

Total No. of Printed Pages : 13

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

A

PG-EE-July, 2025

SET-Y

SUBJECT : Statistics

10057

Sr. No.

Time : 1¼ Hours

Max. Marks : 100

Total Questions : 100

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

Name _____ Date of Birth _____

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(Signature of the Candidate)

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PG-EE-July, 2025/(Statistics)(SET-Y)/(A)

SEAL

1. Which of the following is a condition for a set of vectors to be linearly independent ?
 - (1) The determinant of the matrix formed by vectors is zero
 - (2) No vector in the set can be written as a linear combination of the others
 - (3) All vectors lie in the same plane
 - (4) All vectors are unit vectors
2. If a real matrix A satisfies $A^T A = 0$, then rank of A is :
 - (1) 0
 - (2) 1
 - (3) 2
 - (4) Cannot be determined
3. Suppose M is a 4×4 matrix such that $M^3 = 0$. The maximum possible rank of M is :
 - (1) 3
 - (2) 2
 - (3) 1
 - (4) 0
4. For Matrix

$$A = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -6 & 11 & -6 \end{bmatrix}$$

The eigen values are :

- (1) 1, 2, 3
 - (2) 0, 1, 2
 - (3) 1, -2, -3
 - (4) 2, 2, 2
5. If a vector lies in the null space of a matrix A , then which of the following is **true** ?
 - (1) It is an eigenvector
 - (2) It is orthogonal to the column space of A
 - (3) It lies in the row space
 - (4) It solves $A^T x = 0$
 6. If a matrix A of order 3×3 has rank 2, then the homogeneous system $Ax = 0$ has :
 - (1) Only trivial solution
 - (2) No solution
 - (3) Infinite solutions
 - (4) Exactly one non-trivial solution
 7. Let A be a 2×2 matrix such that $A^2 = I$. Then, which of the following is true about the eigenvalues of A ?
 - (1) ± 1
 - (2) 0 and 1
 - (3) Any real number
 - (4) Purely imaginary

8. What is the determinant of the matrix

$$A = \begin{bmatrix} 1 & 2 & 3 \\ 0 & 1 & 4 \\ 5 & 6 & 0 \end{bmatrix}$$

- (1) 3 (2) -1 (3) 0 (4) 1

9. Which of the following matrices is diagonalizable ?

- (1) A matrix with repeated eigen values but incomplete eigenvectors
(2) A matrix with distinct eigen values
(3) A matrix with determinant 0
(4) A matrix with complex entries only

10. The set of all solutions of a homogeneous linear system forms a :

- (1) Null Space (2) Affine set (3) Convex set (4) Subspace

11. If a function $f(x)$ is one-one and onto, then which of the following must exist ?

- (1) Derivative of $f(x)$ (2) Inverse of $f(x)$
(3) Limit of $f(x)$ (4) Integral of $f(x)$

12. If $f(x)$ is defined as

$$f(x) = \begin{cases} x^2, & x \leq 1 \\ 2x-1, & x > 1 \end{cases}$$

Then $f(x)$ is :

- (1) Continuous but not differentiable at $x = 1$
(2) Differentiable at $x = 1$
(3) Discontinuous at $x = 1$
(4) None of the above

13. If $f(x)$ is increasing and differentiable in (a, b) , which of the following is **true** ?

- (1) $f'(x) < 0$ for all $x \in (a, b)$ (2) $f'(x) > 0$ for all $x \in (a, b)$
(3) $f'(x) = 0$ for all $x \in (a, b)$ (4) $f'(x) \geq 0$ for all $x \in (a, b)$

14. Which condition must be violated for a removable discontinuity to occur at $x = a$?
(1) $\lim_{x \rightarrow a^-} f(x) = \lim_{x \rightarrow a^+} f(x)$ (2) $\lim_{x \rightarrow a} f(x) = f(a)$
(3) $\lim_{x \rightarrow a} f(x)$ exists (4) $f(a)$ is defined
15. If $f(x) = x^n$, what is the n th derivative of $f(x)$?
(1) 0 (2) $n!$ (3) x (4) $n \cdot x^{n-1}$
16. If $f(x, y) = x^2y + xy^2$, then $\frac{\partial^2 f}{\partial x \partial y} =$:
(1) $2x + 2y$ (2) $2x$ (3) $2y$ (4) $x + y$
17. Euler's theorem for a homogeneous function $f(x, y)$ of degree n is :
(1) $x \frac{\partial f}{\partial x} + y \frac{\partial f}{\partial y} = 0$ (2) $x \frac{\partial f}{\partial x} + y \frac{\partial f}{\partial y} = nf$
(3) $x \frac{\partial f}{\partial x} + y \frac{\partial f}{\partial y} = f$ (4) $x^2 + y^2 = nf$
18. If $\int_a^b f(x) dx = I$, then $\int_a^b f(a + b - x) dx =$
(1) $-I$ (2) $a + b$ (3) I (4) $f(b - a)$
19. Which of the following is **not** a property of definite integrals ?
(1) Additivity (2) Reversing limits changes the sign
(3) Differentiation (4) Linearity
20. Which of the following best describes a saddle point ?
(1) Local minimum (2) Local maximum
(3) Not an extremum but a stationary point (4) Point of discontinuity
21. The equation $\frac{\partial y}{\partial x} = xy$ is :
(1) Linear and separable (2) Non-linear and not separable
(3) Linear but not separable (4) Separable but not linear

22. Which of the following is a necessary condition for a differential equation to be separable ?
(1) All terms in x and y can be grouped (2) The equation is linear
(3) It contains second-order derivatives (4) Solution involves Laplace transforms
23. The differential equation $\frac{\partial y}{\partial x} + y = e^x$ is :
(1) Homogeneous linear (2) Non-homogeneous linear
(3) Non-linear (4) Separable only
24. The general solution of $y'' - 4y' + 4y = 0$ is :
(1) $y = C_1 e^{2x} + C_2 e^{-2x}$ (2) $y = (C_1 + C_2 x) e^{2x}$
(3) $y = (C_1 x + C_2) x$ (4) $y = (C_1 + C_2 x)$
25. A particular integral of $y'' + y = \sin x$ is :
(1) $x \cos x$ (2) 0 (3) $-\frac{1}{2} \cos x$ (4) $\frac{1}{2} x \sin x$
26. If y_1 and y_2 are solutions of a homogeneous linear DE, then $c_1 y_1 + c_2 y_2$ is also a solution. This is due to :
(1) Superposition principle (2) Linearity violation
(3) Uniqueness theorem (4) Initial condition
27. A differential equation is said to be homogeneous, if :
(1) RHS is 0 (2) All terms are in y only
(3) Solution is constant (4) Independent variable is absent
28. The order of differential equation $\frac{\partial^3 y}{\partial x^3} + 3 \frac{\partial y}{\partial x} = 0$ is :
(1) 1 (2) 2 (3) 3 (4) 0
29. The interior of the set $A = [0, 1] \cup \{2\}$ is :
(1) $[0, 1]$ (2) $(0, 1)$ (3) $\{2\}$ (4) $(0, 1) \cup \{2\}$

30. The closure of the set $(0, 1) \cup (2, 3)$ is :
(1) $[0, 1) \cup (2, 3)$ (2) $(0, 1) \cup (2, 3]$
(3) $[0, 1] \cup [2, 3]$ (4) $(0, 1) \cup (2, 3)$
31. The set of rational numbers \mathbb{Q} and \mathbb{R} is :
(1) Open (2) Closed
(3) Neither open nor closed (4) Compact
32. The sequence $a_n = \frac{1}{n}$ is :
(1) Increasing and bounded (2) Decreasing and unbounded
(3) Divergent (4) Convergent
33. The function $f(x) = \begin{cases} 1, & x \in \mathbb{Q} \\ 0, & x \notin \mathbb{Q} \end{cases}$ in $[0, 1]$ is :
(1) Continuous (2) Riemann integrable
(3) Not Riemann integrable (4) Constant
34. The root test is stronger than the ratio test when :
(1) a_n involves powers like n^n (2) Alternating series
(3) p-series (4) Telescoping series
35. The sequence $a_n = \frac{n+1}{n}$ converges to :
(1) 1 (2) 0 (3) ∞ (4) Does not exist
36. The series $\sum_{n=1}^{\infty} \frac{(-1)^n}{n}$ is :
(1) Absolutely convergent (2) Conditionally convergent
(3) Divergent (4) Not defined
37. The maximum number of corner points in a 2-variable LPP defined by 3 constraints is :
(1) 2 (2) 3 (3) 4 (4) 6

38. The constraints $x + 2y \geq 10$ and $x \geq 0, y \geq 0$ define a region in which direction ?
 (1) Below the line (2) Above the line
 (3) Between axes (4) Unbounded in negative quadrant
39. If in the simplex tableau, all $C_j - Z_j < 0$, then :
 (1) Problem has no solution (2) Current solution is optimal
 (3) Continue iterations (4) Unbounded solution
40. In a transportation problem with 3 sources and 4 destinations, a basic feasible solution must have :
 (1) 7 allocations (2) 12 allocations
 (3) 6 allocations (4) 8 allocations
41. If a constraint is redundant, then :
 (1) It defines the boundary (2) It affects the optimal solution
 (3) It does not affect the feasible region (4) It causes degeneracy
42. In a 4×4 balanced assignment problem, the number of possible assignments is :
 (1) 16 (2) 24 (3) 4 (4) 256
43. Minimize $Z = x + y$, subject to :

$$x + 2y \geq 8$$

$$3x + y \geq 9$$

$$x, y \geq 0$$
- What is the minimum value of Z ?
 (1) 7 (2) 8 (3) 9 (4) 10
44. A dummy row/column is added in assignment problem when :
 (1) Matrix is square (2) Cost is negative
 (3) Problem is unbalanced (4) Supply > demand
45. The relation between forward difference (Δ) and shift operator (E) is :
 (1) $\Delta = E + 1$ (2) $\Delta = E - 1$ (3) $\Delta = 1 - E$ (4) $\Delta = E^2$

46. For interpolation through 3 points, the degree of interpolating polynomial is :
 (1) 1 (2) 2 (3) 3 (4) 4
47. Using Newton-Raphson method, one iteration for $f(x) = x^3 - x - 2$ starting at $x_0 = 1.5$ gives :
 (1) 1.45 (2) 1.60 (3) 1.52 (4) 1.30
48. Newton-Raphson method formula is :
 (1) $x_{n+1} = x_n + \frac{f(x_n)}{f'(x_n)}$ (2) $x_{n+1} = x_n - \frac{f(x_n)}{f'(x_n)}$
 (3) $x_{n+1} = x_n + f(x_n)f'(x_n)$ (4) $x_{n+1} = \frac{f(x_n)}{x_n}$
49. Use Newton's forward difference formula to estimate $f(2.5)$ given :

x	$f(x)$
2	4
3	9
4	16

- (1) 6.25 (2) 10.25 (3) 12.25 (4) 8.25
50. In Lagrange interpolation, find $f(2)$ given :
 $f(1) = 2, f(3) = 9, f(4) = 16$
 (1) 4 (2) 3 (3) 2 (4) 5
51. In Newton's divided difference table, the value of $f[x_0, x_1, x_2]$ is :
 (1) A first divided difference (2) A second divided difference
 (3) A central difference (4) A backward difference
52. The error in interpolation using Newton's forward formula is proportional to :
 (1) h^2 (2) h^3 (3) h^n (4) $\frac{1}{h}$
53. Who is known as the "Father of Computers" ?
 (1) Alan Turing (2) Charles Babbage
 (3) Bill Gates (4) John von Neumann

54. In MS Word, which menu is used for inserting tables ?
(1) Home (2) Insert (3) Page Layout (4) Review
55. Which symbol is used to end a statement in C ?
(1) . (2) : (3) ; (4) #
56. Which operator is used for modulus in C ?
(1) / (2) % (3) ^ (4) //
57. UNIVAC was primarily used for :
(1) Playing games
(2) Word processing
(3) Business and government data processing
(4) Internet browsing
58. An example of volatile memory is :
(1) Hard disk (2) ROM (3) RAM (4) CD-ROM
59. A commonly used file system in Windows is :
(1) FAT (2) NTFS (3) ext4 (4) HFS
60. What is the purpose of task manager ?
(1) Install software (2) Monitor hardware
(3) View running processes (4) Connect internet
61. The decennial census in India is conducted by :
(1) Ministry of Statistics (2) CSO
(3) NSSO (4) Registrar General of India
62. NSSO is mainly responsible for :
(1) Agricultural census
(2) Population census
(3) Sample surveys on socio-economic issues
(4) Industrial policy design

63. If price of a good in base year is ₹ 50 and in current year is ₹ 75, the simple price index is :
(1) 125 (2) 150 (3) 75 (4) 100
64. The Consumer Price Index (CPI) is mainly used to measure :
(1) Agricultural output (2) Industrial production
(3) Inflation (4) Imports
65. If prices increased 20% and quantities reduced 10%, what is the approximate change in total value ?
(1) Increase by 8% (2) Increase by 10%
(3) No change (4) Decrease by 8%
66. Crude Birth Rate (CBR) = 500 births and mid-year population = 50,000. What is CBR ?
(1) 5 (2) 10 (3) 15 (4) 20
67. Calculate Infant Mortality Rate (IMR) if Infant deaths = 150 and Live births = 5000
(1) 30 (2) 25 (3) 15 (4) 3
68. If demand increases and supply remains constant, equilibrium price :
(1) Falls (2) Doubles (3) Stays same (4) Rises
69. The Law of Demand states :
(1) As price increases, demand increases
(2) As price increases, demand decreases
(3) As income decreases, demand increases
(4) Demand is fixed
70. If price rises from ₹ 10 to ₹ 15 and demand falls from 100 to 80, then price elasticity is :
(1) -0.5 (2) 1.5 (3) -2 (4) -1
71. A bar diagram is best suited for representing :
(1) Continuous variables (2) Discrete variables
(3) Interval variables (4) Time series

72. If a dataset has 10 observations and all are equal to 5, the variance is :
(1) 5 (2) 1 (3) 0 (4) 25
73. The geometric mean is preferred when dealing with :
(1) Time-series data (2) Negative values
(3) Ratios or growth rates (4) Ordinal data
74. The standard measure of kurtosis for a normal distribution is :
(1) 0 (2) 1 (3) 3 (4) -1
75. When analysing water quality parameters using Karl Pearson's coefficient of skewness, the formula $\frac{\text{Mean} - \text{Mode}}{\text{Standard Deviation}}$ yields -0.75. This suggests :
(1) Moderate negative skewness (2) Strong negative skewness
(3) Moderate positive skewness (4) No skewness
76. In forest biomass estimation, if the third moment about the mean $\mu_3 = 125$ and $\sigma^3 = 64$, the coefficient of skewness is :
(1) 1.95 (2) 0.51 (3) 1.25 (4) 2.08
77. If Coefficient of Variation of series X is 20% and that of Y is 15%, then :
(1) X is more consistent (2) Y is more consistent
(3) Both are equally consistent (4) No conclusion
78. A positively skewed distribution has:
(1) Mean > Median > Mode (2) Mode > Median > Mean
(3) Mean = Median = Mode (4) Median > Mode > Mean
79. Correlation coefficient between heights of fathers and sons is 0.8. What is the proportion of explained variation ?
(1) 0.64 (2) 0.8 (3) 0.16 (4) 0.96
80. If X and Y are independent, their regression coefficients are :
(1) 1 (2) 0 (3) -1 (4) Undefined

81. In fitting a parabola by least squares, number of normal equations required is :
(1) 2 (2) 3 (3) 4 (4) 1
82. The correlation coefficient between X and Y is 0.9 , standard deviations of X and Y are 3 and 4 respectively, then Covariance between X and Y is :
(1) 10.8 (2) 12 (3) 8 (4) 9
83. Given $\Sigma x = 15$, $\Sigma y = 20$, $\Sigma xy = 62$, $\Sigma x^2 = 55$, $\Sigma y^2 = 102$, $n = 5$. What is Pearson's Correlation Coefficient r ?
(1) 0.13 (2) 0.82 (3) 0.93 (4) 0.63
84. If $r_{12} = 0.9$, $r_{13} = 0.6$ and $r_{23} = 0.4$, the partial correlation coefficient $r_{12.3}$ is :
(1) 0.82 (2) 0.85 (3) 0.90 (4) 0.78
85. If $b_{yx} = 0.6$ and $b_{xy} = 0.4$, then the value of correlation coefficient (r) is :
(1) 0.5 (2) 0.8 (3) 0.6 (4) 0.3
86. A coin is tossed three times. What is the probability of getting at least one head ?
(1) $1/4$ (2) $1/2$ (3) $3/4$ (4) $7/8$
87. If $X \sim U(0, 1)$, then find $P(0.2 \leq X \leq 0.6)$:
(1) 0.4 (2) 0.5 (3) 0.3 (4) 0.6
88. If a random variable has PDF $f(x) = 3x^2$ on $[0, 1]$, then the expected value $E(X)$ is :
(1) 0.5 (2) 0.75 (3) 0.6 (4) 0.65
89. The moment generating function of $N(\mu, \sigma^2)$ is :
(1) $e^{\mu t} + \frac{\sigma^2 t^2}{2}$ (2) $e^{\mu t} - \frac{\sigma^2 t^2}{2}$ (3) $\mu t + \frac{\sigma^2 t^2}{2}$ (4) $\mu t - \frac{\sigma^2 t^2}{2}$
90. For a fair coin, what is the PMF of the number of heads in two tosses ?
(1) $1/3, 1/3, 1/3$ (2) $1/4, 1/2, 1/4$ (3) $1/2, 1/4, 1/4$ (4) $1/8, 3/8, 4/8$
91. What is the area under the standard normal curve between $\mu - \sigma$ and $\mu + \sigma$?
(1) 50% (2) 68% (3) 95% (4) 99.7%

92. For a binomial distribution with $n = 5$ and $p = 0.4$, what is the probability of getting exactly 2 successes ?
(1) 0.38 (2) 0.62 (3) 0.50 (4) 0.35
93. Which distribution models the number of events in a fixed interval of time or space ?
(1) Binomial (2) Normal (3) Poisson (4) Geometric
94. Which of the following is NOT a property of expectation ?
(1) $E(aX + b) = aE(X) + b$ (2) $E(X + Y) = E(X) + E(Y)$
(3) $E(XY) = E(X)E(Y)$ always (4) $E(c) = c$
95. The expected number of trials to get the first success in a geometric distribution is:
(1) $1/p$ (2) $1 - p$ (3) p (4) $\log(p)$
96. For a uniform distribution $U(0, 5)$, the variance is :
(1) 2.5 (2) 1.25 (3) 25 (4) 2.08
97. Find the value of k so that $f(x) = kx$, $0 \leq x \leq 2$ is a valid PDF.
(1) 1 (2) $1/3$ (3) $1/2$ (4) $1/4$
98. A random variable X has the CDF :
$$F(x) = \begin{cases} 0; & x < 0 \\ \frac{x}{2}; & 0 \leq x < 2 \\ 1; & x \geq 2 \end{cases}$$

What is $P(1 < X < 2)$?
(1) 0.5 (2) 1 (3) 0.25 (4) 0.75
99. The number of customers arriving at a shop per hour follows Poisson ($\lambda = 3$). What's the probability that exactly 5 customers arrive ?
(1) 0.111 (2) 0.199 (3) 0.125 (4) 0.101
100. In a geometric distribution with $p = 0.25$, what is the probability that the first success occurs on the third trial ?
(1) 0.4219 (2) 0.1406 (3) 0.25 (4) 0.1875

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1. If a function $f(x)$ is one-one and onto, then which of the following must exist ?

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 (3) Limit of $f(x)$ (4) Integral of $f(x)$

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$$f(x) = \begin{cases} x^2, & x \leq 1 \\ 2x - 1, & x > 1 \end{cases}$$

Then $f(x)$ is :

- (1) Continuous but not differentiable at $x = 1$ (2) Differentiable at $x = 1$
 (3) Discontinuous at $x = 1$ (4) None of the above

3. If $f(x)$ is increasing and differentiable in (a, b) , which of the following is **true** ?

- (1) $f'(x) < 0$ for all $x \in (a, b)$ (2) $f'(x) > 0$ for all $x \in (a, b)$
 (3) $f'(x) = 0$ for all $x \in (a, b)$ (4) $f'(x) \geq 0$ for all $x \in (a, b)$

4. Which condition must be violated for a removable discontinuity to occur at $x = a$?

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 (3) $\lim_{x \rightarrow a} f(x)$ exists (4) $f(a)$ is defined

5. If $f(x) = x^n$, what is the n th derivative of $f(x)$?

- (1) 0 (2) $n!$ (3) x (4) $n \cdot x^{n-1}$

6. If $f(x, y) = x^2y + xy^2$, then $\frac{\partial^2 f}{\partial x \partial y} = :$

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7. Euler's theorem for a homogeneous function $f(x, y)$ of degree n is :

- (1) $x \frac{\partial f}{\partial x} + y \frac{\partial f}{\partial y} = 0$ (2) $x \frac{\partial f}{\partial x} + y \frac{\partial f}{\partial y} = nf$
 (3) $x \frac{\partial f}{\partial x} + y \frac{\partial f}{\partial y} = f$ (4) $x^2 + y^2 = nf$

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13. Which distribution models the number of events in a fixed interval of time or space ?
(1) Binomial (2) Normal
(3) Poisson (4) Geometric
14. Which of the following is NOT a property of expectation ?
(1) $E(aX + b) = aE(X) + b$ (2) $E(X + Y) = E(X) + E(Y)$
(3) $E(XY) = E(X)E(Y)$ always (4) $E(c) = c$
15. The expected number of trials to get the first success in a geometric distribution is:
(1) $1/p$ (2) $1-p$ (3) p (4) $\log(p)$
16. For a uniform distribution $U(0, 5)$, the variance is :
(1) 2.5 (2) 1.25 (3) 25 (4) 2.08
17. Find the value of k so that $f(x) = kx$, $0 \leq x \leq 2$ is a valid PDF.
(1) 1 (2) $1/3$ (3) $1/2$ (4) $1/4$

18. A random variable X has the CDF :

$$F(x) = \begin{cases} 0; & x < 0 \\ \frac{x}{2}; & 0 \leq x < 2 \\ 1; & x \geq 2 \end{cases}$$

What is $P(1 < X < 2)$?

- (1) 0.5 (2) 1 (3) 0.25 (4) 0.75
19. The number of customers arriving at a shop per hour follows Poisson ($\lambda = 3$). What's the probability that exactly 5 customers arrive ?
- (1) 0.111 (2) 0.199 (3) 0.125 (4) 0.101
20. In a geometric distribution with $p = 0.25$, what is the probability that the first success occurs on the third trial ?
- (1) 0.4219 (2) 0.1406 (3) 0.25 (4) 0.1875
21. A bar diagram is best suited for representing :
- (1) Continuous variables (2) Discrete variables
(3) Interval variables (4) Time series
22. If a dataset has 10 observations and all are equal to 5, the variance is :
- (1) 5 (2) 1 (3) 0 (4) 25
23. The geometric mean is preferred when dealing with :
- (1) Time-series data (2) Negative values
(3) Ratios or growth rates (4) Ordinal data
24. The standard measure of kurtosis for a normal distribution is :
- (1) 0 (2) 1 (3) 3 (4) -1
25. When analysing water quality parameters using Karl Pearson's coefficient of skewness, the formula $\frac{\text{Mean} - \text{Mode}}{\text{Standard Deviation}}$ yields -0.75. This suggests :
- (1) Moderate negative skewness (2) Strong negative skewness
(3) Moderate positive skewness (4) No skewness

26. In forest biomass estimation, if the third moment about the mean $\mu_3 = 125$ and $\sigma^3 = 64$, the coefficient of skewness is :
(1) 1.95 (2) 0.51 (3) 1.25 (4) 2.08
27. If Coefficient of Variation of series X is 20% and that of Y is 15%, then :
(1) X is more consistent (2) Y is more consistent
(3) Both are equally consistent (4) No conclusion
28. A positively skewed distribution has:
(1) Mean > Median > Mode (2) Mode > Median > Mean
(3) Mean = Median = Mode (4) Median > Mode > Mean
29. Correlation coefficient between heights of fathers and sons is 0.8. What is the proportion of explained variation ?
(1) 0.64 (2) 0.8 (3) 0.16 (4) 0.96
30. If X and Y are independent, their regression coefficients are :
(1) 1 (2) 0 (3) -1 (4) Undefined
31. In Newton's divided difference table, the value of $f[x_0, x_1, x_2]$ is :
(1) A first divided difference (2) A second divided difference
(3) A central difference (4) A backward difference
32. The error in interpolation using Newton's forward formula is proportional to :
(1) h^2 (2) h^3 (3) h^n (4) $\frac{1}{h}$
33. Who is known as the "Father of Computers" ?
(1) Alan Turing (2) Charles Babbage
(3) Bill Gates (4) John von Neumann
34. In MS Word, which menu is used for inserting tables ?
(1) Home (2) Insert
(3) Page Layout (4) Review

35. Which symbol is used to end a statement in C ?
(1) . (2) : (3) ; (4) #
36. Which operator is used for modulus in C ?
(1) / (2) % (3) ^ (4) //
37. UNIVAC was primarily used for :
(1) Playing games
(2) Word processing
(3) Business and government data processing
(4) Internet browsing
38. An example of volatile memory is :
(1) Hard disk (2) ROM (3) RAM (4) CD-ROM
39. A commonly used file system in Windows is :
(1) FAT (2) NTFS (3) ext4 (4) HFS
40. What is the purpose of task manager ?
(1) Install software (2) Monitor hardware
(3) View running processes (4) Connect internet
41. The set of rational numbers \mathbb{Q} and \mathbb{R} is :
(1) Open (2) Closed
(3) Neither open nor closed (4) Compact
42. The sequence $a_n = \frac{1}{n}$ is :
(1) Increasing and bounded (2) Decreasing and unbounded
(3) Divergent (4) Convergent
43. The function $f(x) = \begin{cases} 1, & x \in \mathbb{Q} \\ 0, & x \notin \mathbb{Q} \end{cases}$ in $[0, 1]$ is :
(1) Continuous (2) Riemann integrable
(3) Not Riemann integrable (4) Constant

44. The root test is stronger than the ratio test when :
 (1) a_n involves powers like n^n (2) Alternating series
 (3) p-series (4) Telescoping series
45. The sequence $a_n = \frac{n+1}{n}$ converges to :
 (1) 1 (2) 0 (3) ∞ (4) Does not exist
46. The series $\sum_{n=1}^{\infty} \frac{(-1)^n}{n}$ is :
 (1) Absolutely convergent (2) Conditionally convergent
 (3) Divergent (4) Not defined
47. The maximum number of corner points in a 2-variable LPP defined by 3 constraints is :
 (1) 2 (2) 3 (3) 4 (4) 6
48. The constraints $x + 2y \geq 10$ and $x \geq 0, y \geq 0$ define a region in which direction ?
 (1) Below the line (2) Above the line
 (3) Between axes (4) Unbounded in negative quadrant
49. If in the simplex tableau, all $C_j - Z_j < 0$, then :
 (1) Problem has no solution (2) Current solution is optimal
 (3) Continue iterations (4) Unbounded solution
50. In a transportation problem with 3 sources and 4 destinations, a basic feasible solution must have :
 (1) 7 allocations (2) 12 allocations
 (3) 6 allocations (4) 8 allocations
51. The equation $\frac{\partial y}{\partial x} = xy$ is :
 (1) Linear and separable (2) Non-linear and not separable
 (3) Linear but not separable (4) Separable but not linear

52. Which of the following is a necessary condition for a differential equation to be separable ?
(1) All terms in x and y can be grouped (2) The equation is linear
(3) It contains second-order derivatives (4) Solution involves Laplace transforms
53. The differential equation $\frac{\partial y}{\partial x} + y = e^x$ is :
(1) Homogeneous linear (2) Non-homogeneous linear
(3) Non-linear (4) Separable only
54. The general solution of $y'' - 4y' + 4y = 0$ is :
(1) $y = C_1 e^{2x} + C_2 e^{-2x}$ (2) $y = (C_1 + C_2 x) e^{2x}$
(3) $y = (C_1 x + C_2) x$ (4) $y = (C_1 + C_2 x)$
55. A particular integral of $y'' + y = \sin x$ is :
(1) $x \cos x$ (2) 0 (3) $-\frac{1}{2} \cos x$ (4) $\frac{1}{2} x \sin x$
56. If y_1 and y_2 are solutions of a homogeneous linear DE, then $c_1 y_1 + c_2 y_2$ is also a solution. This is due to :
(1) Superposition principle (2) Linearity violation
(3) Uniqueness theorem (4) Initial condition
57. A differential equation is said to be homogeneous, if :
(1) RHS is 0 (2) All terms are in y only
(3) Solution is constant (4) Independent variable is absent
58. The order of differential equation $\frac{\partial^3 y}{\partial x^3} + 3 \frac{\partial y}{\partial x} = 0$ is :
(1) 1 (2) 2 (3) 3 (4) 0
59. The interior of the set $A = [0, 1] \cup \{2\}$ is :
(1) $[0, 1]$ (2) $(0, 1)$ (3) $\{2\}$ (4) $(0, 1) \cup \{2\}$

60. The closure of the set $(0, 1) \cup (2, 3)$ is :

- (1) $[0, 1) \cup (2, 3)$ (2) $(0, 1) \cup (2, 3]$
(3) $[0, 1] \cup [2, 3]$ (4) $(0, 1) \cup (2, 3)$

61. If a constraint is redundant, then :

- (1) It defines the boundary
(2) It affects the optimal solution
(3) It does not affect the feasible region
(4) It causes degeneracy

62. In a 4×4 balanced assignment problem, the number of possible assignments is :

- (1) 16 (2) 24 (3) 4 (4) 256

63. Minimize $Z = x + y$, subject to :

$$x + 2y \geq 8$$

$$3x + y \geq 9$$

$$x, y \geq 0$$

What is the minimum value of Z ?

- (1) 7 (2) 8 (3) 9 (4) 10

64. A dummy row/column is added in assignment problem when :

- (1) Matrix is square (2) Cost is negative
(3) Problem is unbalanced (4) Supply > demand

65. The relation between forward difference (Δ) and shift operator (E) is :

- (1) $\Delta = E + 1$ (2) $\Delta = E - 1$ (3) $\Delta = 1 - E$ (4) $\Delta = E^2$

66. For interpolation through 3 points, the degree of interpolating polynomial is :

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

67. Using Newton-Raphson method, one iteration for $f(x) = x^3 - x - 2$ starting at $x_0 = 1.5$ gives :

- (1) 1.45 (2) 1.60 (3) 1.52 (4) 1.30

68. Newton-Raphson method formula is :

$$(1) x_{n+1} = x_n + \frac{f(x_n)}{f'(x_n)}$$

$$(2) x_{n+1} = x_n - \frac{f(x_n)}{f'(x_n)}$$

$$(3) x_{n+1} = x_n + f(x_n) f'(x_n)$$

$$(4) x_{n+1} = \frac{f(x_n)}{x_n}$$

69. Use Newton's forward difference formula to estimate $f(2.5)$ given :

x	$f(x)$
2	4
3	9
4	16

(1) 6.25

(2) 10.25

(3) 12.25

(4) 8.25

70. In Lagrange interpolation, find $f(2)$ given :

$$f(1) = 2, f(3) = 9, f(4) = 16$$

(1) 4

(2) 3

(3) 2

(4) 5

71. The decennial census in India is conducted by :

(1) Ministry of Statistics

(2) CSO

(3) NSSO

(4) Registrar General of India

72. NSSO is mainly responsible for :

(1) Agricultural census

(2) Population census

(3) Sample surveys on socio-economic issues

(4) Industrial policy design

73. If price of a good in base year is ₹ 50 and in current year is ₹ 75, the simple price index is :

(1) 125

(2) 150

(3) 75

(4) 100

74. The Consumer Price Index (CPI) is mainly used to measure :

(1) Agricultural output

(2) Industrial production

(3) Inflation

(4) Imports

75. If prices increased 20% and quantities reduced 10%, what is the approximate change in total value ?
(1) Increase by 8% (2) Increase by 10%
(3) No change (4) Decrease by 8%
76. Crude Birth Rate (CBR) = 500 births and mid-year population = 50,000. What is CBR ?
(1) 5 (2) 10 (3) 15 (4) 20
77. Calculate Infant Mortality Rate (IMR) if Infant deaths = 150 and Live births = 5000
(1) 30 (2) 25 (3) 15 (4) 3
78. If demand increases and supply remains constant, equilibrium price :
(1) Falls (2) Doubles (3) Stays same (4) Rises
79. The Law of Demand states :
(1) As price increases, demand increases
(2) As price increases, demand decreases
(3) As income decreases, demand increases
(4) Demand is fixed
80. If price rises from ₹ 10 to ₹ 15 and demand falls from 100 to 80, then price elasticity is :
(1) -0.5 (2) 1.5 (3) -2 (4) -1
81. Which of the following is a condition for a set of vectors to be linearly independent ?
(1) The determinant of the matrix formed by vectors is zero
(2) No vector in the set can be written as a linear combination of the others
(3) All vectors lie in the same plane
(4) All vectors are unit vectors
82. If a real matrix A satisfies $A^T A = 0$, then rank of A is :
(1) 0 (2) 1
(3) 2 (4) Cannot be determined
83. Suppose M is a 4×4 matrix such that $M^3 = 0$. The maximum possible rank of M is :
(1) 3 (2) 2 (3) 1 (4) 0

84. For Matrix

$$A = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -6 & 11 & -6 \end{bmatrix}$$

The eigen values are :

- (1) 1, 2, 3 (2) 0, 1, 2 (3) 1, -2, -3 (4) 2, 2, 2

85. If a vector lies in the null space of a matrix A, then which of the following is **true** ?

- (1) It is an eigenvector
(2) It is orthogonal to the column space of A
(3) It lies in the row space
(4) It solves $A^T x = 0$

86. If a matrix A of order 3×3 has rank 2, then the homogeneous system $Ax = 0$ has :

- (1) Only trivial solution (2) No solution
(3) Infinite solutions (4) Exactly one non-trivial solution

87. Let A be a 2×2 matrix such that $A^2 = I$. Then, which of the following is true about the eigenvalues of A ?

- (1) ± 1 (2) 0 and 1 (3) Any real number (4) Purely imaginary

88. What is the determinant of the matrix

$$A = \begin{bmatrix} 1 & 2 & 3 \\ 0 & 1 & 4 \\ 5 & 6 & 0 \end{bmatrix}$$

- (1) 3 (2) -1 (3) 0 (4) 1

89. Which of the following matrices is diagonalizable ?

- (1) A matrix with repeated eigen values but incomplete eigenvectors
(2) A matrix with distinct eigen values
(3) A matrix with determinant 0
(4) A matrix with complex entries only

90. The set of all solutions of a homogeneous linear system forms a :
 (1) Null Space (2) Affine set (3) Convex set (4) Subspace
91. In fitting a parabola by least squares, number of normal equations required is :
 (1) 2 (2) 3 (3) 4 (4) 1
92. The correlation coefficient between X and Y is 0.9, standard deviations of X and Y are 3 and 4 respectively, then Covariance between X and Y is :
 (1) 10.8 (2) 12 (3) 8 (4) 9
93. Given $\Sigma x = 15$, $\Sigma y = 20$, $\Sigma xy = 62$, $\Sigma x^2 = 55$, $\Sigma y^2 = 102$, $n = 5$. What is Pearson's Correlation Coefficient r ?
 (1) 0.13 (2) 0.82 (3) 0.93 (4) 0.63
94. If $r_{12} = 0.9$, $r_{13} = 0.6$ and $r_{23} = 0.4$, the partial correlation coefficient $r_{12.3}$ is :
 (1) 0.82 (2) 0.85 (3) 0.90 (4) 0.78
95. If $b_{yx} = 0.6$ and $b_{xy} = 0.4$, then the value of correlation coefficient (r) is :
 (1) 0.5 (2) 0.8 (3) 0.6 (4) 0.3
96. A coin is tossed three times. What is the probability of getting at least one head ?
 (1) $1/4$ (2) $1/2$ (3) $3/4$ (4) $7/8$
97. If $X \sim U(0, 1)$, then find $P(0.2 \leq X \leq 0.6)$:
 (1) 0.4 (2) 0.5 (3) 0.3 (4) 0.6
98. If a random variable has PDF $f(x) = 3x^2$ on $[0, 1]$, then the expected value $E(X)$ is :
 (1) 0.5 (2) 0.75 (3) 0.6 (4) 0.65
99. The moment generating function of $N(\mu, \sigma^2)$ is :
 (1) $e^{\mu t} + \frac{\sigma^2 t^2}{2}$ (2) $e^{\mu t} - \frac{\sigma^2 t^2}{2}$ (3) $\mu t + \frac{\sigma^2 t^2}{2}$ (4) $\mu t - \frac{\sigma^2 t^2}{2}$
100. For a fair coin, what is the PMF of the number of heads in two tosses ?
 (1) $1/3, 1/3, 1/3$ (2) $1/4, 1/2, 1/4$ (3) $1/2, 1/4, 1/4$ (4) $1/8, 3/8, 4/8$

Total No. of Printed Pages : 13

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ARE ASKED TO DO SO)

C

PG-EE-July, 2025

SET-Y

SUBJECT : Statistics

10059

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 _____

(Signature of the Candidate)

(Signature of the Invigilator)

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STARTING THE QUESTION PAPER.**

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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.
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PG-EE-July, 2025/(Statistics)(SET-Y)/(C)

1. If a constraint is redundant, then :

- (1) It defines the boundary (2) It affects the optimal solution
(3) It does not affect the feasible region (4) It causes degeneracy

2. In a 4×4 balanced assignment problem, the number of possible assignments is :

- (1) 16 (2) 24 (3) 4 (4) 256

3. Minimize $Z = x + y$, subject to :

$$x + 2y \geq 8$$

$$3x + y \geq 9$$

$$x, y \geq 0$$

What is the minimum value of Z ?

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7. Using Newton-Raphson method, one iteration for $f(x) = x^3 - x - 2$ starting at $x_0 = 1.5$ gives :

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(4) $x_{n+1} = \frac{f(x_n)}{x_n}$

9. Use Newton's forward difference formula to estimate $f(2.5)$ given :

x	$f(x)$
2	4
3	9
4	16

- (1) 6.25 (2) 10.25 (3) 12.25 (4) 8.25

10. In Lagrange interpolation, find $f(2)$ given :

$$f(1) = 2, f(3) = 9, f(4) = 16$$

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

11. The equation $\frac{\partial y}{\partial x} = xy$ is :

- (1) Linear and separable (2) Non-linear and not separable
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12. Which of the following is a necessary condition for a differential equation to be separable ?

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- (1) $[0, 1]$ (2) $(0, 1)$ (3) $\{2\}$ (4) $(0, 1) \cup \{2\}$
20. The closure of the set $(0, 1) \cup (2, 3)$ is :
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21. Which of the following is a condition for a set of vectors to be linearly independent ?
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- (1) 0 (2) 1
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23. Suppose M is a 4×4 matrix such that $M^3 = 0$. The maximum possible rank of M is :
- (1) 3 (2) 2 (3) 1 (4) 0

24. For Matrix

$$A = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -6 & 11 & -6 \end{bmatrix}$$

The eigen values are :

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(1) Null Space (2) Affine set (3) Convex set (4) Subspace
31. What is the area under the standard normal curve between $\mu - \sigma$ and $\mu + \sigma$?
(1) 50% (2) 68% (3) 95% (4) 99.7%
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(1) 1 (2) $1/3$ (3) $1/2$ (4) $1/4$
38. A random variable X has the CDF :
$$F(x) = \begin{cases} 0; & x < 0 \\ \frac{x}{2}; & 0 \leq x < 2 \\ 1; & x \geq 2 \end{cases}$$

What is $P(1 < X < 2)$?
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51. The set of rational numbers \mathbb{Q} and \mathbb{R} is :
- (1) Open
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- (1) 1
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57. The maximum number of corner points in a 2-variable LPP defined by 3 constraints is :
(1) 2 (2) 3 (3) 4 (4) 6
58. The constraints $x + 2y \geq 10$ and $x \geq 0, y \geq 0$ define a region in which direction ?
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62. If a dataset has 10 observations and all are equal to 5, the variance is :
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63. The geometric mean is preferred when dealing with :
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65. When analysing water quality parameters using Karl Pearson's coefficient of skewness, the formula $\frac{\text{Mean} - \text{Mode}}{\text{Standard Deviation}}$ yields -0.75 . This suggests :
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66. In forest biomass estimation, if the third moment about the mean $\mu_3 = 125$ and $\sigma^3 = 64$, the coefficient of skewness is :
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67. If Coefficient of Variation of series X is 20% and that of Y is 15%, then :
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71. In fitting a parabola by least squares, number of normal equations required is :
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72. The correlation coefficient between X and Y is 0.9 , standard deviations of X and Y are 3 and 4 respectively, then Covariance between X and Y is :
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73. Given $\Sigma x = 15$, $\Sigma y = 20$, $\Sigma xy = 62$, $\Sigma x^2 = 55$, $\Sigma y^2 = 102$, $n = 5$. What is Pearson's Correlation Coefficient r ?
- (1) 0.13 (2) 0.82 (3) 0.93 (4) 0.63

74. If $r_{12} = 0.9$, $r_{13} = 0.6$ and $r_{23} = 0.4$, the partial correlation coefficient $r_{12.3}$ is :
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75. If $b_{yx} = 0.6$ and $b_{xy} = 0.4$, then the value of correlation coefficient (r) is :
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77. If $X \sim U(0, 1)$, then find $P(0.2 \leq X \leq 0.6)$:
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78. If a random variable has PDF $f(x) = 3x^2$ on $[0, 1]$, then the expected value $E(X)$ is :
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79. The moment generating function of $N(\mu, \sigma^2)$ is :
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80. For a fair coin, what is the PMF of the number of heads in two tosses ?
(1) $1/3, 1/3, 1/3$ (2) $1/4, 1/2, 1/4$ (3) $1/2, 1/4, 1/4$ (4) $1/8, 3/8, 4/8$
81. If a function $f(x)$ is one-one and onto, then which of the following must exist ?
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82. If $f(x)$ is defined as

$$f(x) = \begin{cases} x^2, & x \leq 1 \\ 2x - 1, & x > 1 \end{cases}$$

Then $f(x)$ is :

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(2) Differentiable at $x = 1$
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(4) None of the above

83. If $f(x)$ is increasing and differentiable in (a, b) , which of the following is **true** ?
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84. Which condition must be violated for a removable discontinuity to occur at $x = a$?
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88. If $\int_a^b f(x) dx = I$, then $\int_a^b f(a + b - x) dx =$
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91. In Newton's divided difference table, the value of $f[x_0, x_1, x_2]$ is :
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Total No. of Printed Pages : 13

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ARE ASKED TO DO SO)

D

PG-EE-July, 2025

SET-Y

SUBJECT : Statistics

10060

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 _____

(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 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.**

PG-EE-July, 2025/(Statistics)(SET-Y)/(D)

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41. What is the area under the standard normal curve between $\mu - \sigma$ and $\mu + \sigma$?
(1) 50% (2) 68% (3) 95% (4) 99.7%
42. For a binomial distribution with $n = 5$ and $p = 0.4$, what is the probability of getting exactly 2 successes ?
(1) 0.38 (2) 0.62 (3) 0.50 (4) 0.35
43. Which distribution models the number of events in a fixed interval of time or space ?
(1) Binomial (2) Normal (3) Poisson (4) Geometric

44. Which of the following is NOT a property of expectation ?
 (1) $E(aX + b) = aE(X) + b$ (2) $E(X + Y) = E(X) + E(Y)$
 (3) $E(XY) = E(X)E(Y)$ always (4) $E(c) = c$
45. The expected number of trials to get the first success in a geometric distribution is:
 (1) $1/p$ (2) $1 - p$ (3) p (4) $\log(p)$
46. For a uniform distribution $U(0, 5)$, the variance is :
 (1) 2.5 (2) 1.25 (3) 25 (4) 2.08
47. Find the value of k so that $f(x) = kx$, $0 \leq x \leq 2$ is a valid PDF.
 (1) 1 (2) $1/3$ (3) $1/2$ (4) $1/4$
48. A random variable X has the CDF :

$$F(x) = \begin{cases} 0; & x < 0 \\ \frac{x}{2}; & 0 \leq x < 2 \\ 1; & x \geq 2 \end{cases}$$

 What is $P(1 < X < 2)$?
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 (1) 0.5 (2) 0.75 (3) 0.6 (4) 0.65
69. The moment generating function of $N(\mu, \sigma^2)$ is :
 (1) $e^{t\mu} + \frac{\sigma^2 t^2}{2}$ (2) $e^{t\mu} - \frac{\sigma^2 t^2}{2}$ (3) $\mu t + \frac{\sigma^2 t^2}{2}$ (4) $\mu t - \frac{\sigma^2 t^2}{2}$
70. For a fair coin, what is the PMF of the number of heads in two tosses ?
 (1) $1/3, 1/3, 1/3$ (2) $1/4, 1/2, 1/4$ (3) $1/2, 1/4, 1/4$ (4) $1/8, 3/8, 4/8$
71. If a constraint is redundant, then :
 (1) It defines the boundary (2) It affects the optimal solution
 (3) It does not affect the feasible region (4) It causes degeneracy

72. In a 4×4 balanced assignment problem, the number of possible assignments is :
 (1) 16 (2) 24 (3) 4 (4) 256

73. Minimize $Z = x + y$, subject to :

$$x + 2y \geq 8$$

$$3x + y \geq 9$$

$$x, y \geq 0$$

What is the minimum value of Z ?

- (1) 7 (2) 8 (3) 9 (4) 10

74. A dummy row/column is added in assignment problem when :

- (1) Matrix is square (2) Cost is negative
 (3) Problem is unbalanced (4) Supply > demand

75. The relation between forward difference (Δ) and shift operator (E) is :

- (1) $\Delta = E + 1$ (2) $\Delta = E - 1$ (3) $\Delta = 1 - E$ (4) $\Delta = E^2$

76. For interpolation through 3 points, the degree of interpolating polynomial is :

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

77. Using Newton-Raphson method, one iteration for $f(x) = x^3 - x - 2$ starting at $x_0 = 1.5$ gives :

- (1) 1.45 (2) 1.60 (3) 1.52 (4) 1.30

78. Newton-Raphson method formula is :

- (1) $x_{n+1} = x_n + \frac{f(x_n)}{f'(x_n)}$ (2) $x_{n+1} = x_n - \frac{f(x_n)}{f'(x_n)}$
 (3) $x_{n+1} = x_n + f(x_n)f'(x_n)$ (4) $x_{n+1} = \frac{f(x_n)}{x_n}$

79. Use Newton's forward difference formula to estimate $f(2.5)$ given :

x	$f(x)$
2	4
3	9
4	16

- (1) 6.25 (2) 10.25 (3) 12.25 (4) 8.25

80. In Lagrange interpolation, find $f(2)$ given :

$$f(1) = 2, f(3) = 9, f(4) = 16$$

(1) 4

(2) 3

(3) 2

(4) 5

81. The equation $\frac{\partial y}{\partial x} = xy$ is :

(1) Linear and separable

(2) Non-linear and not separable

(3) Linear but not separable

(4) Separable but not linear

82. Which of the following is a necessary condition for a differential equation to be separable ?

(1) All terms in x and y can be grouped

(2) The equation is linear

(3) It contains second-order derivatives

(4) Solution involves Laplace transforms

83. The differential equation $\frac{\partial y}{\partial x} + y = e^x$ is :

(1) Homogeneous linear

(2) Non-homogeneous linear

(3) Non-linear

(4) Separable only

84. The general solution of $y'' - 4y' + 4y = 0$ is :

(1) $y = C_1 e^{2x} + C_2 e^{-2x}$

(2) $y = (C_1 + C_2 x) e^{2x}$

(3) $y = (C_1 x + C_2) x$

(4) $y = (C_1 + C_2 x)$

85. A particular integral of $y'' + y = \sin x$ is :

(1) $x \cos x$

(2) 0

(3) $-\frac{1}{2} \cos x$

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

86. If y_1 and y_2 are solutions of a homogeneous linear DE, then $c_1 y_1 + c_2 y_2$ is also a solution. This is due to :

(1) Superposition principle

(2) Linearity violation

(3) Uniqueness theorem

(4) Initial condition

87. A differential equation is said to be homogeneous, if :
(1) RHS is 0 (2) All terms are in y only
(3) Solution is constant (4) Independent variable is absent
88. The order of differential equation $\frac{\partial^3 y}{\partial x^3} + 3\frac{\partial y}{\partial x} = 0$ is :
(1) 1 (2) 2 (3) 3 (4) 0
89. The interior of the set $A = [0, 1] \cup \{2\}$ is :
(1) $[0, 1]$ (2) $(0, 1)$ (3) $\{2\}$ (4) $(0, 1) \cup \{2\}$
90. The closure of the set $(0, 1) \cup (2, 3)$ is :
(1) $[0, 1] \cup (2, 3)$ (2) $(0, 1) \cup (2, 3]$
(3) $[0, 1] \cup [2, 3]$ (4) $(0, 1) \cup (2, 3)$
91. Which of the following is a condition for a set of vectors to be linearly independent ?
(1) The determinant of the matrix formed by vectors is zero
(2) No vector in the set can be written as a linear combination of the others
(3) All vectors lie in the same plane
(4) All vectors are unit vectors
92. If a real matrix A satisfies $A^T A = 0$, then rank of A is :
(1) 0 (2) 1
(3) 2 (4) Cannot be determined
93. Suppose M is a 4×4 matrix such that $M^3 = 0$. The maximum possible rank of M is :
(1) 3 (2) 2 (3) 1 (4) 0
94. For Matrix

$$A = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -6 & 11 & -6 \end{bmatrix}$$

The eigen values are :

- (1) 1, 2, 3 (2) 0, 1, 2 (3) 1, -2, -3 (4) 2, 2, 2

95. If a vector lies in the null space of a matrix A , then which of the following is *true* ?
- (1) It is an eigenvector
 - (2) It is orthogonal to the column space of A
 - (3) It lies in the row space
 - (4) It solves $A^T x = 0$
96. If a matrix A of order 3×3 has rank 2, then the homogeneous system $Ax = 0$ has :
- (1) Only trivial solution
 - (2) No solution
 - (3) Infinite solutions
 - (4) Exactly one non-trivial solution
97. Let A be a 2×2 matrix such that $A^2 = I$. Then, which of the following is true about the eigenvalues of A ?
- (1) ± 1
 - (2) 0 and 1
 - (3) Any real number
 - (4) Purely imaginary
98. What is the determinant of the matrix
- $$A = \begin{bmatrix} 1 & 2 & 3 \\ 0 & 1 & 4 \\ 5 & 6 & 0 \end{bmatrix}$$
- (1) 3
 - (2) -1
 - (3) 0
 - (4) 1
99. Which of the following matrices is diagonalizable ?
- (1) A matrix with repeated eigen values but incomplete eigenvectors
 - (2) A matrix with distinct eigen values
 - (3) A matrix with determinant 0
 - (4) A matrix with complex entries only
100. The set of all solutions of a homogeneous linear system forms a :
- (1) Null Space
 - (2) Affine set
 - (3) Convex set
 - (4) Subspace

Answer keys of M.Sc. (Statistics) entrance exam dated 18.07.2025

Q. NO.	A	B	C	D
1	2	2	3	2
2	1	1	2	3
3	2	4	4	3
4	1	2	3	3
5	2	2	2	1
6	3	1	2	1
7	1	2	3	2
8	4	3	2	1
9	2	3	1	1
10	4	3	1	2
11	2	2	1	2
12	1	4	1	3
13	4	3	2	2
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21	1	2	2	3
22	1	3	1	4
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24	2	3	1	1
25	4	1	2	1
26	1	1	3	2
27	1	2	1	3
28	3	1	4	2
29	2	1	2	2
30	3	2	4	1
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36	2	2	4	1
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38	2	3	1	3
39	2	2	4	3
40	1	3	2	3
41	3	3	4	2
42	2	4	3	4
43	4	3	2	3
44	3	1	3	3
45	2	1	1	1
46	2	2	2	4
47	3	3	1	3
48	2	2	4	1
49	1	2	2	4
50	1	1	4	2

Arbuz
18/07/2025

Qalp
18/07/25
Page 1 of 2

Smaluk
18/7/2025

Uguz
18/7/25

Answer keys of M.Sc. (Statistics) entrance exam dated 18.07.2025

Q. NO.	A	B	C	D
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54	2	2	1	3
55	3	4	1	1
56	2	1	2	2
57	3	1	3	1
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61	4	3	2	2
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66	2	2	1	4
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91	2	2	2	2
92	4	1	3	1
93	3	1	2	2
94	3	3	2	1
95	1	1	3	2
96	4	4	2	3
97	3	1	3	1
98	1	2	3	4
99	4	1	2	2
100	2	2	3	4

Arshad
18/07/2025

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18/07/25

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