STATISTICS

1. Which of the following is the $\lim_{n\to\infty}\left(1-\frac{2}{n}\right)^n$?

   (A) 1
   (B) 0
   (C) e^2
   (D) e^{-2}

2. $\lim_{n\to\infty}\frac{\sin n}{n^2}$ is

   (A) -1
   (B) 0
   (C) 1
   (D) Does not have a limit

3. $\sum_{n=1}^{\infty}\frac{1}{3^n}$ is

   (A) 0
   (B) $\frac{1}{2}$
   (C) 1
   (D) 2

4. Which of the following is equal to $f\left(g\left(\frac{1}{2}\right)\right)+g\left(f\left(\frac{1}{2}\right)\right)$, where $f(x)=x,\ 0<x<1$ and $g(x)=1-x,\ 0<x<1$ and $f\left(g(.)\right)$ denotes the composition of functions *f* and *g*?

   (A) 0
   (B) 1
   (C) $\frac{1}{2}$
   (D) 2

5. $\int_0^\infty e^{-x^2/2} dx$ is

(A) $\sqrt{\dfrac{\pi}{2}}$
(B) $\sqrt{\pi}$
(C) $\dfrac{\pi}{2}$
(D) $\dfrac{1}{\pi}$

6. $\int_{-1}^{1} |x| \, dx$ is

(A) 0
(B) 1
(C) $\dfrac{1}{2}$
(D) 2

7. Which of the following is not true for an idempotent matrix?

(A) The matrix is its own inverse always
(B) The rank of the matrix is equal to the number of non-null entries in its leading diagonal
(C) The rank of the matrix is equal to its trace
(D) The product of the matrix with itself is the same as itself

8. Which of the following is not true for the matrix $M = \begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$?

(A) M is symmetric
(B) M is idempotent
(C) M is non-singular
(D) The product of M with itself is the identity matrix of order 2

9. Which of the following is not true for the matrix $M = \begin{bmatrix} 0 & -1 \\ -1 & 0 \end{bmatrix}$?

(A) One of the eigenvalue of M is 1
(B) Both the eigenvalues of M are real
(C) The two eigenvalues of M are 1 and 1
(D) One of the eigenvalue of M is -1

10. Which of the following is not satisfied by any vector space *V*?

(A) There is a vector called null vector in *V*
(B) The null vector in *V* is unique
(C) The null vector in *V* is the null vector in any subspace of *V*
(D) *V* need not have any null vector

11. Let $P(E)=\frac{1}{2}, P(F)=\frac{1}{2}, \; P(E \mid F)=\frac{1}{3}$. Then $P(E \cup F)$ is

(A) $\frac{1}{6}$

(B) $\frac{1}{3}$

(C) $\frac{1}{2}$

(D) $\frac{5}{6}$

12. For any two mutually exclusive events *E* and *F* in a probability space, which of the following need not be true?

(A) $P(E \cap F)=0$
(B) $P(E \mid F)=0$ provided $P(F)>0$
(C) $P(E \cup F)=P(E)+P(F)$
(D) $P(E \cap F)= P(E)P(F)$

13. Which of the following is equal to $P(E \cup F)$ for two independent events *E* and *F* in a probability space given that $P(E)$ and $P(F)$ are in (0, 1)?

(A) $P(E)+P(F)$
(B) $1-P(E^c)P(F^c)$
(C) $1-P(E)P(F)$
(D) $P(E)P(F)$

14. What is the probability of getting at least one Tail if two fair coins are thrown simultaneously once?

(A) $\frac{1}{4}$

(B) $\frac{1}{2}$

(C) $\frac{3}{4}$

(D) $\frac{1}{3}$

15. What is the second moment of random variable *X*, given that its expected value is 1 and the coefficient of variation is 1?

(A) 0
(B) 1
(C) 2
(D) 4

16. Which of the following is the probability distribution of sum of ten independent and identically distributed Bernoulli random variables, with success probability $P[X=1]=\frac{2}{3}$?

(A) Binomial distribution with parameters 10 and $\frac{1}{30}$

(B) Binomial distribution with parameters 10 and $\frac{2}{3}$

(C) Bernoulli distribution with parameter 10

(D) Binomial distribution with parameters 10 and 1

17. If $M(t)$ is the moment generating function of a random variable *X*, then

(A) $M(0)=0$

(B) $M(0)=P(X=0)$

(C) $M(0)=1$

(D) $M(0)=E(X)$

18. The degrees of freedom of errors in a completely randomized design model with 20 observations and 4 treatments is

(A) 15
(B) 17
(C) 16
(D) 18

19. A data set has mean 5 and variance 5. If it is found that all the observations in the data set have to be 1 more than what they are, which of the following is true?

(A) The new mean is 5 and the new variance is 5
(B) The new mean is 6 and the new variance is 6
(C) The new mean is 5 and the new variance is 6
(D) The new mean is 6 and the new variance is 5

20. Let F be the distribution function of a random variable X. Then, which of the following is not true?

(A) Domain of F is the whole real line
(B) Range of F is the closed interval [0, 1]
(C) The function F is non-decreasing
(D) The function F is a continuous function

21. Which of the following is true for a random variable U having Uniform distribution over (0, 1)?

(A) Random variable $\frac{1}{U}$ has Uniform distribution over (0, 1)

(B) Random variable $U - 1$ has Uniform distribution over (0, 1)

(C) Random variable $2 - U$ has Uniform distribution over (1, 2)

(D) Square of U has Uniform distribution over (0, 1)

22. Which of the following is not true if X has standard normal distribution?

(A) Distribution of $-X$ is standard normal
(B) Distribution of $1 - X$ is normal with mean 1 and variance 1
(C) Distribution of $X - 1$ is normal with mean -1 and variance 1
(D) Distribution of $\frac{1}{X}$ is normal with mean 0 and variance 1

23. Which of the following can be an ideal curve to represent the population growth?

(A) Logistic curve
(B) Logarithmic curve
(C) Ogive curve
(D) Pareto curve

24. For what possible values of x, the series $\sum_{n=0}^{\infty} \frac{9+x^n}{5^n}$ converges?

(A) For all values less than 0
(B) $x > 0$
(C) $-3 < x < 3$
(D) $-5 < x < 5$

25. Which of the following series converge?

(i) $\sum_{n=1}^{\infty} \frac{(-1)^n}{1+\frac{1}{n}}$

(ii) $\sum_{n=2}^{\infty} \frac{1}{\ln\left(n^4\right)}$

(iii) $\sum_{n=1}^{\infty} \frac{n}{\sqrt{n^2+1}}$

(A) (i) and (ii)
(B) (ii) and (iii)
(C) (i), (ii) and (iii)
(D) None of the above

26. If the terms of a sequence $\{a_n\}$ are: $a_n = \frac{1}{3n^3} + \frac{2^2}{3n^3} + \frac{3^2}{3n^3} + \ldots + \frac{n^2}{3n^3}$. What will be $\lim_{n\to\infty} a_n$?

(A) Sequence diverges
(B) 1
(C) $\frac{1}{3}$
(D) $\frac{1}{9}$

27. Let A be a 4×4 nonsingular matrix and B be the matrix obtained from A by adding to its third row twice the first row. Then $\det\left(2A^{-1}B\right)$ equals

(A) 2
(B) 4
(C) 8
(D) 16

28. Let f be defined on [0, 1] as

$$f(x) = \begin{cases} 0, & \text{if } x \text{ is rational} \\ 1, & \text{if } x \text{ is irrational} \end{cases}$$

Which of the following is true about f ?

(A) Bounded and Rieman integrable over [0, 1]
(B) Not bounded and Rieman integrable over [0, 1]
(C) Bounded and not Rieman integrable over [0, 1]
(D) Neither bounded nor Rieman integrable over [0, 1]

29. The system of equations $4x + 6y = 8$, $7x + 8y = 9$, $3x + 2y = 1$, has

(A) no solution
(B) only one solution
(C) two solutions
(D) infinite number of solutions

30. If $\int_0^x f(t)dt = x^2 \sin x + x^3$, then $f\left(\frac{\pi}{2}\right)$ is

(A) $\left(\frac{\pi}{2}\right)^2 + \left(\frac{\pi}{2}\right)^3$
(B) $\pi + \frac{3\pi^2}{4}$
(C) $\pi - \frac{3\pi^2}{4}$
(D) 0

31. On which interval, the series $\sum_{m=1}^{\infty} x^{\ln m}$, $x > 0$, is convergent?

(A) $\left(0, \frac{1}{e}\right)$

(B) $\left(\frac{1}{e}, e\right)$

(C) $(0, e)$

(D) $(1, e)$

32. Let M be a 3×3 matrix and suppose that 1, 2 and 3 are the eigenvalues of M. If $M^{-1} = \frac{M^2}{\alpha} - M + \frac{11}{\alpha} I_{33}$ for some scalar $\alpha \neq 0$, then α is equal to

(A) 2
(B) 3
(C) 6
(D) 11

33. Which of the following is the symmetric matrix for the given quadratic form

$$Q = 2x_1^2 + 2x_2^2 + 5x_3^2 - 3x_1x_2 + 7x_3x_1$$

(A) $\begin{bmatrix} 1 & -7/2 & 3/2 \\ -7/2 & 2 & 0 \\ 3/2 & 0 & 5/2 \end{bmatrix}$

(B) $\begin{bmatrix} 1 & -3/2 & 7/2 \\ -3/2 & 2 & 0 \\ 7/2 & 0 & 5/2 \end{bmatrix}$

(C) $\begin{bmatrix} 1 & 3/2 & -7/2 \\ 3/2 & 2 & 0 \\ -7/2 & 0 & 5/2 \end{bmatrix}$

(D) $\begin{bmatrix} 2 & -3/2 & 7/2 \\ -3/2 & 2 & 0 \\ 7/2 & 0 & 5 \end{bmatrix}$

34. Let $P = \dfrac{XX^T}{X^T X}$ be an $n \times n$ $(n > 1)$ matrix, where X is a non-zero column vector. Then which one of the following statements is false?

(A) P is idempotent
(B) P is symmetric
(C) P is orthogonal
(D) Rank of P is one

35. $\lim\limits_{n \to \infty} \dfrac{1-2+3-4+5-6+....(-2n)}{\sqrt{n^2+1}+\sqrt{n^2-1}}$ equals

(A) ∞

(B) $\dfrac{1}{2}$

(C) 0

(D) $-\dfrac{1}{2}$

36. If A is a 3 × 3 non zero matrix such that $A^2 = \mathbf{0}$, then the number of non zero eigen values of A is

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

37. Let A be a 3 × 3 real matrix with eigenvalues 1, 2, 3 and let $B = A^{-1} + A^2$. Then the trace of the matrix B is equal to

(A) $\dfrac{91}{6}$

(B) $\dfrac{95}{6}$

(C) $\dfrac{97}{6}$

(D) $\dfrac{101}{6}$

38. The value of $\iint_S e^{-(x+y)} dx\, dy,$ where $S = \{(x, y): 0 < x < 1,\ y > 0, 1 < x + y < 2\}$ equals

(A) 1
(B) 2
(C) $e^{-1} - e^{-2}$
(D) $e^2 - e$

39. Let $f(x) = x|x| + |x-1|,\ -\infty < x < \infty$, then

(A) f is not differentiable at $x = 0$ and $x = 1$
(B) f is differentiable at $x = 0$ but not differentiable at $x = 1$
(C) f is not differentiable at $x = 0$ but differentiable at $x = 1$
(D) f is differentiable at $x = 0$ and $x = 1$

40. Which one of the following is (are) examples of Secondary Data?

(i) Counting number of mistakes in a book
(ii) Copying the number of runs scored by Batsman in Test match

(A) Only (i)
(B) Only (ii)
(C) Both (i) and (ii)
(D) Neither (i) nor (ii)

41. Ten observations are collected on a variable in an interval scale . Then which one of the following cannot be true?

(A) Its standard deviation is positive when the mean is positive
(B) Its mean could be negative while variance is positive
(C) Both mean and variance have to be of the same sign
(D) Its mean could be negative while standard deviation is positive

42. The mean marks of 50 students were found to be 20, but later it was discovered that a score 73 was misread as 23. The correct mean is

(A) 19
(B) 21
(C) 23
(D) 23.5

43. A student pedals from his home to the college at the speed of 10 km/hour and back at the speed of 15 km/hour. Then his average speed in km/hour is

(A) 12
(B) 12.2
(C) 12.5
(D) None of the above

44. In a one-day cricket match a bowler bowls three maiden overs and concedes 5, 7, 8, 1, 2, 1 and 1 runs respectively in the overs of his full share. What could be suggested as the most appropriate representative value?

(A) 2.5
(B) 1.5
(C) 1
(D) Cannot be computed

45. The formula for calculating Compound Rate of interest is essentially based on

(A) Arithmetic Mean
(B) Geometric Mean
(C) Harmonic Mean
(D) None of the above

46. Given 10 observations, if one of the observations is zero, one should not use

(A) Arithmetic Mean and Geometric Mean
(B) Geometric Mean and Harmonic Mean
(C) Harmonic Mean and Arithmetic Mean
(D) Arithmetic Mean, Geometric Mean and Harmonic Mean

47. In an experiment, weights of 15 students were collected at random. The following data in kilogram was reported:

56, 46, 77, 70, 60, 65, 51, 45, 62, 53, 55, 60 and 81, while two responders did not disclose the exact weight.

To understand the variations in weight, what could be the most appropriate measure ?

(A) Range
(B) Quartile deviation
(C) Standard Deviation
(D) Data is not adequate for answering the query

48. If the algebraic sum of deviations of 10 observations measured from 15 is 7, then the mean is

(A) 10.5
(B) 70
(C) 15.5
(D) 15.7

49. The mean score obtained by boys in an entrance exam was 60 and that of girls was 40. If the average marks of all those who took the exam was 46, then the percentage of boys and girls who took exam was

(A) (60, 40)
(B) (40, 60)
(C) (30, 70)
(D) (70, 30)

50. A system consisting of n components function, if and only if, at least one of the n components functions. Suppose that all the n components of the system function independently, each with probability $\frac{3}{4}$. If the probability of functioning of system is $\frac{63}{64}$, then the value of n is

(A) 2
(B) 3
(C) 4
(D) 5

51. A player tossed three fair coins. He wins ₹50 if three heads occur, ₹20 if two heads occur and ₹10 if one head occurs. What is his expected gain?

(A) $\frac{70}{4}$
(B) $\frac{65}{4}$
(C) $\frac{70}{2}$
(D) $\frac{65}{2}$

52. If $F(x) = c\left(1 - e^{-2x}\right),\ x \geq 0,$ is a distribution function of a random variable, then c is

(A) $\frac{1}{2}$

(B) 1

(C) 2

(D) -1

53. The first four moments of a distribution are 0, 2, 0, 12. Then the distribution is

(A) positively skewed
(B) negatively skewed
(C) mesokurtic
(D) platykurtic

54. Mean deviation is least when measured from

(A) Mean
(B) Median
(C) Mode
(D) Zero

55. For a binomial distribution, if the mean is 2 and the variance is $\frac{4}{3}$, then the probability of success is

(A) $\frac{1}{4}$

(B) $\frac{3}{4}$

(C) $\frac{2}{3}$

(D) $\frac{1}{3}$

56. If $X_1, X_2, ..., X_n$ are independent and identically distributed random variables following geometric distribution, then the distribution of $\sum_{i=1}^{n} X_i$ is

(A) Geometric
(B) Poisson
(C) Negative binomial
(D) Binomial

57. Let X be a continuous random variable such that $E|X| < \infty$ and $P\left(X \geq \frac{1}{2} + x\right) = P\left(X \leq \frac{1}{2} - x\right)$ for all $x \in \mathbb{R}$. Then

(A) $E(X) = \frac{1}{2}$ and median(X) $= \frac{1}{2}$

(B) $E(X) = \frac{1}{2}$ and median(X) $> \frac{1}{2}$

(C) $E(X) < \frac{1}{2}$ and median(X) $= \frac{1}{2}$

(D) $E(X) < \frac{1}{2}$ and median(X) $> \frac{1}{2}$

58. If $f(x) = ce^{-\frac{x^2}{4} + \frac{3x}{2}}$ is the pdf of a normal $N(\mu, \sigma^2)$ distribution then (μ, σ^2) are

(A) (2, 3)
(B) (3, 1)
(C) (3, 2)
(D) None of the above

59. Let $X \sim N(\mu, \sigma^2)$. If $P(X \leq 15) = \frac{1}{2}$, then μ is

(A) 10
(B) 15
(C) 20
(D) None of the above

60. Let X be any random variable with mean μ and variance 9. Then, the smallest value of m such that $P\left(|X-\mu|<m\right)\geq 0.99$, is

(A) 90

(B) $\sqrt{90}$

(C) $\sqrt{\dfrac{100}{11}}$

(D) 30

61. Let X_1 and X_2 be independent random variables with respective moment generating functions $M_1(t)=\left(\frac{3}{4}+\frac{1}{4}e^t\right)^3$ and $M_2(t)=e^{2\left(e^t-1\right)}$, $-\infty<t<\infty$. Then, the value of $P\left(X_1+X_2=1\right)$ is

(A) $\dfrac{81}{64}e^{-2}$

(B) $\dfrac{27}{64}e^{-2}$

(C) $\dfrac{11}{64}e^{-2}$

(D) $\dfrac{27}{32}e^{-2}$

62. A circle of random radius R (in cm) is constructed, where the random variable R has uniform distribution over the interval (0, 1). Then, the probability that the area of the circle is less than 1 cm^2, is

(A) $\dfrac{1}{4\sqrt{\pi}}$

(B) $\dfrac{1}{3\sqrt{\pi}}$

(C) $\dfrac{1}{2\sqrt{\pi}}$

(D) $\dfrac{1}{\sqrt{\pi}}$

63. Perfect positive correlation was found between two series of X and Y. If the covariance between the two was 2 and variance of X was 4, then the variance of Y series is

(A) 1

(B) 0.5

(C) $\frac{1}{\sqrt{2}}$

(D) 0.75

64. If correlation coefficient between (X, Y) is 0.5, then correlation between ($-2X + 1$, $3Y + 2$) will be

(A) 0.5
(B) –0.5
(C) 0
(D) 1

65. Let X and Y be two variables and $aX + bY + c = 0$. If a and b are of the same signs, then the correlation coefficient between X and Y is

(A) -1
(B) Zero
(C) 1
(D) Between -1 and $+1$

66. For a given data on X and Y, which one of the following statements is false?

(A) Correlation coefficient is the geometric mean between the regression coefficients
(B) Correlation coefficient and regression coefficients are between -1 and $+1$
(C) Correlation coefficient and regression coefficients are independent of origin
(D) Arithmetic mean of the regression coefficients is always greater than the correlation coefficient

67. Let $X_1, X_2, ..., X_n, X_{n+1}$ be a random sample from $N(\mu, 1)$. If $\overline{X_n} = \frac{1}{n}\sum_{i=1}^{n} X_i$ and $T = \frac{1}{2}\left(\overline{X_n} + X_{n+1}\right)$, then for estimating μ

(A) T is unbiased and consistent
(B) T is biased and consistent
(C) T is unbiased and not consistent
(D) T is biased and not consistent

68. Let X_k $(k=1,2,3)$ be independent random variables having the probability density function

$$f_k(x)=\begin{cases} k\theta e^{-k\theta x}, & \text{if } 0<x<\infty \\ 0, & \text{otherwise} \end{cases} \quad \text{where } \theta > 0.$$

Then a sufficient statistic for θ is

(A) $X_1+X_2+X_3$
(B) $X_1+X_2+3X_3$
(C) $3X_1+2X_2+X_3$
(D) $X_1+2X_2+3X_3$

69. Let $X_1, X_2, ..., X_n$ be a random sample from a Poisson distribution with parameter $\theta>0$ and $T=\sum_{i=1}^{n} X_i$. Then the uniformly minimum variance unbiased estimator of θ^2 is

(A) $\dfrac{T(T-1)}{n^2}$

(B) $\dfrac{T(T-1)}{n(n-1)}$

(C) $\dfrac{T(T-1)}{n(n+1)}$

(D) $\dfrac{T^2}{n}$

70. Let $x_1=3, x_2=4, x_3=3.5, x_4=2.5$ be the observed values of a random sample from a probability density function

$$f(x\,|\,\theta)=\frac{1}{3}\left[\frac{1}{\theta}e^{-\frac{x}{\theta}}+\frac{1}{\theta^2}e^{-\frac{x}{\theta^2}}+e^{-x}\right], \ x>0, \ \theta>0.$$

Then the method of moments estimate of θ is

(A) 1
(B) 2.5
(C) 3.5
(D) 4

71. Let $X_1, X_2, ..., X_n$ be a random sample from a distribution with the probability density function

$$f(x;\theta) = \begin{cases} e^{-(x-2\theta)}, & \text{if } \; x > 2\theta \\ 0, & \text{otherwise} \end{cases}.$$

Then the maximum likelihood estimator of θ is

(A) $\min\left(X_1, X_2, ..., X_n\right)$

(B) $\max\left(X_1, X_2, ..., X_n\right)$

(C) $\dfrac{\max\left(X_1, X_2, ..., X_n\right)}{2}$

(D) $\dfrac{\min\left(X_1, X_2, ..., X_n\right)}{2}$

72. Let X be a random variable with the probability density function

$$f\left(x \mid \theta\right) = \begin{cases} 2\theta x + 1 - \theta, & \text{if } \; 0 < x < 1, \; -1 \le \theta \le 1 \\ 0, & \text{otherwise} \end{cases}$$

Based on a sample of size one, the most powerful critical region for testing $H_0 : \theta = 0,$ against $H_0 : \theta = 1$ at level $\alpha = 0.2$ is given by

(A) $X < \dfrac{4}{5}$

(B) $X > \dfrac{2}{5}$

(C) $X > \dfrac{8}{5}$

(D) $X > \dfrac{4}{5}$

73. If X is an $F(m,n)$ random variable, where $m>2,\ n>2$, then $E(X)E\left(\frac{1}{X}\right)=$

(A) $\frac{n(n-2)}{m(m-2)}$

(B) $\frac{m(m-2)}{n(n-2)}$

(C) $\frac{mn}{(m-2)(n-2)}$

(D) $\frac{m(n-2)}{n(m-2)}$

74. Let $X_1, X_2, ..., X_{21}$ be a random sample from a distribution having the variance 5. Let $\bar{X} = \frac{1}{21}\sum_{i=1}^{21} X_i$ and $S = \sum_{i=1}^{21}\left(X_i - \bar{X}\right)^2$. Then, $E(S)$ is

(A) 5
(B) 0.25
(C) 105
(D) 100

75. Let X be a random sample of size one from $U(\theta,\theta+1)$ distribution, $\theta \in \mathbb{R}$. For testing $H_0:\theta=1$ against $H_1:\theta=2$, the critical region $\{x: x>1\}$ has

(A) power = 0 and size = 1

(B) power = $\frac{1}{2}$ and size = 1

(C) power = 1 and size = 0

(D) power =1 and size = 1

76. Let $X_1, X_2, ..., X_n$ be i.i.d. Exp(1) random variables and $S_n = \frac{1}{n}\sum_{i=1}^{n} X_i$. Using the central limit theorem, $\lim_{n\to\infty} P(S_n > n)$ is

(A) 0
(B) $\frac{1}{3}$
(C) $\frac{1}{2}$
(D) 1

77. If X_1 and X_2 are i.i.d $N(0, 1)$ random variables, then $P\left(X_1^2 + X_2^2 \le 2\right)$ equals

(A) e^{-1}
(B) e^{-2}
(C) $1-e^{-1}$
(D) $1-e^{-2}$

78. How many random samples (with replacement) of size *n* we can have from a population of size *N*?

(A) N^n
(B) nN
(C) ${}^N Pn$
(D) ${}^N Cn$

79. In a simple random sampling without replacement, if $\overline{y}$ = 50, *n* = 100, *N* = 500 then the estimated population total is

(A) 500
(B) 2500
(C) 5000
(D) 25000

80. When no information except that on the total number of units in the stratum is given, then one can use

(A) Equal allocation
(B) Neyman allocation
(C) Optimum allocation
(D) Proportional allocation

81. A shipment of 8 similar microcomputer to a retail outlet contain 3 defectives. If a college makes a random purchase of 2 of these computers then the probability that exactly one computer is defective is

(A) $\frac{5}{14}$
(B) $\frac{15}{28}$
(C) $\frac{3}{28}$
(D) $\frac{1}{28}$

82. If X ~ Binomial (n, p), the distribution of $Y = (n - X)$ is

(A) Binomial $(n, 1)$
(B) Binomial (n, x)
(C) Binomial(n, p)
(D) Binomial(n, q)

83. Which one of the following tests uses information on signs as well as magnitude for testing for the median of a distribution?

(A) Kolmogorov Smirnov test
(B) Mann Whitney U test
(C) Sign test
(D) Wilcoxon Signed rank test

84. In the time series analysis, the moving average method aims at

(A) Measuring seasonal variation
(B) Giving Trend in a straight line
(C) Smoothing a series
(D) All of the above

85. If $P(A) = p_1$, $P(B) = p_2$, $P(A \cap B) = p_3$ with $p_1, p_2, p_3 > 0$ then $P(A^c \cap B^c)$ is equal to

(A) $p_1 + p_2 - p_3$
(B) $1 - p_1 - p_2 + p_3$
(C) $p_1 - p_2 - p_3$
(D) $1 - p_1 - p_2 - p_3$

86. A random variable X takes values 0, 1, 2, 3, ... with probability proportional to $(x+1)\left(\frac{1}{5}\right)^x$. Then $P(X \le 1)$ is equal to

(A) $\frac{112}{225}$
(B) $\frac{110}{225}$
(C) $\frac{113}{225}$
(D) $\frac{109}{225}$

87. The cumulative distribution function of a random variable X is

$$F(x) = \begin{cases} 0 \\ \frac{1}{2}, & 0 \le x < 2 \\ \frac{5}{6}, & 2 \le x < 3 \\ 1, & x \ge 3 \end{cases}$$

Then, $P[X = 2]$ is

(A) $\frac{1}{3}$
(B) $\frac{1}{4}$
(C) $\frac{1}{7}$
(D) $\frac{1}{6}$

88. Let X ~ Binomial $\left(2, \frac{1}{2}\right)$ and $Y = X^2$ then $E(Y)$ is

(A) 2
(B) $\frac{3}{2}$
(C) 4
(D) $\frac{1}{9}$

89. A discrete r.v. X assumes three values −3, 0, 4 and $P(X = 0) = \frac{1}{2}$ and $E(X) = \frac{9}{8}$ then $P(X = 4)$ is

(A) $\frac{1}{8}$
(B) $\frac{2}{8}$
(C) $\frac{3}{8}$
(D) $\frac{1}{2}$

90. Let X be a continuous random variable with c.d.f. $F(x)$. Then, $E\left[F(X)\right]^n$ is

(A) $(n + 1)^{-2}$
(B) $(n + 1)^{-1}$
(C) $(n + 1)$
(D) $(n + 1)^2$

91. The arithmetic and geometric mean of two observations are 5 and 4 respectively. Then the observations are

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

92. What is the Harmonic mean of $1, \frac{1}{2}, \frac{1}{3}, ..., \frac{1}{n}$?

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

93. If mean and coefficient of variation (in percentage) of X are 20 and 20 respectively, what is the variance of $Y = 10 - 2X$?

(A) 64
(B) 16
(C) 36
(D) 84

94. If the values of the 1^{st} and 3^{rd} quartiles are 20 and 30 respectively, then the value of inter quartile range is

(A) 10
(B) 25
(C) 5
(D) 0

95. To compare several treatments, when the experimental units are homogeneous, the appropriate design to be used is

(A) Randomized Block Design
(B) Latin Square Design
(C) Split Plot Design
(D) Completely Randomized Design

96. The maximum possible number of orthogonal contrasts among v treatments is

(A) v
(B) $v-1$
(C) $v-2$
(D) v^2

97. An unbiased die is thrown. The mathematical expectation of the number of points is

(A) 2.3
(B) 3.2
(C) 3.5
(D) 5.3

98. The pdf of a random variable is $f(x) = \begin{cases} \frac{3}{4}x(2-x); & 0 \le x \le 2 \\ 0; & \text{otherwise} \end{cases}$

then the median of the distribution is

(A) 1
(B) $\frac{2}{3}$
(C) $\frac{3}{4}$
(D) $\frac{4}{5}$

99. If $\operatorname{cov}(X, Y) = 5$, then $\operatorname{cov}\left[(2X+5), 3Y+7\right]$ is equal to

(A) 24
(B) 26
(C) 30
(D) 28

100. If X_1 and X_2 are independent variables with mean (1, 2) and variance $\left(\frac{1}{4}, \frac{1}{2}\right)$ then $\operatorname{var}\left(X_1 X_2\right)$ is

(A) $\frac{5}{8}$
(B) $\frac{5}{4}$
(C) $\frac{13}{8}$
(D) $\frac{21}{8}$

101. The variance of the Poisson variable X is 2. Then its mgf is

(A) $e^{2\left(1-e^{t}\right)}$

(B) $e^{\left(1-2e^{t}\right)}$

(C) $e^{2e^{t}}$

(D) $e^{2\left(e^{t}-1\right)}$

102. A random variable X has mean 50 and variance 100. By using Chebychev's inequality, the upper bound for $P\left[|X-50|\geq 15\right]$ is

(A) $\frac{3}{4}$

(B) $\frac{2}{9}$

(C) $\frac{1}{9}$

(D) $\frac{4}{9}$

103. If X is a random variate such that $E(X) = 3$, $E(X^{2}) = 13$, then $P\left[-2 < X < 8\right]$ is greater than or equal to

(A) $\frac{21}{25}$

(B) $\frac{4}{25}$

(C) $\frac{1}{25}$

(D) $\frac{2}{25}$

104. The probability density function of X is $f(x) = \begin{cases} \frac{1}{4}, & |x| < 2 \\ 0, & \text{otherwise} \end{cases}$.

Then, $P(2X + 3 > 5)$ is equal to

(A) $\frac{1}{3}$

(B) $\frac{1}{2}$

(C) $\frac{1}{7}$

(D) $\frac{1}{4}$

105. A random variable X takes values -1, 1, 3 with equal probability. Then, $P(|X - 3| > 1)$ is equal to

(A) $\frac{1}{6}$

(B) 0

(C) $\frac{1}{3}$

(D) $\frac{2}{3}$

106. Let $f(x, y) = \begin{cases} 24xy; & x > 0, \ y > 0, \ x + y \le 1 \\ 0, & \text{otherwise} \end{cases}$.

Then the conditional density of Y given $X = x$ is

(A) $\frac{2y}{(1-x)^2}; \ 0 < y < 1 - x$

(B) $\frac{2y}{(1-x)^2}; \ 0 < y < 1 + x$

(C) $\frac{(1-x)^2}{2y}; \ 0 < y < 1$

(D) $\frac{(1-x)^2}{2y}; \ 0 < x < 1$

107. The pdf of a random variable is given by $f(x)=\begin{cases} ax^2(b-x); & 0\le x\le 1 \\ 0 & \text{otherwise} \end{cases}$.

Given that the mean is 0.6, the value of a and b are

(A) 1, 12
(B) 12, 1
(C) 1, 10
(D) 10, 1

108. A continuous random variable X has the following distribution function

$$F(x)=\begin{cases} 1-e^{-2x}; & x>0 \\ 0; & \text{elsewhere} \end{cases}.$$

Then, $P(2 < X < 3 \mid X > 5/2)$ is

(A) $\dfrac{e^{-6}-e^{-4}}{e^{-5}}$

(B) $\dfrac{e^{-5}-e^{-6}}{e^{-5}}$

(C) $\dfrac{e^{-6}}{e^{-5}}$

(D) e^{5}

109. A box contains 3 blue and 2 red marbles while another box contains 2 blue and 5 red marbles. A marble drawn at random from one of the boxes, if turns out to be blue, what is the probability that it came from the first box?

(A) $\dfrac{17}{31}$

(B) $\dfrac{19}{31}$

(C) $\dfrac{20}{31}$

(D) $\dfrac{21}{31}$

110. The moment generating function of a random variable X is given by

$M_X(t) = \left(1-\frac{t}{5}\right)^{-1}$; $t < 5$, then the mean and variance of X are

(A) $\frac{1}{5}, \frac{1}{25}$

(B) $\frac{1}{25}, \frac{1}{5}$

(C) $\frac{2}{5}, \frac{3}{25}$

(D) $\frac{3}{25}, \frac{2}{5}$

111. If X follows a Binomial distribution with $n = 8$ and $p = \frac{1}{2}$ then $P(|X-5| \le 2)$ is equal to

(A) $\frac{109}{128}$

(B) $\frac{117}{128}$

(C) $\frac{115}{128}$

(D) $\frac{113}{128}$

112. The cumulative distribution function of a continuous random variable is given by

$$F(x) = \begin{cases} 0, & x < 1 \\ \dfrac{(x-1)^2}{2}, & 1 \le x < 2 \\ \dfrac{(x-2)^3}{2} + \dfrac{1}{2}, & 2 \le x < 3 \\ 1, & x \ge 3 \end{cases}$$

Then $P\left(\frac{3}{2} < x < \frac{5}{2}\right)$ is equal to

(A) $\frac{3}{16}$

(B) $\frac{1}{16}$

(C) $\frac{5}{16}$

(D) $\frac{7}{16}$

113. A fair dice is tossed eight times. The probability that a third six is observed on the eighth throw is

(A) $\frac{{}^7C_2 \times 5^5}{6^8}$

(B) $\frac{{}^7C_2}{6^6}$

(C) $\frac{{}^7C_2 \times 5^4}{6^8}$

(D) $\frac{{}^7C_2}{6^8}$

114. Let X and Y are two independent chi-square variates with 2 and 3 degrees of freedom (d.f.) respectively. Then the distribution of $Z = \frac{3}{2}\frac{X}{Y}$ follows

(A) F distribution with (2, 3) d.f.
(B) F distribution with (3, 2) d.f.
(C) t distribution with 5 d.f.
(D) Chi-square with 5 d.f.

115. The characteristic function of the standard Cauchy distribution is

(A) e^{-t}
(B) e^{t}
(C) $e^{-|t|}$
(D) $e^{|t|}$

116. There are three children in a family. What will be the probability that they include (i) exactly 2 girls (ii) not more than one girl

(A) $\frac{3}{8}$ and $\frac{1}{2}$
(B) $\frac{5}{8}$ and $\frac{3}{4}$
(C) $\frac{2}{3}$ and $\frac{1}{2}$
(D) $\frac{3}{8}$ and $\frac{3}{4}$

117. If A and B are two independent events both having probability 'p' and $P(A \cup B) = \alpha$. Then the value of 'p' is

(A) $\sqrt{1-\alpha}$
(B) $\sqrt{\alpha-1}$
(C) $1-\sqrt{1-\alpha}$
(D) $\sqrt{1-\alpha}-1$

118. Let $X_1, X_2, \ldots X_n$ be i.i.d random variables with mean μ and variance σ^2.

If $\frac{X_1^2 + X_2^2 + \ldots X_n^2}{n} \xrightarrow{p} c$, where c is a positive constant. The value of c is

(A) μ
(B) $\mu+\sigma$
(C) σ^2
(D) $\mu^2+\sigma^2$

119. Complete the following ANOVA table:

Source of variation	D.F.	S.S.	M.S.
Blocks	$p-1$	90	30
Treatments	4	q	25
Error	r	120	10
Total	19	--	--

(A) $p = 4$ $q = 100$ $r = 12$
(B) $p = 4$ $q = 100$ $r = 10$
(C) $p = 4$ $q = 90$ $r = 12$
(D) $p = 3$ $q = 100$ $r = 12$

120. Which one of the following in a linear contrast of the treatment effects T_1, T_2, T_3,T_4?

(A) $3T_1 + T_2 - 3T_3 + T_4$
(B) $T_1 + 3T_2 - 3T_3 + T_4$
(C) $-3T_1 - T_2 + T_3 + 3T_4$
(D) $T_1 + T_2 + T_3 - T_4$

121. The standard deviation of first n natural numbers is

(A) $\sqrt{\frac{n^2-1}{12}}$
(B) $\sqrt{\frac{n^2-1}{6}}$
(C) $\sqrt{\frac{n^2+1}{6}}$
(D) $\sqrt{\frac{n^2+1}{12}}$

122. If X is a Poisson variable and $P[X = 0] = P[X = 1]$, then $E(X)$ is

(A) 4
(B) 5
(C) 1
(D) 2

123. If X is a Normal random variable with mean μ and variance $\sigma^2 = 9$ and Z is a standardized Normal random variable such that $P[X \leq 15] = P[Z \leq 1]$, then the value of mean μ is

(A) 7
(B) 12
(C) 7.5
(D) 16

124. If a random variable X follows Normal with mean 0 and variance σ^2, then $E[X \mid X > 0]$ is

(A) $\sqrt{\dfrac{2}{\pi}}$
(B) $\sqrt{2\pi}\sigma$
(C) $\sqrt{\dfrac{2}{\pi}}\sigma$
(D) 0

125. If the correlation coefficient between X and Y is 0.8, then the correlation between $U = \dfrac{X-10}{2}$ and $V = \dfrac{Y-5}{2}$ is

(A) 0.8
(B) 0.016
(C) 0.4
(D) 0.2

126. Critical region of size α which minimized β amongst all critical regions of size α is called

(A) powerful critical region
(B) minimum critical region
(C) best critical region
(D) worst critical region

127. A hypothesis is rejected at the level of significance $\alpha = 0.05$ by a test. Then which one of the following statements is true regarding the p-value of the test?

(A) $p = 0.05$
(B) $p < 0.05$
(C) $p > 0.05$
(D) All of the above

128. If T_n is unbiased and consistent for θ , then

(A) ${T_n}^2$ is unbiased and consistent for θ^2
(B) ${T_n}^2$ is unbiased but not consistent for θ^2
(C) ${T_n}^2$ is biased but consistent for θ^2
(D) ${T_n}^2$ is biased and not consistent for θ^2

129. A four digit number is formed by the digits 1, 2, 3, 4 with no repetition. Find the probability that the number is (i) odd (ii) divisible by 4.

(A) $\frac{2}{3}$ and $\frac{1}{4}$
(B) $\frac{1}{4}$ and $\frac{2}{3}$
(C) $\frac{1}{2}$ and $\frac{1}{4}$
(D) $\frac{2}{3}$ and $\frac{1}{2}$

130. The arithmetic mean of the series $a, ar, ar^2, ..., ar^{n-1}$ is

(A) $\dfrac{a\left(r^n - 1\right)}{n(r-1)}$
(B) $\dfrac{a\left(1 - r^n\right)}{1-r}$
(C) $\dfrac{a\left(1 - r^n\right)}{n(r-1)}$
(D) $\dfrac{na\left(r^n - 1\right)}{(1-r)}$

131. Two contrasts $c_i^T \hat{\beta}$ and $c_j^T \hat{\beta}$ are said to be orthogonal if

(A) $c_i^T c_j = 1$
(B) $c_i^T c_j = 0$
(C) $c_i^2 = 1$
(D) $c_i^2 = 0$

132. The analysis of variance technique test the significant difference of

(A) Two or more means when σ^2 is known
(B) Two or more means when σ^2 is unknown
(C) Two or more variances when μ is known
(D) Two or more variances when μ is unknown

133. In an Randomized Block Design (RBD) with r blocks and v treatments, one observation is missing. The best estimate of the missing observation given that B and T denote the block and treatment totals corresponding to the missing observation and G is the grand total of available data is

(A) $\dfrac{rT + vB - G}{(r-1)(v-1)}$

(B) $\dfrac{rB + vT - G}{(r-1)(v-1)}$

(C) $\dfrac{rT + vB + G}{(r-1)(v-1)}$

(D) $\dfrac{rB + vT + G}{(r-1)(v-1)}$

134. Suppose you conduct a hypothesis test and observe values for the sample mean and sample standard deviation when $n = 25$ that do not lead to the rejection of H_0. Suppose the p-value calculated is 0.0667. What will happen to the p-value if you observe the same sample mean and standard deviation for a sample > 25?

(A) Increase
(B) Decrease
(C) Stay the same
(D) May either increase or decrease

135. A null hypothesis can only be rejected at the 5% significance level if and only if

(A) a 95% confidence interval includes the hypothesized value of the parameter
(B) a 95% confidence interval does not include the hypothesized value of the parameter
(C) the null hypothesis is void
(D) the null hypotheses includes sampling error

136. A random sample $X_1, X_2, \ldots\ldots, X_n$ is drawn from a distribution with density function $f(x,\theta) = \theta(1-x)^{1-\theta}; 0 < x < 1,\ \theta > 0$. Then, a sufficient statistics for θ is

(A) $\sum X_i$
(B) sample median
(C) $\sum \log(1 - X_i)$
(D) $\sum X_i^2$

137. Let $(X_1, X_2, \ldots\ldots, X_n)$ be a random sample of observations with mean μ and finite variance. Then for estimating μ, the statistic $T_n = 2\sum_{i=1}^{n} \frac{iX_i}{n(n+1)}$ is

(A) unbiased and consistent
(B) biased and consistent
(C) unbiased but not consistent
(D) biased and not consistent

138. Three random observations X_1, X_2, X_3 are made on a Poisson distribution with parameter λ. Let g(λ) = $e^{-\lambda}$. Then the Cramer Rao lower bound for the variance of unbiased estimators of g(λ) is given by

(A) $\frac{\lambda e^{-2\lambda}}{3}$
(B) $e^{-\lambda/3}$
(C) $\lambda^2 e^{-\lambda}$
(D) $e^{-3\lambda}$

139. Let $X_1, X_2, \ldots\ldots, X_n$ be a random sample from $U(0,\theta)$. Then an unbiased estimator for θ is

(A) $\sum_{i=1}^{n} X_i$
(B) $\frac{(n+1)}{n}\max(X_1, \ldots X_n)$
(C) $\frac{(n+1)}{n}\min(X_1, X_2, \ldots X_n)$
(D) $\left(\max(X_1, \ldots X_n) - \min(X_1, \ldots X_n)\right)$

140. A sufficient condition for an estimator T_n to be consistent for θ is that

(A) var $(T_n) \to 0$ as $n \to \infty$
(B) $E\,(T_n) \to \theta$ as $n \to \infty$
(C) var $\dfrac{T_n}{E(T_n)} \to 0$ as $n \to \infty$
(D) $E\,(T_n) \to \theta$ and var $(T_n) \to 0$ as $n \to \infty$

141. If X is a Poisson variate with parameter λ, then the unbiased estimator based on a single observation X of $e^{-3\lambda}$ is

(A) $(-3)^X$
(B) $(-2)^X$
(C) $(3)^X$
(D) $(2)^X$

142. A valid t-test to assess an observed difference between two sample mean value requires

(i) both populations are independent
(ii) the observations to be sampled from normally distributed parent population
(iii) the variance to be the same for both populations

(A) (i) and (ii)
(B) (ii) and (iii)
(C) (i) and (iii)
(D) All the three conditions

143. The probability of correctly rejecting the null hypothesis when the alternative hypothesis is true is called

(A) Level of significance
(B) Type I error
(C) Power
(D) Statistic

144. The interval estimate of a population mean with large sample size and known standard deviation is given by (with the usual notations)

(A) $\bar{x} \pm z_{\alpha/2} \sigma_{\bar{x}}$

(B) $\bar{x} \pm z_{\alpha/2} s_{\bar{x}}$

(C) $\bar{x} \pm t_{\alpha/2} \sigma_{\bar{x}}$

(D) $\bar{x} \pm t_{\alpha/2} s_{\bar{x}}$

145. Which one of the following test is used to test whether an observed correlation coefficient is significantly different from zero?

(A) A test based on Standard Normal distribution
(B) A test based on Chi-square distribution
(C) A test based on t-distribution
(D) A test based on F-distribution

146. Let $X_1, X_2, \ldots, X_n$ be a random sample from $N(\mu, \sigma^2)$, σ^2 is known

To test $H_0 : \mu = \mu_0$ Vs. $\mu = \mu_1$, we use

(A) Z – test (Normal test)
(B) t – test
(C) F – test
(D) Chi square test

147. The probability density function of Normal distribution is

$f(x) = \frac{2\sqrt{2}}{\sqrt{\pi}} e^{-2(2x-1)^2}; -\infty < x < \infty$, Then the mean and variance are

(A) $\left(\frac{1}{2}, \frac{1}{16}\right)$

(B) $\left(\frac{1}{16}, \frac{1}{2}\right)$

(C) $\left(\frac{1}{3}, \frac{1}{5}\right)$

(D) $\left(\frac{1}{5}, \frac{1}{3}\right)$

148. If X is a Poisson variate with parameter λ such that $P(X = 2) = 9\ P(X = 4) + 90P(X = 6)$ then the variance of X is

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

149. If X and Y are two independent Poisson random variables with equal means, and the probabilities are equal when $X = 3$ and $Y = 4$, then the variance of $3X + 2Y$ is

(A) 13
(B) 52
(C) 25
(D) 14

150. Let $X_1 \sim N(\mu = 2, \sigma^2 = 1)$ and $X_2 \sim N(\mu = 3, \sigma^2 = 2)$, then the distribution of $2X_1 + 3X_2$ is

(A) $N(12, 15)$
(B) $N(15,12)$
(C) $N(22, 13)$
(D) $N(13, 22)$

ANSWER KEY

Subject Name: 614 STATISTICS

SI No.	Key	SI No.	Key	SI No.	Key	SI No.	Key	SI No.	Key
1	D	31	A	61	A	91	A	121	A
2	B	32	C	62	D	92	C	122	C
3	B	33	D	63	A	93	A	123	B
4	B	34	C	64	B	94	C	124	C
5	A	35	D	65	A	95	D	125	A
6	B	36	A	66	B	96	B	126	C
7	A	37	B	67	C	97	C	127	B
8	B	38	C	68	D	98	A	128	C
9	C	39	B	69	A	99	C	129	C
10	D	40	B	70	B	100	C	130	A
11	D	41	C	71	D	101	D	131	B
12	D	42	B	72	D	102	D	132	B
13	B	43	A	73	C	103	A	133	B
14	C	44	C	74	D	104	D	134	B
15	C	45	B	75	D	105	D	135	B
16	B	46	B	76	C	106	A	136	C
17	C	47	B	77	C	107	B	137	A
18	C	48	D	78	A	108	B	138	A
19	D	49	C	79	D	109	D	139	B
20	D	50	B	80	D	110	A	140	D
21	C	51	A	81	B	111	A	141	A
22	D	52	B	82	D	112	D	142	D
23	A	53	C	83	D	113	A	143	C
24	D	54	B	84	C	114	A	144	A
25	D	55	D	85	B	115	C	145	C
26	D	56	C	86	A	116	A	146	A
27	D	57	A	87	A	117	C	147	A
28	C	58	C	88	B	118	D	148	D
29	B	59	B	89	C	119	A	149	B
30	B	60	D	90	B	120	C	150	D