61413

ROLL No. | | | | | |

TEST BOOKLET No. 126

TEST FOR POST GRADUATE PROGRAMMES

STATISTICS

Time: 2 Hours

Maximum Marks: 450

INSTRUCTIONS TO CANDIDATES

1. You are provided with a Test Booklet and an Optical Mark Reader (OMR) Answer Sheet to mark your responses. Do not soil the Answer Sheet. Read carefully all the instructions given on the Answer Sheet.

2. Write your Roll Number in the space provided on the top of this page.

3. Also write your Roll Number, Test Code, and Test Subject in the columns provided for the same on the Answer Sheet. Darken the appropriate bubbles with a Ball Point Pen.

4. The paper consists of 150 objective type questions. All questions carry equal marks.

5. Each question has four alternative responses marked A, B, C and D and you have to darken the bubble fully by a Ball Point Pen corresponding to the correct response as indicated in the example shown on the Answer Sheet.

6. Each correct answer carries 3 marks and each wrong answer carries 1 minus mark.

7. Space for rough work is provided at the end of this Test Booklet.

8. You should return the Answer Sheet to the Invigilator before you leave the examination hall. However, you can retain the Test Booklet.

9. Every precaution has been taken to avoid errors in the Test Booklet. In the event of any such unforeseen happenings, the same may be brought to the notice of the Observer/Chief Superintendent in writing. Suitable remedial measures will be taken at the time of evaluation, if necessary.

STATISTICS

1. The sequence $1+\frac{1}{1!}+\frac{1}{2!}+....+\frac{1}{n!}$ is

(A) monotonic increasing (B) monotonic decreasing
(C) non-decreasing (D) None of the above

2. The value of determinant $\begin{vmatrix} 0 & c & b \\ -c & 0 & a \\ -b & -a & 0 \end{vmatrix}$ is

(A) 0 (B) bc
(C) abc (D) $a^2b^2c^2$

3. $\lim_{n\to\infty}\left(\frac{1^2+2^2+....+n^2}{n^3}\right)$ is equal to

(A) $\frac{1}{2}$ (B) $\frac{1}{4}$
(C) $\frac{2}{7}$ (D) $\frac{1}{3}$

4. The matrix $\begin{bmatrix} 0 & i \\ -i & 0 \end{bmatrix}$ is a

(A) hermitian matrix (B) skew hermitian matrix
(C) symmetric matrix (D) skew symmetric matrix

5. Let X follow $U\left(\frac{\pi}{2}, \frac{\pi}{2}\right)$. Then the p.d.f. of $Y = \tan x$ follow

(A) Beta (B) Gamma
(C) Pareto (D) Cauchy

6. If X and Y are correlated variables, then $E(Y \mid X)$ and $E(X \mid Y)$ will give

(A) regression curves
(B) normal equation
(C) regression coefficients
(D) coefficient of determination

7. The cumulative distribution function of a random variable X is given by

$$F(x) = \begin{cases} 0 & x < 0 \\ x + \frac{1}{2} & 0 \le x \le \frac{1}{2} \\ 1 & x > \frac{1}{2} \end{cases}$$

Then $P\left[X > \frac{1}{4}\right]$ is

(A) $\frac{1}{4}$
(B) $\frac{1}{2}$
(C) 1
(D) 0

8. Which one of the following is not a property of geometric mean?

(A) The geometric mean utilises all the information available.
(B) Geometric mean is greater than the arithmetic mean.
(C) If a single value of the variate is zero, then the geometric mean is zero.
(D) Negative value of the variate will lead to imaginary value of the geometric mean.

9. 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 values of a and b are

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

10. A valid t-test to assess an observed difference between two independent sample mean values requires:
(i) both populations are independent.
(ii) the observations arise from normally distributed parent population.
(iii) the variance must be the same for both populations.
Choose the correct set of requirements.

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

11. Let $X_1, X_2, \ldots, X_n$ be a random sample from $B(1, p)$, then a consistent estimator of $p(1-p)$ is

(A) $\overline{X}$
(B) $\overline{X}^2$
(C) $\overline{X}(1-\overline{X})$
(D) $n\overline{X}$

12. If A and B are two independent events such that $P(\overline{A}) = 0.7$, $P(\overline{B}) = k$ and $P(A \cup B) = 0.8$, then the value of k is

(A) $\frac{5}{7}$
(B) $\frac{2}{7}$
(C) 1
(D) 0

13. The Central Limit Theorem tells that the sampling distribution of a statistic is approximately normal. Which of the following conditions are necessary for the theorem to be valid?

(A) Sample size has to be large
(B) Population from which the samples are drawn is normal
(C) Population variance has to be small
(D) Population from which the samples are drawn is symmetric

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

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

15. If the coefficient of correlation between two variables is – 0.4, then the coefficient of determination is

(A) 0.84 (B) 0.6
(C) 0.16 (D) – 0.6

16. A family of parametric distributions, for which the mean and variance do not exist, is

(A) Polya's distribution
(B) Cauchy distribution
(C) Negative binomial distribution
(D) Pareto distribution

17. The r.v. X has the p.d.f. $f(x) = ae^{-ax}, 0 < x < \infty$. Then the c.d.f. is

(A) $1 - e^{-x/a}$ (B) $1 - e^{x/a}$
(C) $1 - e^{-ax}$ (D) $1 - e^{ax}$

18. X takes the value 0, 1, 2, 3 with respective probabilities 0.1, 0.3, 0.5 and 0.1. What is the mean of $Y = X^2 + 2X$?

(A) 20 (B) 16
(C) 15.1 (D) 6.4

19. If $A=\begin{bmatrix} a & 0 & 0 \\ 0 & b & 0 \\ 0 & 0 & c \end{bmatrix}$, then A^{-1} is equal to

(A) $\begin{bmatrix} a & 0 & 0 \\ 0 & b & 0 \\ 0 & 0 & c \end{bmatrix}$

(B) $\begin{bmatrix} 1/a & 0 & 0 \\ 0 & 1/b & 0 \\ 0 & 0 & 1/c \end{bmatrix}$

(C) $\begin{bmatrix} -a & 0 & 0 \\ 0 & -b & 0 \\ 0 & 0 & -c \end{bmatrix}$

(D) $\begin{bmatrix} bc & 0 & 0 \\ 0 & ca & 0 \\ 0 & 0 & ab \end{bmatrix}$

20. If $M=\begin{bmatrix} 1 & 1 & 0 \\ -1 & 1 & 2 \\ 2 & 2 & 0 \\ -1 & 0 & 1 \end{bmatrix}$, then the rank of M is equal to

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

21. If one root of the equation $x^2 + px + q = 0$ is $3 - i\sqrt{2}$, then the value of p and q are

(A) −6, 11
(B) 6, 11
(C) −6, 7
(D) −6, 14

22. The matrix $\begin{pmatrix} 1 & -1 & 4 \\ 2 & -1 & 5 \\ 2 & -2 & 8 \end{pmatrix}$ is

(A) singular with rank 2
(B) non-singular with rank 3
(C) singular with rank 1
(D) non-singular with rank 2

23. The value of $\lim_{x \to 0} \frac{\sin x}{x}$ is

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

24. Given the two lines of regression as $3X - 4Y + 8 = 0$ and $4X - 3Y = 1$, the means of X and Y are

(A) $\overline{X} = 4, \overline{Y} = 5$ (B) $\overline{X} = 3, \overline{Y} = 4$
(C) $\overline{X} = \frac{4}{3}, \overline{Y} = \frac{5}{4}$ (D) $\overline{X} = \frac{3}{4}, \overline{Y} = \frac{4}{5}$

25. The mean of the values 0, 1, 2, ..., n with corresponding weights ${}^nC_0, {}^nC_1, \ldots, {}^nC_n$ respectively is

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

26. 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

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

(A) $\sqrt{\frac{2}{\pi}}$ (B) $\sqrt{2\pi}\,\sigma$

(C) $\sqrt{\frac{2}{\pi}}\,\sigma$ (D) 0

28. If $P\left[|X-1| \le 2\right] \ge 0.75$, then the mean and variance of the distribution of X are

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

29. The joint probability density function of (X, Y) is given by

$$f(x,y) = xy^2 + \frac{x^2}{8}; \quad 0 < x < 2; \quad 0 < y < 1$$
$$= 0 \qquad \text{otherwise}$$

Then $P[X > 1]$ is

(A) $\frac{19}{24}$ (B) $\frac{5}{24}$

(C) $\frac{1}{24}$ (D) $\frac{1}{2}$

30. Time reversal test and Factor reversal test are satisfied by

(A) Laspeyre's index number
(B) Paasche's index number
(C) Fisher's index number
(D) Marshall-Edgeworth index number

31. A simple random sample of size 6 is drawn using without replacement method from a population of size 10. If population variance is 9, the standard error of the estimate of the population mean is

(A) $\sqrt{\frac{2}{3}}$ (B) $\sqrt{\frac{3}{2}}$

(C) $\sqrt{\frac{5}{2}}$ (D) $\sqrt{\frac{2}{5}}$

32. If λ denote the likelihood ratio test statistic, then under null hypothesis $-2 \log \lambda$ follows

(A) Standard normal distribution
(B) Chi square distribution
(C) Student-t distribution
(D) Uniform distribution

33. For the observations $x_1, x_2, \ldots, x_n$, $\sum_{i=1}^{n}(x_i - A)^2$ is minimum, when A is

(A) median (B) mode
(C) mean (D) range

34. The producer's risk is the

(A) probability of rejecting a good lot
(B) probability of accepting a good lot
(C) probability of rejecting a bad lot
(D) probability of accepting a bad lot

35. A random sample of size 25 is drawn from a population with mean 50 and variance 100. The standard deviation of the sample mean is

(A) 4 (B) 2
(C) 10 (D) 100

36. The limit point of the sequence $\left(1+\frac{1}{n}\right)^n$ is

(A) $\frac{1}{e}$ (B) e^2

(C) $\sqrt{e}$ (D) e

37. Read the following statements

(i) Any convergent sequence is a bounded sequence.

(ii) Any bounded sequence is a convergent sequence.

The correct statement is

(A) (i) and (ii) are true (B) only (i) is true

(C) only (ii) is true (D) (i) and (ii) are false

38. If two independent random variables X and Y have Poisson distribution with parameters 3 and 4 respectively, then $P(X+Y=0)$ is

(A) e^{-3} (B) e^{-4}

(C) e^{-7} (D) e^{-12}

39. The PGF of a discrete random variable X, with $P(X=0)=0.5$, $P(X=1)=0.3$ and $P(X=3)=0.2$ is

(A) $0.3t+0.2t^3$ (B) $0.5+0.3t$

(C) $0.5+0.3t+0.2t^3$ (D) $0.2t^3$

40. The mean and variance of a random variable X, with $PGF\ G_X(t)=\frac{3}{4-t}$ are

(A) $\frac{1}{3},\frac{4}{9}$ (B) $\frac{4}{9},\frac{1}{3}$

(C) $\frac{1}{7},\frac{4}{7}$ (D) $\frac{5}{7},\frac{1}{7}$

41. The arithmetic mean of the following distribution is

x	1	2	3	n
f_x:	1	2	3	n

(A) $\frac{n(n+1)}{2}$
(B) $\frac{n(n+1)(2n+1)}{6}$
(C) 1
(D) $\frac{2n+1}{3}$

42. The Crude Death Rate (CDR) is defined as

(A) $CDR = \frac{D}{P} \times 1000$
(B) $CDR = \frac{P}{D} \times 1000$
(C) $CDR = \frac{D}{P} \times 100$
(D) $CDR = \frac{P}{D} \times 100$

where D and P are number of deaths and total population, respectively.

43. The mean and standard deviation of a Chi-square distribution with 8 degrees of freedom are respectively

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

44. The power of a statistical test depends upon
(i) sample size
(ii) level of significance
(iii) variance of sampled population
(iv) the difference between the value specified by the null and the alternative hypothesis.

(A) (i) and (ii)
(B) (ii) and (iii)
(C) (i) and (iv)
(D) All of the above

45. The p.d.f. of a random variable X is $f(x)=2e^{-2x}, x>0$. If $F(x)$ is the c.d.f., then $F(2)$ is

(A) $\frac{e^4-1}{e^4}$ (B) $\frac{e-1}{e}$

(C) $\frac{e^3-1}{e}$ (D) $\frac{e+1}{e-1}$

46. The ANOVA table for a RBD is given below:

Source of variation	d.f	S.S	M.S.S	F ratio
Treatments	2	72		x
Blocks	3			y
Error	-	12	-	
Total	11	126		

After finding the missing entries, the value of F for treatments x and blocks y are respectively

(A) $x=7,\ y=18$ (B) $x=18,\ y=7$

(C) $x=12,\ y=6$ (D) $x=6,\ y=12$

47. The Maximum Likelihood Estimator of θ based on a random sample of size n from $U(0, \theta)$ is

(A) the sample mean (B) the sample median

(C) the largest order statistic (D) the smallest order statistic

48. The first census of free India was conducted in the year

(A) 1948 (B) 1949

(C) 1950 (D) 1951

49. If the difference between the mean and the variance of a binomial distribution with $n = 25$ is 1, then the value of p is

(A) 0.04 (B) 0.2
(C) 0.96 (D) 0.8

50. In Neyman-Pearson theory of hypothesis testing, one expects that as the sample size increases

(A) the probability of first kind of error will remain the same but that of the second kind will decrease
(B) the probabilities of both kinds of errors will be the same
(C) the probability of first kind of error alone will decrease
(D) the probabilities of both kinds of error will decrease

51. Bayes' theorem is applicable to the events that are

(A) independent (B) conditional
(C) disjoint (D) All of the above

52. The arithmetic mean of two numbers is 13 and their geometric mean is 12. Then the numbers are

(A) 12, 14 (B) 13, 13
(C) 15, 11 (D) 18, 8

53. If $X = 4Y + 5$ and $Y = kX + 4$ are the regression lines of X on Y and of Y on X respectively, then

(A) $0 \le k \le 1$ (B) $0 \le k \le \frac{1}{2}$
(C) $0 \le k \le \frac{1}{4}$ (D) $-1 \le k \le 1$

54. 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

55. From the seven items A, B, C, D, E, F and G a sample of 3 items is drawn using simple random sampling without replacement basis. What is the probability that the sample will contain (C, F, G)?

(A) $\frac{1}{35}$ (B) $\frac{3}{7}$
(C) $\frac{1}{210}$ (D) $\frac{1}{126}$

56. Which one of the following statements is correct?

(A) Sampling and non sampling errors are present both in sample survey and census.
(B) Non sampling errors are present both in sample survey and census.
(C) Non sampling errors are present only in census.
(D) Non sampling errors are present in sample survey only.

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

(A) $Var(T_n) \rightarrow 0$ as $n \rightarrow \infty$
(B) $E(T_n) \rightarrow 0$ as $n \rightarrow \infty$
(C) $Var(T_n)/E(T_n) \rightarrow 0$ as $n \rightarrow \infty$
(D) $E(T_n) \rightarrow \theta$ and $Var(T_n) \rightarrow 0$ as $n \rightarrow \infty$

58. The geometric series $\sum_{n=1}^{\infty} \frac{1}{n^p}$

(i) converges if $p<1$.

(ii) diverges if $p \geq 1$.

The correct statement is

(A) only (i) is false
(B) only (ii) is false
(C) both (i) and (ii) are false
(D) both (i) and (ii) are true

59. The eigen vectors of the matrix $\begin{bmatrix} 4 & 1 \\ 3 & 2 \end{bmatrix}$ are

(A) $X_1 = \begin{bmatrix} -1 \\ 3 \end{bmatrix}$ $X_2 = \begin{bmatrix} 1 \\ 1 \end{bmatrix}$
(B) $X_1 = \begin{bmatrix} 1 \\ -3 \end{bmatrix}$ $X_2 = \begin{bmatrix} -1 \\ 1 \end{bmatrix}$
(C) $X_1 = \begin{bmatrix} -1 \\ -3 \end{bmatrix}$ $X_2 = \begin{bmatrix} 1 \\ 1 \end{bmatrix}$
(D) $X_1 = \begin{bmatrix} 1 \\ 3 \end{bmatrix}$; $X_2 = \begin{bmatrix} 1 \\ 1 \end{bmatrix}$

60. If 2, 3 are the eigen values of $\begin{bmatrix} 2 & 0 & 1 \\ 0 & 2 & 0 \\ a & 0 & 2 \end{bmatrix}$, the value of '$a$' is

(A) -1
(B) 2
(C) 1
(D) -2

61 If $x \log_{10} 4 = 2 \log_{10} (1-2^x)$, then x is equal to

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

62. The average (A.M.) cost of 5 apples and 4 mangoes is Rs.36. The average cost of 7 apples and 8 mangoes is Rs. 48. The total cost of 24 apples and 24 mangoes is

(A) 1044
(B) 2088
(C) 720
(D) 324

63. A boat can move at 5 km/hr in still water. The speed of stream of the river is 1 km/hr. The boat takes 80 minutes to go from a point A to another point B and return to the same point. What is the distance between the two points?

(A) 50 km (B) 60 km
(C) 72 km (D) 30 km

64. Three squares of a chessboard are chosen at random. The probability that two are of one colour and one is of another colour is

(A) 67/992 (B) 16/21
(C) 31/32 (D) 1/50

65. 10 is the mean of a set of 7 observations and 5 is the mean of another set of 3 observations. The mean of the combined set is

(A) 15 (B) 10
(C) 8.5 (D) 7.5

66. For a binomial distribution with $n=10$ and $p=\frac{1}{2}$, the mode of the distribution is at

(A) $x=2$ (B) $x=3$
(C) $x=4$ (D) $x=5$

67 Which of the following is a non-random method of selecting samples from a population?

(A) Multistage sampling (B) Cluster sampling
(C) Quota sampling (D) All of the above

68. A random variable Y has the following distribution

Y	-1	0	1	2
$P(Y=y)$:	$3k$	$2k$	0.4	0.1

The value of the constant k is:

(A) 0.10
(B) 0.15
(C) 0.20
(D) 0.01

69. Symbolically $P_{0n} \times P_{n0} = 1$ stands for

(A) circular test
(B) factor reversal test
(C) time reversal test
(D) None of the above

70. If A and B are any two events such that $P(A) = \frac{1}{3}$, $P(B) = \frac{3}{4}$ and $P(A \cup B) = \frac{11}{12}$, then $P(A^c \mid B)$ is

(A) 2/9
(B) 1/12
(C) 7/9
(D) 2/7

71 The mean μ and variance σ^2 of a normal distribution with probability density function $f(x) = \frac{1}{\sqrt{32\pi}} \exp\left\{-\frac{\left(2x - \frac{1}{5}\right)^2}{128}\right\}$ are

(A) $\mu = 0.2,\ \sigma^2 = 4$
(B) $\mu = 0.1,\ \sigma^2 = 16$
(C) $\mu = 0.1,\ \sigma^2 = 64$
(D) $\mu = 0.2,\ \sigma^2 = 16$

72. If the angle between two regression lines obtained using the data from variables X and Y is 90°, then the correlation between X and Y is

(A) 0
(B) 1
(C) -1
(D) 0.5

73. Under usual notations, which of the following inequality is correct?

(A) $V_{opt} \leq V_{SRS} \leq V_{prop}$
(B) $V_{prop} \leq V_{opt} \leq V_{SRS}$
(C) $V_{opt} \leq V_{prop} \leq V_{SRS}$
(D) $V_{prop} \leq V_{SRS} \leq V_{opt}$

74. Let $X_1, \ldots, X_n$ be a random sample of size 'n' from $N(0, \theta), \theta > 0$. The MLE of θ is

(A) $\overline{X}$
(B) $\sum_{i=1}^{n}(X_i - \overline{X})^2$
(C) $\sum_{i=1}^{n}\frac{X_i^2}{n}$
(D) $\sum_{i=1}^{n} X_i$

75. The number of runs of 'F' in the sequence SSFFFSFSFSSFFFS is

(A) 8
(B) 5
(C) 7
(D) 4

76. Probability of including a specified unit in a sample of size n selected out of N units by SRSWOR is

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

77. If the mean of a frequency distribution is 100 and its coefficient of variation is 45%, then the standard deviation is

(A) 45
(B) 0.45
(C) 4.5
(D) 450

78. If C is the event that at 9.30 A.M a certain doctor is in his office and D is the event that he is in the hospital with respective probabilities 0.48 and 0.25. Then the probability that he is neither in his office nor in the hospital is

(A) 0.20 (B) 0.21
(C) 0.24 (D) 0.25

79. The average quality of the product after sampling and 100% inspection of rejected lots is called

(A) AOQL (B) AOQ
(C) RQL (D) LTPD

80 $\lim_{x \to 4} \frac{x^2 - x - 12}{x - 4}$ is

(A) 0 (B) ∞
(C) 3 (D) 7

81 The least upper bound of the set $\left\{1 - \frac{1}{n} : n \in N\right\}$ is

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

82. A graph which is commonly used to measure income inequality is

(A) ogive curve (B) Lorez curve
(C) frequency curve (D) Pie diagrams

83. The empirical relation among averages is

(A) Mean – Mode = 2 (Mean – Median)
(B) Mean – Mode = 4 (Mean – Median)
(C) Mean – Mode = 3 (Mean – Median)
(D) Mean – Mode = Median

84. The point of intersection of the two ogive curves for a given data provides

(A) first quartile
(B) third quartile
(C) second quartile
(D) fourth quartile

85. The mean of the distribution in which the values of x are 1, 2, n and the frequency of each being unity is

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

86. The mean of a set of observations is 42. If each observation is divided by 3 and 5 is added to each, the mean becomes

(A) 14
(B) 9
(C) 47
(D) 19

87 The coefficient of variation of n observations is C. The coefficient of variation, when each of the observation is multiplied by K is

(A) KC
(B) $\frac{C}{K}$
(C) C
(D) $K + C$

88. In a unimodal distribution, the mean is smaller than the mode. The distribution is

(A) positively skewed (B) negatively skewed
(C) symmetric (D) None of the above

89. The measure of skewness of a distribution, based on quartiles Q_1, Q_2, Q_3 is given by

(A) $\frac{Q_3 - Q_3 + Q_1}{Q_3 - Q_1}$ (B) $\frac{Q_1 - Q_2 + Q_3}{3}$
(C) $\frac{Q_3 - 2Q_2 + Q_3}{Q_3 - Q_1}$ (D) $\frac{Q_3 - Q_1}{Q_3 + Q_1}$

90. Two coins are tossed. The events $A = \{T\,T\}$ and $B = \{H\,H\}$ are

(A) mutually exclusive but not independent.
(B) mutually exclusive and independent.
(C) independent but not mutually exclusive.
(D) None of the above

91. Two dice are thrown. It is given that one of the dice shows 5. The probability that the sum of points on the two dice is 9 is

(A) $\frac{1}{9}$ (B) $\frac{1}{18}$
(C) $\frac{2}{11}$ (D) $\frac{1}{36}$

92. Let A and B be two events associated with an experiment. Suppose that $P(A) = 0.4$, $P(A \cup B) = 0.7$ and $P(B) = P$ For what value of P are A and B independent?

(A) 0.6 (B) 0.5
(C) 0.4 (D) 0.3

93. The probability of three independent events A, B and C are $P(A)=\frac{2}{3}$, $P(B)=\frac{3}{4}$ and $P(C)=\frac{1}{5}$ respectively. Then $P(A \cup B \cup C)$ is

(A) $\frac{4}{5}$ (B) $\frac{1}{15}$

(C) $\frac{14}{15}$ (D) $\frac{3}{5}$

94. $A \supset B$ and $r = P(A)/P(B)$, then

(A) $r < 1$ (B) $r > 1$

(C) $r < 0$ (D) $r = \infty$

95. If $P(A/B) = P(A)$, then $P(B/A) =$

(A) $P(A)$ (B) $P(B)$

(C) $P(A \cup B)$ (D) $P(A) + P(B)$

96. Three houses were available in a locality for allotment. Three persons applied for a house. The probability that all the three persons applied for the same house is

(A) $\frac{1}{3}$ (B) $\frac{1}{9}$

(C) $\frac{1}{27}$ (D) 1

97. The probability that a student passes in mathematics is $\frac{4}{9}$ and that he passes in physics is $\frac{2}{5}$. Assuming that passing in mathematics and physics are independent, what is the probability that he passes in mathematics and fails in physics?

(A) $\frac{4}{15}$ (B) $\frac{8}{45}$
(C) $\frac{26}{45}$ (D) $\frac{19}{45}$

98. The distribution having memory less property is

(A) rectangular distribution (B) normal distribution
(C) Cauchy distribution (D) exponential distribution

99. Let (X,Y) have joint pdf given by $f(x,y)=e^{-(x+y)}$; $x,y>0$ Then

(A) X and Y are independent.
(B) X and Y are not independent.
(C) correlation coefficient between X and Y is 1.
(D) None of the above

100. The pdf of X is $f(x)=\frac{1}{2}e^{-|x|}$; $-\infty < x < \infty$. The distribution is

(A) exponential (B) Cauchy
(C) Pareto (D) Laplace

101. Let X be a discrete random variable and $F(x)$ is its cdf, then $P(a < X \leq b)$ is

(A) $F(b)-F(a)$ (B) $F(b)+F(a)$
(C) $F(b)\times F(a)$ (D) 0

102. For the following probability distribution of X

x	0	1	2	3
$p(x)$:	$\frac{1}{6}$	$\frac{1}{2}$	$\frac{3}{10}$	$\frac{1}{30}$

$P(0 < X < 2)$ is equal to

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

103. A random variable X takes values x with $p(x)$ as under:

x	0	1	2	3	4	5	6
$p(x)$:	k	$3k$	$5k$	$7k$	$9k$	$11k$	$13k$

The smallest value of x for which $p(X \le x) > \frac{1}{2}$ is

(A) 4 (B) 5
(C) 6 (D) 3

104. If X is continuous random variable, then the probability at a point a is

(A) 1 (B) a
(C) 0 (D) Cannot say

105. If $F(x) = \begin{cases} 0 & if\ x < 0 \\ x^2 & if\ 0 \le x < 1 \\ 1 & if\ x > 1 \end{cases}$

then $p(X > 0.75)$ is equal to

(A) 0.5 (B) 0.4375
(C) 0.4537 (D) 0.4735

106. If $f(x) = 6x(1-x);\ 0 \le x \le 1$ and $p(X < b) = p(X > b)$, then b satisfies the equation

(A) $4b^3 - 6b^2 + 1 = 0$ (B) $4b^3 + 6b^2 + 1 = 0$
(C) $4b^3 - 6b^2 - 1 = 0$ (D) $4b^3 - 6b^2 + 3 = 0$

107. If the pdf of a random variable X is

$$f(x) = \begin{cases} \dfrac{3}{x^4} & if\ \ x > 1 \\ 0 & \text{otherwise} \end{cases}$$

then $E(X)$ is

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

108. Let the pmf of a discrete random variable x be
$p(x) = p(1-p)^x \quad x = 0, 1, 2 \ldots;\ 0 < p < 1.$
Then $E(X)$ is

(A) $\frac{p}{(1-p)}$ (B) $\frac{(1-p)}{p}$
(C) $\frac{1}{p}$ (D) $\frac{1}{(1-p)}$

109. Given that $E(X + c) = 8,\ E(X - c) = 12$. Then c is

(A) 2 (B) -2
(C) 4 (D) -4

110. The variance of the random variable X is 4. Its mean is 2. Then $E(X^2)$ is

(A) 1 (B) 4
(C) 8 (D) 16

111. The moment generating function of a random variable is $(1-t)^{-2}$ The variance of the random variable is

(A) 4 (B) 6
(C) 2 (D) 0

112. A random variable X has mean 3 and variance 2. Then for any $t \geq 0$, the upper bound for $P(|X-3| \geq t)$ is

(A) $\frac{2}{t^2}$ (B) $\frac{t^2}{2}$
(C) $\frac{4}{t^2}$ (D) $\frac{1}{t^2}$

113. The pdf of a continuous random variable X is $f(x) = k\ e^{-|x|}$. Then k is

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

114. Let X be a random variable with pdf $f(x) = \frac{1}{2}$, $|x| < 1$ and 0 otherwise.

Then $E(X)$ is

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

115. X and Y are independent random variables with variances 1 and 2 respectively. Then $V(2X-5Y)$ is

(A) 46
(B) 49
(C) 54
(D) 48

116. If X and Y are independent, then

(A) $E(X+Y)=E(X)E(Y)$
(B) $E(XY)=E(X)E(Y)$
(C) $E(XY)=E(X)+E(Y)$
(D) $E(XY)=0$

117. If X is a random variable with mean μ and variance σ^2, then $E\left(\frac{X-\mu}{\sigma}\right)+V\left(\frac{X-\mu}{\sigma}\right)$ is

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

118. Binomial distribution applies to

(A) rare events
(B) dichotomous, repeated independent outcomes
(C) impossible events
(D) three events

119. Which one of the following is true in the case of binomial distribution?

(A) Mean 7 ; variance 16
(B) Mean 5 , variance 9
(C) Mean 6 ; SD $\sqrt{2}$
(D) Mean 4 ; SD $\sqrt{5}$

120. A box contains 100 watches of which 20 are defective. 10 watches are selected at random for inspection. The probability that all 10 are defective is

(A) $\left(\frac{1}{5}\right)^{10}$ (B) $\frac{10}{5^{10}}$

(C) $\left(\frac{4}{5}\right)^{10}$ (D) $1-\left(\frac{4}{5}\right)^{10}$

121. If a random variable X follows a Poisson distribution with parameter $\lambda = 3$, then $E\left(X^2\right)$ is

(A) 3 (B) 9

(C) 12 (D) 27

122. For a Poisson distribution

A) mean = standard deviation

(B) mean = variance

(C) mean # variance

(D) mean > variance

123. If X follow $N\left(\mu, \sigma^2\right)$, the points of inflexion are

(A) $\pm\mu$ (B) $\mu\pm\sigma$

(C) $\sigma\pm\mu$ (D) $\mu\pm2\sigma$

124. In a normal distribution skewness is

(A) one (B) zero

(C) greater than one (D) less than one

125. If X is a normal variate with mean 80 and standard deviation 10, then $p(X \leq 80)$ is

(A) 1
(B) $\frac{1}{2}$
(C) 0
(D) 0.6826

126. If $X \sim N(2, 4)$ and $Y \sim N(-1, 4)$ are independent, then the coefficient of variation of $X + Y$ is

(A) $\frac{3}{4}$
(B) $2\sqrt{2}$
(C) $\frac{3}{2}$
(D) 0

127. If the correlation coefficient between two variables X and Y is -1, then the two regression lines

(A) are perpendicular to each other
(B) coincide
(C) are parallel to each other
(D) do not exist

128. If the regression lines between two random variables are $2x - 3y = 5$ and $2x - 9y = 10$, then r_{xy} is

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

129. The correlation coefficient between X and Y is -0.4. The correlation coefficient between $3X$ and $2Y$ is

(A) -0.6
(B) 0.9
(C) -0.4
(D) 0.[illegible]

130. The correct pair of values of two regression coefficient is

(A) $\left(-2, \frac{1}{3}\right)$ (B) $(-1, 1)$

(C) $(3, 2)$ (D) $\left(\frac{1}{3}, 2\right)$

131. If the covariance between two random variables is positive, then the correlation coefficient will be between

(A) $(-1, 0)$ (B) $(0, 1)$

(C) $\left(\frac{-1}{2}, \frac{1}{2}\right)$ (D) $(0, \infty)$

132. Which of the following cannot be the multiple correlation coefficient between X_1 and (X_2, X_3)?

(A) 1 (B) 0

(C) 0.4 (D) -0.4

133. If the slope of the trend is positive, it shows

(A) a decreasing trend (B) a constant trend

(C) an oscillating trend (D) an increasing trend

134. Vital statistics is mainly concerned with

(A) births (B) deaths

(C) marriages (D) All of the above

135. Vital statistics are generally expressed as

(A) percentages (B) per million

(C) per trillion (D) per thousand

136. Let $x_1, x_2, ..., x_n$ be a random sample from a normal distribution $N(\mu, \sigma^2)$. An unbiased estimator of σ^2 is

(A) $\bar{x}$
(B) $\sum xi^2$
(C) $\frac{1}{n}\sum(xi-\bar{x})^2$
(D) $\frac{1}{n-1}\sum(xi-\bar{x})^2$

137. Let X have F – distribution with (4, 8) df. The distribution of $\frac{1}{X}$ will be

(A) F with (4, 8) df
(B) F with (8, 4) df
(C) t with 4 df
(D) F with (4, 4) df

138. As $n \to \infty$, the standard error of the sample mean from $N(\mu, \sigma'^2)$ tends to

(A) ∞
(B) 0
(C) 1
(D) $\frac{1}{\sqrt{n}}$

139. Let $X_1, X_2, ..., X_n$ be a random sample from $N(\mu, \sigma^2)$ then $X_1, X_2, ...+ X_n$ is

(A) sufficient statistic for μ
(B) sufficient statistics for σ^2
(C) unbiased for μ
(D) unbiased for σ^2

140. Sufficient statistic for a parameter can be found using

(A) Rao-Blackwell theorem
(B) Neyman-Fisher theorem
(C) Neyman-Pearson lemma
(D) Inversion theorem

141. The likelihood function is the

(A) joint density as a function of $\underline{x}$ given θ
(B) joint density as a function of θ given $\underline{x}$
(C) conditional density of $\underline{x}$ given θ
(D) None of the above

142. The minimum variance estimate obtained through Rao-Blackwell theorem is

(A) a function of the sufficient statistic
(B) not a function of the sufficient statistic
(C) not unbiased
(D) consistent

143. For testing the independence of attributes in an $m \times n$ contingency table, the degrees of freedom for the Chi-square is

(A) $m+n-1$ (B) $mn-1$
(C) $(m-1)(n-1)$ (D) $m-n$

144. F – distribution is

(A) positively skewed (B) negatively skewed
(C) symmetrical (D) None of the above

145. The power of the test is defined as the probability of

(A) rejecting H_0 when H_0 is true
(B) rejecting H_1 when H_0 is true
(C) rejecting H_0 when H_0 is false
(D) None of the above

146. The factor $\left(1-\frac{n}{N}\right)$ is called

(A) sampling fraction
(B) finite population correction
(C) sampling proportion
(D) sampling interval

147. Which one of the following is correctly matched?

(A) $\bar{x}$ – chart $\bar{c} \pm 3\sqrt{c}$
(B) c – chart $\bar{x} \pm A_2 \bar{R}$
(C) R – chart $D_3 \bar{R}$ and $D_4 \bar{R}$
(D) np – chart $\bar{x} \pm A_3 \bar{R}$

148. The confidence interval for μ in a normal population with mean μ and variance σ^2 (known) is based on the

(A) normal distribution
(B) t – distribution
(C) F – distribution
(D) exponential distribution

149. Analysis of variance is a technique to test the hypothesis of the equality of several ________ (assuming normality).

(A) variances
(B) correlation coefficient
(C) replications
(D) means

150. In systematic sampling, the following is selected at random

(A) First unit only
(B) Last unit only
(C) Half of the units
(D) All units

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