box $01 = [n + \gamma]^2$ us the metric (1) $\sigma^2 \chi^2$ distribution (2) $N(0, \sigma^2)$ distribution (3) $\frac{e^{-n}\sigma^2}{n}$ distribution (4) Beta distribution Hotelling T^2 can be approximated to statistic 'F' with usual notation as test criteria 56. following the inequality for rejection as : (1) $T^2 > F_{p,n-p;\alpha}f$ or n > p(2) $T^2 < F_{p,n-p;\alpha} f$ or n > p(3) $T^2 > \frac{n-1}{n-p} F_{p,n-p;\alpha} f \text{ or } n > p$ (4) $T^2 > \frac{n-p}{n-1} F_{p,n-p;\alpha} f \text{ or } n > p$

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57.	A measure of association between a discriminant function and a set of dummy variables that define the group membership is known as :				
	(1) Multivariate Correlation (2) Multicollinearity				
	(3) Canonical Correlation (4) Biserial Correlation				
58.	The ratio of number of replications required in CRD and RBD for the same amount of information is :(1) 3:2(2) 5:3(3) 5:4(4) 3:5				
59.	In a Randomised Block Design, we always have :				
	(1) Number of blocks = Number of treatments				
	(2) Number of blocks > Number of treatments				
	(3) Number of blocks < Number of treatments				
	(4) All of the above				
60.	The additional effect gained due to combined effect of two or more factors is known as :				
	(1) Main Effect (2) Interaction Effect				
	(3) Either (1) or (2) (4) Neither (1) or (2)				
61.	The mean of Binomial distribution $B(n, p)$ is :				
	(1) np (2) $np - 1$ (3) $np - 2$ (4) $np - 3$				
62.	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				
63.	Let 'X' be a continuous random variable with Probability Density Function $\int ax, 0 \le x \le 1$				
nteria	$f(x) = \begin{cases} a, & 1 \le x \le 2\\ -ax + 3a, & 2 \le x \le 3 \end{cases}$				
	$\begin{bmatrix} 0, & x > 3 \end{bmatrix}$ Then the value of 'a' is given by :				
	(1) 0.4 (2) 0.5 (3) 0.3 (4) 0.1				

H

C.A.	Let 'X' be a continuous random varia	ble with Probability Density Function
04.	$\int ax, \qquad 0 \le x \le 1$	(1) $\mathcal{B}_0 \times \mathcal{B}_0 = 1$ and $\mathcal{B}_0 = 1$
	$f(x) = \begin{cases} a, & 1 \le x \le 2 \\ -ax + 3a, & 2 \le x \le 3 \end{cases}$	$(3) R_0/R_0 = 1 \text{ and } 0.5$
	$\begin{bmatrix} 0, & \dots & \dots & x > 3 \end{bmatrix}$	73. Weight in Laspeyre's price index n
	Then the value of $P(X \le 1.5)$ is given by :	(1) Quantity during the current yes
	(1) 0.5 (2) 0.81 (3)	0.19 0.19 0.17 0.17 0.17
65	The moment generating function of Poisson	Distribution is :
00.	(1) $e^{\lambda}(e^{t}-1)$ (2) $e^{t}(e^{\lambda}-1)$ (3)	$e^t - 1 \qquad (4) e^{\lambda}(1 - e^t)$
66.	Which of the following is the median of the	exponential distribution with parameter λ ?
	(1) λ (2) $-\lambda^{-1}$ (3)	λ^{-1} (4) λ^{-2} (1)
67.	The Quartile Deviation of the normal distrib	75. Fisher's ideal formula does no stutution :
	(1) Q. D. = $\frac{2}{4}\sigma$ (2) Q. D. = $\frac{2}{3}\sigma$ (3)	Q. D. = $\frac{2}{5}\sigma$ (4) Q. D. = $\frac{5}{4}\sigma$
68.	If A and B are two independent events, then	$P(\overline{A} \cap \overline{B})$ is equal to :
	(1) $P(\overline{A})P(\overline{B})$ (2)	$1 - P(A \cup B)$ and it to be set at
	(3) $[1 - P(A)][1 - P(B)]$ (4)	All of the above
69.	If event A and event B has occurred and is probability $P(A B)$ is equal to :	t is known that $P(B) = 1$, the conditional
	(1) $P(A)$ (2) $P(B)$ (3)	One (4) Zero
70.	. The recurrence formula for geometric distrib	oution is given by : shares leso T (1)
	(1) $p(x+i) = qp(x+i)$ (2)	p(x) = qp(x+i)
	(3) $p(x + i) = qp(x)$ (4)	p(x) = p(x + i)
71.	For a standard $n \times n$ Latin Square, how may with the same standard ?	any different Latin squares can be obtained
	(1) $n!(n-2)!$ (2)	(n-1)! (n-2)! (n-1)! (n-2)!
	(3) $n!(n-1)!$ (4)) $n! (n + 1)!$ obtained in $U(\ell)$
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72. The condition for the time reversal test to hold good with usual notations is :

(1) $P_{01} \times P_{10} = 1$ (2) $P_{10} \times P_{01} = 0$ (3) $P_{01}/P_{10} = 1$ (4) $P_{01} + P_{10} = 1$

73. Weight in Laspeyre's price index number is known as

- (1) Quantity during the current year
- (2) Quantity in the base year (1.0 (8)
- (3) Price during the current year
- (4) Price in the base year
- 74. In India, the collection of vital statistics started for first time in :(1) 1720(2) 1886(3) 1969(4) 1946
- - (3) Factor Reversal Test
- 76. If l_x is the number of persons living at the age 'x' and ' L_x ' the number of persons living in the mid of 'x' and '(x + 1)' years, then the relation between l_x and L_x is :

(4) Unit Test

- (1) $L_x = \frac{1}{2}(l_x + l_{x+1})$ (2) $L_x = \left(\frac{x}{2} + l_x\right)$ (3) $L_x = l_{x+\frac{1}{2}}$ (4) $L_x = l_{x+\frac{3}{2}}$
- 77. Fertility rates mainly depend on :
 - (1) Total female population
 - (2) Total population
 - (3) Female population of child bearing age
 - (4) Number of newly born babies
- **78.** If the quantity demanded of a commodity is unresponsive to change in prices, then the demand of that commodity is :
 - (1) Perfectly Inelastic (2) Elastic
 - (3) Unit Elastic (4) Inelastic

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•	is a solution of the solution	
79. The elasticity for the demand of the datable goods	History Ideal Index vinue of	
(1) Zero (2) Equation (2) Equat	than Unity	
(3) Greater than unity (1) 2000	BCT (m)	
80. Consider the following matrix : $\begin{bmatrix} 0 & 0 & 1/2 & 1/2 \end{bmatrix}$	 It a negative value appears in them 	85.
0 0 1/2 1/2	in the second	
$P = \begin{vmatrix} 1/2 & 1/2 & 0 & 0 \end{vmatrix}$	(1) The solution is optimal	
	(2) The solution is inteasible	
If P is a stochastic matrix, then which of the follow (1) D is Equation (2) P is	wing is not true ? Regular	
(1) P is Ergodic . (2) P is (3) P is not Regular (4) Both	h (1) and (3) depend to IIA (4)	
81. Construction of life tables is based on the assumption	tion that : Anna munitum of T	
	Max Z = cx	
(1) Age - specific death rates are constant at an a	Subject to	
(2) Death rates are uniformly distributed between	two birth days. $T = T A$	
(3) Mortality rates are same for male and female	populations.	
In In		
(4) All of the above		
82. A life table consists of :		
(1) Seven columns (2) Eig	ht columns states to and a nI	
(3) Six columns (4) Nir	ne Columns a amost	
	(1) m + m	
83. King's abridged life tables are based in the calcul	m - m (E)	
(1) Central mortality rate		
(2) The number of persons and deaths for centra	al age in the interval $\{x, x + n\}$	
(2) $Poth(1)$ and (2)	(1) $\sum a_i = \sum b_i^{(1)}$	
(3) Both (1) and (2) (4) Neither (1) nor (2)	(3) $\sum a_j = 0^{-2}$ strateging binant solution	
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If Laspeyre's price index number is 324 and Paasche's Price Index number is 144, then 84. Fisher's Ideal Index Number is : (4) 222

C

- (2) 234 (3) 216 (1) 180
- If a negative value appears in the solution values (X_B) column of the simplex table, 85. then:
 - (1) The solution is optimal
 - (2) The solution is infeasible
 - (3) The solution is unbounded
 - (4) All of the above
- The maximum number of extreme points for a LPP 86.

Max Z = cx

Subject to

 $Ax = b; x \ge 0$

Where A is $m \times n$ matrix is equal to :

- (2) $\frac{n!}{m!(n-m)!}$ evode solve (h)(1) $\frac{m!}{n!(m-n)!}$ (4) mn (3) (m - n)
- In a basic feasible solution of an $m \times n$ transportation problem, the number of positive 87. allocations is atmost :
 - (2) m + n 1(4) m + n 2(1) m + n(3) m - n
- The necessary and sufficient condition for the existence of a feasible solution of a 88. transportation problem is :
 - (2) $\sum a_i \neq \sum b_j$ (2) for the conductive (1) (1) $\sum a_i = \sum b_i$ (4) $\sum b_j = 0$ (3) $\sum a_i = 0$

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s9.	Consider th	ie linear	programming problem :
	Max $Z = 3$.	$x_1 + 2x_2$	9 (5)

Subject to

 $x_1 + x_2 \le 4$ $x_1 - x_2 \leq 2$ $x_1, x_2 \ge 0$

Then its solution is :

- If A is a square matrix, then A + A, AA' and A'A are : (1) $x_1 = 3$, $x_2 = 1$, Max Z = 11 (2)
- (2) $x_1 = 1, x_2 = 3, \text{Max } Z = 10$
- (3) $x_1 = 2, x_2 = 1, \text{Max } Z = 11$
- (4) $x_1 = 1, x_2 = 2, \text{ Max } Z = 10$
- **90.** The probability of living of a person in the age group 'x' to (x + n)' can be obtained by
 - (1) l_{x+n}/l_x (2) $(l_x - l_{x+n})/l_{x+n}$ (3) $(l_x - l_{x+n})/l_x$ (4) l_x / l_{x+n} .89
- 91. Let 'f' be a non-constant entire function. Which of the following properties is possible
 - (1) Re f(z) = Im f(z)(2) |f(z)| < 1 > 1(3) Im(z) < 0(4) $f(z) \neq 0$ (1) (1)
- 92. Let 'f and 'g' be mesomorphic function on (c. If 'f' has a zero of order 'k' at z = a and z has a pole of order 'm' at z = 0, then g(f(z)) has :
 - (1) a zero of order km at z = a
 - (2) a pole of order km at z = a
 - (3) a zero of order $|\mathbf{k} \mathbf{m}|$ at z = a
 - (4) a pole of order |k-m| at z = a

The set of vectors $X_1 = (2, 1, 4), X_2 = (-3, 2, -1), X_3 = (1, -3, -2)$ is : If X and Y are standard nor 93.

- (1) Linearly dependent
- (3) Both of them
- (2) Linearly independent

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(4) None of these

94.	Let a be 2×2 with $Det(A) = 1$ & Trace(A)	A) = 3, then Trace(A^2)	is: derobienco - 88
•	(1) 7 (2) 8	(3) 9	4) 10
OF	If $A = (2 \times 2)$ matrix over IR with Det(A)	+ I) = 1 + Det (A), then	n we can conclude that :
95.	(1) $\operatorname{Det}(A) = 0$	(2) $A = 0$	
	(1) $Det(A) = 0$ (3) $Tr(A) = 0$	(4) A is non-singular	1
	(3) $H(A) = 0$	and A'A are :	Then its solution
96.	(1) Symmetric	(2) Skew Symmetric	(1) $\eta = 3, \pi_2 = 0$
	(1) Symmetrie (3) Hermitian	(4) Skew Hermitian	
	$1/n$ $1/n^{a_n+1}$ provided limit	on RHS exists. This re	sult is known as :
97.	If $\lim_{n \to \infty} a_n^{-n} = \lim_{n \to \infty} \frac{1}{a_n}$ provided minet	2. Max Z = 10	f = (x, y) = (x, (w))
	(1) Cauchy 1st Theorem on Limits	(2) Cauchy 2nd The	corem on Limits
	(3) Squeeze Principle	(4) Leibnitz' Rule	
	(2) $(l_x - l_{x+n}) H_{x+n}$		
98.	$\lim_{n \to \infty} \left(1 + \frac{1}{n} \right)^n \text{ is :} \tag{b}$		
	(1) 1 more and (2) 0 10 double	(3) e suites insian	(4) 2
	$q = (1 + (-1)^n)^n$	$\left(\frac{1}{2}\right)^n$ then :	
99.	Consider the sequence $a_n = \begin{pmatrix} 1 \\ 1 \end{pmatrix}$	n)	
	(1) $\limsup_{n \to \infty} \operatorname{Sup}(a_n) = \lim_{n \to \infty} \operatorname{Inf}(a_n) = 1$		
t bns	(2) $\lim_{n \to \infty} \sup(a_n) = \lim_{n \to \infty} \inf(a_n) = e$		
	(2) $\lim_{n \to \infty} \operatorname{Sup}(a) = \lim_{n \to \infty} \operatorname{Inf}(a) = \frac{1}{2}$		
	(3) $\lim_{n \to \infty} \sup(a_n) - \lim_{n \to \infty} \inf(a_n) = e$		
	(4) $\lim_{n \to \infty} \operatorname{Sup}(a_n) = e, \lim_{n \to \infty} \operatorname{Inf}(a_n) = \frac{1}{e}$	z = 1 at $z = a$	
8	XOX I Wans standard normal variat	tes with correlation co	efficient 'p' between them
100	then the correlation coefficient betwee	en X^2 and Y^2 is :	93. The set of vectors J
	(1) $20 = 1$ (2) 0^2	(3) p	(4) √ρ

(DO NOT OPEN THIS QU	Tot JESTION BOOKLET BEFO ARE ASKED TO DO SO) PHD-EE-2023-24 Statistics	al No. of Printed Pages : 17 RE TIME OR UNTIL YOU SET-Y 10008 Sr. No.
Time : 1¼ Hours Roll No. (in figures)	Max. Marks : 100	Total Questions : 100
Name	Date of Birth	
Father's Name	- Mother's Name	
Date of Examination		
	_	1
(Signature of the Candidate)		(Signature of the Invigilator)

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

SEAI

1. All questions are compulsory.

- 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 shall be got uploaded on the University Website immediately after the conduct of Entrance Examination. Candidates may raise valid objection/complaint if any, with regard to discrepancy in the question booklet/answer key within 24 hours of uploading the same on the University Website. The complaint be sent by the students to the Controller of Examinations by hand or through email. 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 one full mark. Cutting, erasing, overwriting and more than one answer in OMR Answer-Sheet will be treated as incorrect answer.
- 7. Use only Black or Blue Ball Point Pen of good quality in the OMR Answer-Sheet.
- 8. Before answering the questions, the candidates should ensure that they have been supplied correct and complete booklet. Complaints, if any, regarding misprinting etc. will not be entertained 30 minutes after starting of the examination.

- 1. Construction of life tables is based on the assumption that :
 - (1) Age specific death rates are constant at all ages.
 - (2) Death rates are uniformly distributed between two birth days.
 - (3) Mortality rates are same for male and female populations.
 - (4) All of the above
- 2. A life table consists of :

(2) Eight columns

1

- (1) Seven columns
 (3) Six columns
- (4) Nine Columns
- 3. King's abridged life tables are based in the calculation of :
 - (1) Central mortality rate
 - (2) The number of persons and deaths for central age in the interval $\{x, x + n\}$
 - (3) Both (1) and (2)
 - (4) Neither (1) nor (2)
 - 4. If Laspeyre's price index number is 324 and Paasche's Price Index number is 144, then Fisher's Ideal Index Number is :
 - (1) 180 (2) 234 (3) 216 (4) 222
 - 5. If a negative value appears in the solution values (X_B) column of the simplex table, then :

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- (1) The solution is optimal
- 10. The probability of living of a person in the age group 'x to (x + a) can be obta
- (2) The solution is infeasible
- (3) The solution is unbounded
- (4) All of the above

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6. The maximum number of extreme points for a LPP

 $\operatorname{Max} Z = cx$

Subject to

 $Ax = b; x \ge 0$ (2) Death rates are uniformly distributed between two birth rates are uniformly distributed between two births are as $Ax = b; x \ge 0$

Where A is $m \times n$ matrix is equal to :

(1) $\frac{m!}{n!(m-n)!}$ (2) $\frac{n!}{m!(n-m)!}$ (3) (m-n) (4) mn^{n}

- 7. In a basic feasible solution of an $m \times n$ transportation problem, the number of positive allocations is at most :
 - (1) m + n (2) m + n 1 (3) m n (4) m + n 2
- 8. The necessary and sufficient condition for the existence of a feasible solution of a transportation problem is :

(1)
$$\sum a_i = \sum b_j$$
 (2) $\sum a_i \neq \sum b_j$ (3) $\sum a_i = 0$ (4) $\sum b_j = 0$

9. Consider the linear programming problem : Max $Z = 3x_1 + 2x_2$

Subject to

A off Lasposte's price index number is 324 and Paasche's Price $4 \ge x + x$ then is 144, then Fighter's ideal index Number is $2 \ge x - x$

$$x_1, x_2 \ge 0$$

Then its solution is :

- (1) $x_1 = 3$, $x_2 = 1$, Max Z = 11(2) $x_1 = 1$, $x_2 = 3$, Max Z = 10(3) $x_1 = 2$, $x_2 = 1$, Max Z = 11(4) $x_1 = 1$, $x_2 = 2$, Max Z = 10
- 10. The probability of living of a person in the age group 'x' to (x + n)' can be obtained by the formula :
 - (1) l_{x+n}/l_x
 - (3) $(l_x l_{x+n})/l_x$

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(2)
$$(l_x - l_{x+n})/l_{x+n}$$

(4) l_x/l_{x+n}

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y

11.	In SRSWOR, if $\overline{y} = 50$, $n = 100$, $N = 50$	500, th	en the estimate	d population total	is · o ·
	(1) 250 (2) 500	(3)	25000	(4) 2500	ц, .
12.	Headquarters of Field Operations Divis	sion of	NSSO are loca	ated at :	
	(1) New Delhi (2) Kolkata	(3)	Bombay	(4) Chennai	
13.	The variance of stratified sampling mea	an \overline{Y}_{st}	is :	1) Number of bloc	
	(1) $\sum_{h=1}^{L} \left(\frac{1}{N_h} - \frac{1}{n_h} \right) W_h^2 S_h^2$	(2)	$\sum_{h=1}^{L} \left(\frac{1}{n_h} - \frac{1}{N} \right)$	$\left(\frac{1}{h}\right)W_h^2S_h^2$	
	(3) $\sum_{h=1}^{L} \left(\frac{1}{N_h} - \frac{1}{n_h} \right) \dot{s}_h^2$	(4)	$\sum_{h=1}^{L} \left(\frac{1}{n_h} - \frac{1}{N_h} \right)$	$-\frac{1}{h}W_h^2S_h^2$	20. 7
14.	In simple random sampling, the biased	of ratio	o estimator is u	nbiased if ·	
	(1) They are independent	(2)	They are uncor	related	
	(3) They are correlated	(4)	They are depen	ident	
15.	Wishart distribution (σ^2, n) follows :	n OvoD			
	(1) $\sigma^2 \chi^2$ distribution	(2) 1	$V(0, \sigma^2)$ distrib	bution	
is, eac	(3) $\frac{e^{-n}\sigma^2}{n}$ distribution	(4) I	Beta distributio	Neelam has apped	22.
16.	Hotelling T^2 can be approximated to s following the inequality for rejection as	statistic :	c 'F' with usua	al notation as test	criteria
	(1) $T^2 > F_{p,n-p;\alpha} f$ or $n > p$	(2) 7	$T^2 < F_{p,n-p;\alpha}f$	f or $n > p$	

(3)
$$T^2 > \frac{n-1}{n-p} F_{p,n-p;\alpha} f \text{ or } n > p$$
 (4) $T^2 > \frac{n-p}{n-1} F_{p,n-p;\alpha} f \text{ or } n > p$

- 17. A measure of association between a discriminant function and a set of dummy variables that define the group membership is known as :
 - (1) Multivariate Correlation
- (2) Multicollinearity
- (3) Canonical Correlation (4) Biserial Correlation
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18. The ratio of number of replications required in CRD and RBD for the same amount of information is :

D

(1) 3:2 (2) 5:3 (3) 5:4 (4) 3:5

19. In a Randomised Block Design, we always have :

(1) Number of blocks = Number of treatments

(2) Number of blocks > Number of treatments

- (3) Number of blocks < Number of treatments
- (4) All of the above

4

- 20. The additional effect gained due to combined effect of two or more factors is known as :
 - (1) Main Effect (2) Interaction Effect
 - (3) Either (1) or (2) (4) Neither (1) or (2)
- **21.** If the random variables X, Y and Z have the means $\mu_x = 5$, $\mu_y = 7$ and $\mu_z = 4$; $\sigma_X^2 = 10$, $\sigma_Y^2 = 14$ and $\sigma_Z^2 = 20$; Cov(X, Y) = 1, Cov (X, Z) = 3 and Cov(Y, Z) = 2, then what is the covariance of U = X + 4Y + 2Z and V = 3X Y Z?
 - (1) -76 (2) 82 (3) -82 (4) 76
- 22. Neelam has appeared in an examination which follows multiple choice questions, each having five possible answers. The probability that she knows an answer is 0.75. If she does not know an answer, she will guess, with the conditional probability 1/5 of being correct. The conditional probability that Neelam knows the answer, given that she gives the correct answer is :
 - (1) 0.25 (2) 0.80 (3) 0.90 (4) 0.94
- 23. A drunkard takes a forward step with probability 'p' and a backward step with probability 'q'. After taking 11 steps, the probability that he is the one step away from the starting point is :

(2) $2(p^6 + q^5)$ (1) $p^6 + q^6$ (3) 462 $p^6 q^5$ (4) 462 $p^5 q^5$

24. For the sequence $\{X_n\}$ of independent random variables the following are defined : $P(X_k = \pm 2^k) = 2^{-(2k+1)}; P(X_k = 0) = 1 - 2^{-2k}$

Which of the following are not correct(s)?

(a) WLLN holds because $E(X_k) = 0$ and $\lim_{n \to \infty} \frac{B_n}{n^2} \to 0$ where $B_n = \operatorname{Var}\left(\sum_{i=1}^n X_i\right)$

(b) Weak law of large numbers holds by Khinchin's theorem because $E(X_k)$ is finite.

(c) WLLN holds since X_k are identically distributed.

Select the correct answer using code given below :

- (2) (a) and (b) only (1) (b) and (c) only
- (3) (a) and (c) only (4) (a), (b) and (c) only
 - 25. If σ_X^2 , σ_Y^2 and σ_{X-Y}^2 are the variances of X, Y and X Y respectively, then what is the coefficient of correlation between 'X' and 'Y' ?
 - (1) $\frac{\sigma_X^2 + \sigma_Y^2 \sigma_{X-Y}^2}{2\sigma_X \sigma_Y}$ (2) $\frac{\sigma_X^2 + \sigma_Y^2}{2\sigma_X \sigma_Y}$ (3) $\frac{\sigma_X^2 + \sigma_Y^2 - \sigma_{X+Y}^2}{2\sigma_x \sigma_y}$ (4) $\frac{\sigma_X^2 - \sigma_Y^2}{2\sigma_T\sigma_Y}$
 - 26. Let X and Y be independent Gamma $G(\alpha_1, \beta)$ and $G(\alpha_2, \beta)$ random variables respectively. Then $\frac{X}{X+Y}$ is distributed as :
 - (1) $G(\alpha_1 + \alpha_2, \beta)$ (2) $\beta_1(\alpha_1, \alpha_2)$ (4) $G(\alpha_1, \alpha_2)$
 - (3) U(0, 1)

27. The Joint Density Function of 'X' and 'Y' is given by :

 $f(x, y) = \begin{cases} 2e^{-x}e^{-2y} & 0 < x < \infty, 0 < y < \infty \\ 0 & \text{otherwise} \end{cases}$

What is the value of P(X < Y)?

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

(4) 1/6

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 28. For a certain frequency distribution, the numerical computation yields the following : Mean = 62, Median = 65, Coefficient of skewness = -0.3, then the standard deviation is equal to :

D

- (1) 10 (2) 30 (3) 90 (4) 300
- 29. Let 'X' be a random variable having Probability Density Function :

$$f(x) = \begin{cases} x/2 & 0 < x < 1 \\ 1/2 & 1 < x \le 2 \\ (3-x)/3 & 2 < x \le 3 \end{cases}$$

Then P(1.5 < X < 2.5|X > 1) equals to :
(1) 3/8 (2) 5/8 (3) 1/2 (4) 1/4

30. Let X_1, X_2, \dots, X_n be i.i.d. random variables with $E(X_i) = \mu$ and $E(X_i^2) < \infty$, then the consistent estimator for μ is :

(1)
$$\frac{2i^2}{n(n+1)\sum X_i}$$

(2) $\frac{2}{n(n+1)}\sum X_i$
(3) $\frac{2i}{n(n+1)}\sum X_i$
(4) $\frac{2}{n(n+1)}\sum iX_i$

31. The pgf of a certain distribution is given as :

 $P(s) = 3 s^2 - 2s + 6$

6

What is the mean of this distribution ?

32. The relation between student's -t and F-distribution is :

- (1) $F_{1,1} = t_n^2$ (2) $F_{n,1} = t_1^2$ (3) $F_{1,n} = t_{\infty}^2$ (4) $F_{1,n} = t_n^2$
- **33.** The minimum variance unbiased estimator of θ^2 based on a sample of size 'n' from $N(\theta \ 1)$ is :
 - (1) $\bar{X}^2 1/n$ (2) $\bar{X}^2 + 1/n$
 - (3) $\sum (X_i \overline{X}^2)/n$ (4) $\sum (X_i \overline{X}^2)/(n-1)$

	•			
34.	The Bayes estimator of a parameter un	nder squared err	or loss function is :	.15
	(1) Posterior mean	(2) Posterio	r median	
	(3) Posterior mode	(4) Posterio	variance	
35.	. The decision criteria in SPRT depends	on the function	(3) $Im(z) < 0$:	
	(1) Type I error	(2) Type II o	Let T and g be meaning	
	(3) Both type I and type II error	(4) Neither	Type I nor Type II error	
36.	What is an unbiased estimator of θ for	the distribution	$f(x, \theta) = \theta e^{-\theta} x, x \ge 0$?	
	(1) $\frac{(n-1)\overline{X}}{n}$ (2) $\frac{(n-1)}{n\overline{X}}$	(3) $\frac{\overline{X}}{n-1}$	$(4) \ \frac{1}{(n-1)\overline{X}}$	
37.	Given a random sample :			
	$f(x,\theta) = \frac{2}{\alpha^2} (\alpha - x), \ 0 < x < \alpha$			
	What is the MLE of α ?			
	(1) X (2) 2X (7)	(3) $\frac{X^2}{2}$	(4) $\frac{X}{2}$	
38.	For a particular hypothesis test, the respectively, 0.05 and 0.09. The power	probabilities of of the test is :	f type I and type II error	ors are
	(1) 0.95 (2) 0.14	(3) 0.86	(4) 0.91	
39.	A random sample of 100 articles are tal average diameter of the articles is 0.33 95% confidence interval for the average	ken from a batc 54 and a standa e diameter of the	h of 2000 articles shows the of 2000 articles shows the rd deviation 0.048. What batch ?	hat the is the
	(1) (0.2934, 0.4235) $(2) (0.2021, 0.2824)$	(2) (0.3448,0	.3632) multimold (E)	
	(5) (0.3021,0.3824)	(4) (0.3923,0	.4212)	
40.	Which of the following is true ?			
	(1) Unbiased estimator is always efficient	ent.	(I) Catchy 1st Theorem	
	(2) Consistent estimator is always unbia	ased.		
	(3) Unbiased estimator is always consis	stent.		
	(4) MLE is always a function of sufficient	ent statistic.		

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41.	Let 'f' be a non-constant entire function	. Which of the following properties is possible
	for 'f' for each $z \in \mathbb{C}$?	And the second association and the second se
	(1) Re $f(z) = Im f(z)$	(2) $ f(z) < 1$ above to realize (2)
	(3) $Im(z) < 0$	(4) $f(z) \neq 0$
42.	Let 'f' and 'g' be mesomorphic function has a pole of order 'm' at $z = 0$, then $g(f($	on (c. If 'f' has a zero of order 'k' at $z = a$ and z (z)) has :
	(1) a zero of order km at $z = a$	
	(2) a pole of order km at $z = a$	36. What is an unbiased estimator of 6 for th
	(3) a zero of order $ k - \hat{m} $ at $z = a$	
	(4) a pole of order $ k-m $ at $z = a$	
43.	The set of vectors $X_1 = (2, 1, 4), X_2 = (2, 1, 4)$	$(-3, 2, -1), X_3 = (1, -3, -2)$ is :
	(1) Linearly dependent	(2) Linearly independent
	(3) Both of them	(4) None of these
44.	Let a be 2×2 with $Det(A) = 1$ & Trace	(A) = 3, then Trace(A^2) is :
	(1) 7 (2) 8	(3) 9 (4) 10
45.	If A is (2×2) matrix over IR with Det(A	(A + I) = 1 + Det (A), then we can conclude that :
	(1) $Det(A) = 0$	(2) $A = 0$
	(3) $Tr(A) = 0$	(4) A is non-singular
AG	If A is a square matrix then $A + A' AA$	and A'A are :
on 40.	(1) Symmetric	(2) Skew Symmetric
	(1) Symmetric (2) Harmitian $(2536.0.8446.0)$ (2)	(4) Skew Hermitian $(2+0) + (220)$ (1)
	(4) (0.3923.0.4212)	(3) (0.3021,0.3824)
47	• If $\lim_{n \to \infty} a_n^{1/n} = \lim_{n \to \infty} \frac{a_{n+1}}{a_n}$ provided limit	t on RHS exists. This result is known as :
	(1) Cauchy 1st Theorem on Limits	
	(2) Cauchy 2nd Theorem on Limits	
	(3) Squeeze Principle	
	(4) Leibnitz' Rule	(4) MLE is always a function of sufficien
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48. $\lim_{n \to \infty} \left(1 + \frac{1}{n}\right)^n$ is:

- (1) 1 (2) 0 (3) e (4) 2
 - **49.** Consider the sequence $a_n = \left(1 + (-1)^n \frac{1}{n}\right)^n$ then :
- (1) $\lim \operatorname{Sup}(a_n) = \lim \operatorname{Inf}(a_n) = 1$ If X_1, X_2, \dots, X_n is a random sample form poisson distribution with parameter X
 - (2) $\lim_{n \to \infty} \operatorname{Sup}(a_n) = \lim_{n \to \infty} \operatorname{Inf}(a_n) = e$
 - (3) $\lim_{n \to \infty} \operatorname{Sup}(a_n) = \lim_{n \to \infty} \operatorname{Inf}(a_n) = \frac{1}{\rho}$
 - (4) $\lim_{n \to \infty} \operatorname{Sup}(a_n) = e, \lim_{n \to \infty} \operatorname{Inf}(a_n) = \frac{1}{a_n}$

Which of the following could be used 50. If X and Y are standard normal variates with correlation coefficient ' ρ ' between them, then the correlation coefficient between X^2 and Y^2 is :

- (1) $2\rho 1$ (2) ρ^2 (3) ρ (4) $\sqrt{\rho}$
- 51. Let Y_1 , Y_2 , Y_3 be uncorrelated observations with common variance σ^2 and expectations given by $(Y_1) = \beta_1$, $E(Y_2) = \beta_2$ and $E(Y_3) = \beta_1 + \beta_2$ where β_1 and β_2 are unknown parameters. The best linear unbiased estimator of $\beta_1 + \beta_2$ is :
 - (1) $\frac{1}{2}(Y_1+Y_2+Y_3)$ (2) $Y_1 + Y_2$ (3) $\frac{1}{2}(Y_1+Y_2+2Y_3)$ (4) $\frac{1}{2}(Y_1-Y_2-Y_3)$ (5)

(n+1) R = R(1+n)

52. Under the regulatory conditions, if λ_n is the likelihood ratio, then the asymptotic of a distribution of $-2\log \lambda_n$ as $n \to \infty$ is : non-element to be a distribution of $-2\log \lambda_n$ as $n \to \infty$ is :

(1) Normal distribution

(2) Chi square distribution

(3) F-distribution

(4) T distribution

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If the pdf of a random variable 'X' is $f(x, \theta) = 1 - \theta^2$, $0 \le x \le \frac{1}{1 - \theta^2}$ and if we reject 53. $H_0: \theta = \frac{1}{2}$ against the alternative $H_1: \theta = \frac{3}{4}$ whenever $x \ge 1$, then what is the power of (2) $\frac{1}{2}$ (3) $\frac{7}{16}$ (4) $\frac{9}{16}$ the test ? (1) $\frac{15}{16}$ If X_1, X_2, \ldots, X_n is a random sample form poisson distribution with parameter ' λ ', then the maximum likelihood estimator of log λ is given by : 54. (1) $e^{\left(\sum_{i=1}^{n} \frac{X_i}{n}\right)}$ (2) $\log\left(\sum_{i=1}^{n} \frac{X_i}{n}\right)$ (3) $e^{\left(\sum_{i=1}^{n} X_{i}\right)}$ (4) $\log\left(\sum_{i=1}^{n} X_{i}\right)$ Which of the following could be used as a test for autocorrelation up to third order ? 55. (2) The Breusch-Goldfrey test (1) Spearmen Correlation test (4) The Gold-Fled Quandt test (3) The Durbin Watson test The following equation represent a simultaneous equation model : $K_1 = \alpha_1 K_2 + \beta_1 Z_1 + u_1$ 56. $K_2 = \alpha_2 K_1 + \beta_2 Z_2 + u_2$ OLS will suffer from simultaneous bias if : (1) u_1 is correlated with Z_1 (2) Z_1 is correlated with Z_2

(4) K_1 is correlated with u_1 (3) K_2 is correlated with u_1

57. Having known the last census population ' P_0 ' and growth rate 'r', the population after (2) $\hat{P}_t = P_0 (1+n)^r$ (1) 'n' years based on compound interest formula will be :

(4) $\hat{P}_t = P_0 / (1+n)^r$ moduling (2) (1) $\hat{P}_t = P_0 (1+r)^n$ (3) $\hat{P}_t = P_0 / (1+r)^n$

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58.	Vital rates are customarily expressed as	Fisher's ideal formula does not suistly :	
	(1) Percentages (2)	(2) Per Thousand	• • •
	(3) Per Million	(4) Per Trillion The Property (2)	
59.	Age - Specific mortality rates fail to rev	If i, is the number of persons livin: Ise	
	(1) Mortality conditions	(2) Age-distribution of persons	
	(3) Sex Ratio (2)	(4) All of the above	
60.	The relationship between NRR and GR	R is :	
	(1) NRR and GRR are usually equal		
	(2) NRR can never exceed GRR		
	(3) NRR is generally greater than GRR	(i) Total female population $= 21$ (2)	
	(4) None of the above	(3) Female population of child bearing	
61.	For a standard $n \times n$ Latin Square, how with the same standard ?	v many different Latin squares can be ob	tained
	(1) $n!(n-2)!$	(2) $(n-1)!(n-2)!$	
	(3) $n!(n-1)!$	(4) $n!(n+1)!$	
62.	The condition for the time reversal test t	to hold good with usual notations is	
	(1) $P_{01} \times P_{10} = 1$	(2) $P_{10} \times P_{01} = 0$	
	(3) $P_{01}/P_{10} = 1$	(4) $P_{01} + P_{10} = 1$ (1)	
63.	Weight in Laspevre's price index number	(3) Creater than unity	
	 (1) Quantity during the current year (2) Quantity in the base year 	Consider the following matrix [0 0 1/2 1/2]	
	(3) Price during the current war	$P = \begin{bmatrix} 0 & 0 & 1/2 & 1/2 \end{bmatrix}$	
	(4) Price in the base year		
	(1) Thee in the base year		
64.	In India, the collection of vital statistics	started for first time in :	
	(1) 1720 (2) 1886	(3) 1969 (4) 1946	

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- Fisher's ideal formula does not satisfy 65.
 - (2) Circular Test (1) Time Reversal Test
 - (4) Unit Test (3) Factor Reversal Test
- If l_x is the number of persons living at the age 'x' and ' L_x ' the number of persons living 66. in the mid of 'x' and '(x + 1)' years, then the relation between l_x and L_x is : mismold (D)

(1)
$$L_x = \frac{1}{2}(l_x + l_{x+1})$$

(2) $L_x = \left(\frac{x}{2} + l_x\right)$
(3) $L_x = l_{x+\frac{1}{2}}$
(4) $L_x = l_{x+\frac{3}{2}}$

- Fertility rates mainly depend on : 67.
 - (1) Total female population
 - (2) Total population
 - (3) Female population of child bearing age
 - (4) Number of newly born babies
- 68. If the quantity demanded of a commodity is unresponsive to change in prices, then the demand of that commodity is :
 - (2) Elastic (1) Perfectly Inelastic (4) Inelastic
 - (3) Unit Elastic
- The elasticity for the demand of the durable goods is : 69.
 - (1) Zero
 - (3) Greater than unity

- (2) Equal to unity (4) Less than Unity
- 70. Consider the following matrix :

	0	0	1/2	1/2
7	0	0	1/2	1/2
P =	1/2	1/2	0	0
	1/2	1/2	0	0

If P is a stochastic matrix, then which of the following is not true ?

- (1) P is Ergodic
- (3) P is not Regular

- (2) P is Regular
- (4) Both (1) and (3)

71. Service time in queueing theory is usually assumed to follow : no long the off

- (1) Poisson Distribution (2) Erlang Distribution
- (3) Exponential Distribution (4) Normal Distribution

72. For MIMI1 queueing system, the expected number of customers in systems are :

(1) $L_S = \left(\frac{\lambda}{\mu - \lambda}\right)$ (2) $L_S = \left(\frac{\lambda - \mu}{\lambda}\right)$ (3) $L_S = \left(\frac{\mu}{\mu - \lambda}\right)$ (4) $L_S = \left(\frac{\mu - \lambda}{\lambda}\right)$

73. Which of the following relationships is not true?

(1) $W_S = W_q + \frac{1}{\mu}$ (2) $L_S = \lambda W_S$ (3) $L_S = L_q + \frac{1}{\lambda}$ (4) $L_q = \lambda W_q$

74. Maximize $Z = 10 x_1 + 25 x_2$, subject to $0 \le x_1 \le 3, 0 \le x_2 \le 3, x_1 + x_2 \le 5$ (1) 80 at (3, 2)(2) 75 at (0,3)(3) 30 at (3,0)(4) 95 at (2,3)

75. Which variable is added for the less than or equal to type of constraint ?

(1) Slack (2) Surplus (3) Artificial (4) Basic

(C) (Y-T3?) (astraites?) (SC - 3 P.T.O.

76. The convex combination of two points $\bar{x}_1, \bar{x}_2 \in X$ is referred as :

- (1) $(1-\lambda)\bar{x}_1+\lambda\bar{x}_2, 0 \le \lambda \le 1$
- (2) $(1 \lambda)\bar{x}_1 + \lambda\bar{x}_2$, λ is any real number
- (3) $\bar{x}_1 + \lambda \bar{x}_2, 0 \le \lambda \le 1$ module module and module and the second sec
- (4) $\lambda \bar{x}_1 + \lambda \bar{x}_2$, λ is any real number

77. The assignment problem is :

- (1) non-linear programming problem
- (2) dynamic programming problem
- (3) integer linear programming problem
- (4) integer non-linear programming problem

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78.	8. The order of Convergence of Secant Method is :				
	(1) 2.4 (2) 2 (3) 1.62 (4) 1	3 (Dec using			
79.	'9. If $f(0) = 3$, $f(1) = 5$, $f(3) = 21$, then the unique polynomials of degree Newton divided difference interpolation will be :	2 or less using			
	(1) $2x^2 + 2x + 1$ (2) $2x^2 - 3x + 1$				
	(1) $2x^{2} + 2x + 1$ (3) $2x^{2} + 3$ (4) $x^{2} + 3x - 2$				
80	The third difference of a cubic $\Delta^3 y$ function are :				
00.	(1) Constant (2) Not constant				
	(3) Variables (4) None of the above				
	The mean of Binomial distribution $B(n, p)$ is :				
81.	81. The mean of binomial (1) np (2) $np - 1$ (3) $np - 2$ (4) $np - 2$	3			
	Given that $E[X + 4] = 10$ and $E[X + 4]^2 = 116$, then $Var[X]$ is equal to :				
82.	82. Given that L_{1}^{-1} (2) 8 (3) 12 (4) 16				
58	(1) 4	ensity Function			
83	83. Let X be a continuous $\leq x \leq 1$ $(ax, 0 \leq x \leq 1)$				
	$a, 1 \le x \le 2$				
	$f(x) = \begin{cases} -ax + 3a, & 2 \le x \le 3 \end{cases}$				
	(0, x) = 0				
	Then the value of 'a' is given by: (3) 0.3 (4) 0.1				
	(1) 0.4 (2) 0.5 (3) 0.5	Density Function			
8	84. Let 'X' be a continuous random variable with Probability	+ 12 £ (4)			
·	$ax, \qquad 0 \le x \le 1$ $1 \le r \le 2$				
	$f(x) = \begin{cases} a, & 1 \le x \le 2 \\ ax + 3a, & 2 \le x \le 3 \end{cases}$				
	0, x > 3				
	Then the value of $P(X \le 1.5)$ is given by :	(3) integer			
	(1) 0.5 (2) 0.81 (3) 0.19 (4) 0.	(4) integer			
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연116년11일 수천입상 위

85.	The moment generating function of Po	isson Distribution is : and a strange of the state			
	(1) $e^{\lambda}(e^{t}-1)$ (2) $e^{t}(e^{\lambda}-1)$	(3) $e^t - 1$ (4) $e^{\lambda}(1 - e^t)$			
86.	Which of the following is the median of	of the exponential distribution with parameter λ ?			
	(1) λ (2) $-\lambda^{-1}$	(3) λ^{-1} (4) λ^{-2} (5) (5)			
87.	The Quartile Deviation of the normal d	listribution is :			
	(1) Q. D. = $\frac{2}{4}\sigma$ (2) Q. D. = $\frac{2}{3}\sigma$	(3) Q. D. = $\frac{2}{5}\sigma$ (4) Q. D. = $\frac{3}{4}\sigma$			
88.	If A and B are two independent events, then $P(\overline{A} \cap \overline{B})$ is equal to :				
	(1) P(A)P(B)	$(2) 1 - P(A \cup B)$			
	(3) $[1 - P(A)][1 - P(B)]$	(4) All of the above			
89.	If event A and event B has occurred	and it is known that $P(R) = 1$ the conditional			
	probability $P(A B)$ is equal to :	and a to move that $r(D) = 1$, the conditional			
	(1) $P(A)$ (2) $P(B)$	(3) One (4) Zero			
90.	The recurrence formula for geometric distribution is given by :				
	(1) $p(x+i) = qp(x+i)$	(2) $p(x) = qp(x + i)$			
	(3) $p(x + i) = qp(x)$	(4) $p(x) = p(x + i)^{1160} = 10^{100} \text{ substant}$.82			
91.	The correct relationship between A.M,	G.M., and $H.M.$ is :			
	(1) $A.M.=G.M.=H.M.$	(2) G.M. \geq A.M. \geq H.M.			
	(3) H.M. \geq G.M. \geq A.M.	(4) A.M. \geq G.M. \geq H.M			
92.	Average wages of workers of factory are Rs. 550 per month and the standard deviation of wages is 110. The coefficients of variation is :				
	(1) 30% (2) 15%	(3) 500% (4) 20%			
93.	If the mode of a frequency distribution distribution is :	is 16 and its mean is 16, then the median of the			
	(1) 0 (2) 16	(3) 32 (4) 8			
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If Quartile deviation of a set of observations is given as 6.4 and the value of first 94. quartile is 5. What is the value of the third quartile ? (4) 20.2 (3) 17.8 (2) 15.3 (1) 12 For a leptokurtic frequency curve, the measures of kurtosis is : 95. (2) -3 (3) less than 1 (4) greater than 3 (1) 0Standard error of the sample correlation coefficient 'r' is based on 'n' paired values is : 96. (1) $\frac{1+r^2}{\sqrt{n}}$ (2) $\frac{1+r^2}{n}$ (3) $\frac{1-r^2}{\sqrt{n}}$ (4) $\frac{1+r^2}{\sqrt{n-1}}$ 97. Given the following set of equations : $x_1 + 4x_2 - x_3 = 3$ s known that P(B) = 1, the conditional $5x_1 + 2x_2 + 3x_3 = 4$ The basic feasible solution involving x_1 and x_2 is : (1) $\left(\frac{5}{9}, \frac{11}{18}, 0\right)$ (2) $\left(\frac{5}{9}, 0, 0\right)$ (3) $\left(0, \frac{11}{18}, 0\right)$ (4) $\left(\frac{2}{9}, 0, \frac{3}{14}\right)$ The range of a partial correlation coefficient is : 98. (4) -1 to 1 (3) 0 to 1 (2) $-\infty$ to ∞ (1) 0 to ∞ The correct relationship between A.M. G.M., and H The term regression was introduced by : 99. (2) R.A. Fisher (1) Sir Francis Galton (4) P.C. Mahalanobis (3) Karl Pearson If Regression Equations are : 100. 6y = 5x + 9015x = 8y + 30And the variance of x = 4, then the correlation coefficient between 'x' and 'y' is : (4) 0.88 (3) 0.78 (2) 0.67(1) 0.45

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Answe	er keys of PHD-EE-2023	3-24 (STATISTICS) entr	ance exam dated 22.0	3.2024
Q. NO.	A	В	С	D
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8	4	1	1	1
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12	4	4	1	1
13	2	A	3	<u> </u>
10	2	1	<u> </u>	2
15	J	1	1	1
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45	2	1	4	3
46	3	1	3	1
47	3	3	1	2
48	1	3	4	3
49	3	3	1	4
50	2	1	2	2

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O NO	Α	В	С	D
<u>U. NU.</u>	2	4	3	3
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00	1	1	2	2
0/	2	2	1	4
00	Δ	4	1	1
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93	3	4	1	3
94	3	<u> </u>	2	4
95	3		1	2
96	1	3		1
97	2	3	2	<u> </u>
98	1	2	3	4
99	1	2	4	
100	1	1 2	L 2	1 4

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