Register Number

Part III — STATISTICS

(English Version)

Time Allowed : 3 Hours]   [Maximum Marks : 150

PART – I

Note : i)   Answer *all* the questions.

ii)   Each question carries *one* mark.

Choose the best answer :   50 × 1 = 50

1.   A coin is tossed 6 times. The number of points in the sample space is

a)   12   b)   16

c)   32   d)   64.

2.   Probability is expressed as

a)   ratio   b)   percentage

c)   proportion   d)   all of these.

3.   Probability of drawing a spade queen from a well-shuffled pack of cards is

a) $\dfrac{1}{13}$ b) $\dfrac{1}{52}$

c) $\dfrac{4}{13}$ d)   1.

[Turn over

4. Three dice are thrown simultaneously. The probability that sum being 3 is

    a)   0   b) $\dfrac{1}{216}$

    c) $\dfrac{2}{216}$ d) $\dfrac{3}{216}$.

5. The conditional probability of B given A is

    a) $\dfrac{P(A \cap B)}{P(B)}$ b) $\dfrac{P(A \cap B)}{P(A)}$

    c) $\dfrac{P(A \cup B)}{P(B)}$ d) $\dfrac{P(A \cup B)}{P(A)}$.

6. If $P(A) = 0.5$, $P(B) = 0.3$ and the events A and B are independent, then $P(A \cap B)$ is

    a)   0.8   b)   0.15

    c)   0.08   d)   0.015.

7. The probability of not getting 2, when a die is thrown is

    a) $\dfrac{1}{3}$ b) $\dfrac{2}{3}$

    c) $\dfrac{1}{6}$ d) $\dfrac{5}{6}$.

8. $\displaystyle\sum_{i=1}^{n} P(x_i)$ is equal to

    a)   0   b)   1

    c)   – 1   d) ∞ .

9. $E(2x + 3)$ is

    a) $E(2x)$ b) $2E(x) + 3$

                                    d) $2x + 3$

10. $Var(5x+2)$ is

    a) $25\,Var(x)$ b) $5\,Var(x)$

    c) $2\,Var(x)$ d)   25.

11. Variance of the random variable X is $\dfrac{1}{16}$; its standard deviation is

    a) $\dfrac{1}{256}$ b) $\dfrac{1}{32}$

    c) $\dfrac{1}{64}$ d) $\dfrac{1}{4}$.

12. If $f(x)$ is distribution function, then $F(\infty)$ is equal to

    a) -1 b)   0

    c)   1   d) ∞ .

13. If x is a discrete random variable with the probabilities p_i, then the expected value of x^2 is

    a) $\sum x_i p_i$ b) $\sum x_i^2 p_i$

    c) $\sum x_i^2 p_i^2$ d) $\sum x_i p_i^2$.

14. Variance of a constant a is

    a) a^2 b)   0

    c)   1   d) -1.

15. Binomial distribution applies to

    a)   rare events

    b)   repeated alternatives

    c)   three events

    d)   impossible events.

[Turn over

16. The mean of the Binomial distribution $15 \, C_x \left(\dfrac{2}{3} \right)^x \left(\dfrac{1}{3} \right)^{15-x}$ in which $p = \dfrac{2}{3}$ is

    a)   5   b)   10

    c)   15   d)   3.

17. If for a Binomial distribution, $n = 4$ and also $P(x = 2) = 3 \, P(x = 3)$, then the value of p is

    a) $\dfrac{9}{11}$ b)   1

    c) $\dfrac{1}{3}$ d)   none of these.

18. The Binomial distribution is completely determined if .... is known.

    a) p b) q

    c) p and q d) n and p.

19. For a Poisson distribution

    a)   Mean > Variance   b)   Mean = Variance

    c)   Mean < Variance   d)   Mean ≤ Variance.

20. If the Poisson variables X and Y have parameters M_1 and M_2, then $X + Y$ is a Poisson variable with parameter

    a) $M_1 M_2$ b) $M_1 + M_2$

    c) $M_1 - M_2$ d) M_1 / M_2.

21. In a normal distribution, skewness is

    a)   one   b)   zero

                                   d)   < 1

22. The probability that a random variable X lies in the interval

    $(\mu - 2\sigma , \mu + 2\sigma)$ is

    a)   0·9544

    b)   0·6826

    c)   0·9973

    d)   0·0027.

23. If X is a normal variable with $\mu = 100$ and $\sigma^2 = 25$ then $P(90 < x < 120)$
    is same as

    a) $P(-1 < z < 1)$

    b) $P(-2 < z < 4)$

    c) $P(4 < z < 4.1)$

    d) $P(-2 < z < 3)$.

24. Alternative hypothesis is

    a)   always left tailed

    b)   always right tailed

    c)   always one tailed

    d)   one tailed or two tailed.

25. In the right tailed test, the critical region is

    a)   0

    b)   1

    c)   lies entirely in right tail

    d)   lies in the left tail.

26. Area of the critical region depends on

    a)   size of type I error

    b)   size of type II error

    c)   value of the test statistics

    d)   number of observations.

[Turn over

27. Testing $H_0 : \mu = 100$ vs $H_1 : \mu \neq 100$ leads to

    a) one sided right tailed test

    b) one sided left tailed test

    c) two tailed test

    d) none of these.

28. Standard error of number of success is given by

    a) $\sqrt{\dfrac{pq}{n}}$

    b) $\sqrt{npq}$

    c) npq

    d) $\sqrt{\dfrac{np}{q}}$.

29. Test statistic for difference between two means is

    a) $\dfrac{\bar{x} - \mu}{\sigma / \sqrt{n}}$

    b) $\dfrac{p - P}{\sqrt{\dfrac{PQ}{n}}}$

    c) $\dfrac{\bar{x}_1 - \bar{x}_2}{\sqrt{\dfrac{\sigma_1^2}{n_1} + \dfrac{\sigma_2^2}{n_2}}}$

    d) $\dfrac{p_1 - p_2}{\sqrt{PQ\left(\dfrac{1}{n_1} + \dfrac{1}{n_2}\right)}}$.

30. Statistic $Z = \dfrac{\bar{X} - \bar{Y}}{\sigma \sqrt{\dfrac{1}{n_1} + \dfrac{1}{n_2}}}$ is used to test the null hypothesis

    a) $H_0 : \mu_1 + \mu_2 = 0$

    b) $H_0 : \mu_1 - \mu_2 = 0$

    c) $H_0 : \mu = \mu_0$ (a constant)

    d) none of these.

31. If $\hat{P} = \dfrac{2}{3}$, then $\hat{Q}$ is

    a) $\dfrac{1}{3}$

    b) $\dfrac{3}{2}$

    c) $\dfrac{2}{3}$

    d) 0.

32. Student's *t*-distribution was pioneered by

   a)   Karl Pearson

   b)   Laplace

   c)   R. A. Fisher

   d)   William S. Gosset.

33. The difference of two means in case of a small sample is tested by the formula

   a) $t = \dfrac{\bar{x}_1 - \bar{x}_2}{S}$

   b) $t = \dfrac{\bar{x}_1 - \bar{x}_2}{S} \sqrt{\dfrac{n_1 - n_2}{n_1 + n_2}}$

   c) $t = \dfrac{\bar{x}_1 - \bar{x}_2}{S} \sqrt{\dfrac{n_1 n_2}{n_1 + n_2}}$

   d) $t = \sqrt{\dfrac{n_1 n_2}{n_1 + n_2}}$.

34. Paired *t*-test is applicable when the observations in the two samples are

   a)   paired

   b)   correlated

   c)   equal in number

   d)   all of these.

35. When observed and expected frequencies completely coincide, x^2 will be

   a)   – 1

   b)   + 1

   c)   greater than 1

   d)   0.

36. For $v = 2$, $\chi^2_{0.05}$ equals

   a)   5·9

   b)   5·99

   c)   5·55

   d)   5·95.

37. Degrees of freedom for Chi-square in case of contingency table of order (4 × 3) are

   a)   12

   b)   9

   c)   8

   d)   6.

[Turn over

38. Equality of several normal population means can be tested by

   a)   Bartlet's test   b) F-test

   c) χ^2-test   d) t-test.

39. In the case of two-way classification, the total variation (TSS) equals

   a) $SSR + SSC + SSE$ b) $SSR - SSC + SSE$

   c) $SSR + SSC - SSE$ d) $SSR + SSC.$

40. Analysis of variance technique originated in the field of

   a)   Agriculture   b)   Industry

   c)   Biology   d)   Genetics.

41. In the case of one-way classification with N observations at t treatments, the error degrees of freedom is

   a) $N - 1$ b) $t - 1$

   c) $N - t$ d) $Nt.$

42. A time series consists of

   a)   two components   b)   three components

   c)   four components   d)   five components.

43. Moving average method is used to calculate

   a)   Trend values   b)   Cyclic variations

   c)   Seasonal indices   d)   none of these.

44. The sales of a departmental store on any important festival are as___ __th the component of time-series

    a) Secular trend   b) Seasonal variation

    c) Irregular variation   d) All of these.

45. Measures of association usually deal with

    a) Attributes   b) Quantitative factors

    c) Variables   d) none of these.

46. With the two attributes, the total number of class frequencies is

    a) two   b) four

    c) eight   d) nine.

47. If the attributes are A and B, $(AB) > \dfrac{(A) \cdot (B)}{N}$, then the attributes are

    a) independent

    b) positively associated

    c) negatively associated

    d) no conclusion.

48. Decision theory is concerned with

    a) the amount of information that is available

    b) criteria for measuring the 'goodness' of a decision

    c) selecting optimal decisions in sequential problems

    d) all of these.

[Turn over

49. Maximin return, Maximax return and Minimax regret are criteria that

    a)   lead to the same optimal decision

    b)   cannot be used with probabilities

    c)   both (a) and (b)

    d)   none of these.

50. The criterion which selects the action for which maximum pay-off is lowest is known as

    a)   Max-min criterion

    b)   Min-max criterion

    c)   Max-max criterion

    d)   none of these.

PART – II

Note : i)   Answer any *fifteen* questions.

       ii)   Each question carries *two* marks.   15 × 2 = 30

51. Define conditional probability.

52. State the axioms of probability.

53. Define random variable.

54. What is probability mass function ?

55. Define the expectation of a continuous random variable.

56. Comment the following :

"For a Binomial distribution, mean = 7 and variance = 16."

57. Give any two examples of Poisson distribution.

58. Find the probability that standard normal variate lies between $Z = 0.78$ and $Z = 2.75$.

59. Define null hypothesis and alternative hypothesis.

60. Explain clearly Type I and Type II errors.

61. In a test, if $Z_o \leq Z_e$, what is your conclusion about the null hypothesis ?

62. State any two assumptions of Student's t-test.

63. Define chi-square variate.

64. Write a short note on Yate's correction.

65. What is time series ?

66. Write briefly about Seasonal Variation.

67. What do you understand by consistency of data ?

68. Give Yule's coefficient of association.

69. Explain the meaning of 'Statistical decision theory'.

70. What is a pay-off matrix ?

[Turn over

PART – III

Note : i)   Answer any *six* questions.

ii) Each question carries *five* marks.   6 × 5 = 30

71. A ball is drawn at random from a box containing 5 green, 6 red and 4 yellow balls. Determine the probability that the ball drawn is (i) green, (ii) red, (iii) yellow, (iv) green or red and (v) not yellow.

72. Let X be a discrete random variable with the following probability distribution :

X	– 3	6	9
P (X = x)	$\frac{1}{6}$	$\frac{1}{2}$	$\frac{1}{3}$

Find the mean and variance.

73. Eight coins are tossed simultaneously. Find the probability of getting at least six heads.

74. If 3% of bulbs manufactured by a company are defective, then find the probability in a sample of 100 bulbs exactly five bulbs are defective.

$\left(e^{-3} = 0.04979 \right)$.

75. A coin was tossed 400 times and the head turned up 216 times. Test the hypothesis that the coin is unbiased.

76. A random sample of size 20 from a population gives the sample standard deviation of 6. Test the hypothesis that the population standard deviation is 9.

77. Calculate 3 yearly moving average of the following data :

Year	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
Production (in tonnes)	50	36	43	45	39	38	33	42	41	34

78. Show that whether A and B are independent, positively or associated :

$(AB) = 128$, $(\alpha B) = 384$, $(A\beta) = 24$ and $(\alpha\beta) = 72$.

79. Given the following pay-off of 3 acts :

A_1, A_2, A_3 and their events E_1, E_2, E_3 :

States of nature	Acts		
	A_1	A_2	A_3
E_1	35	– 10	– 150
E_2	200	240	200
E_3	550	640	750

The probabilities of the states of nature are respectively 0·3, 0·4 and 0·3. Calculate and tabulate EMV and conclude which of the acts can be chosen as the best.

PART – IV

Note : i) Answer any *four* questions.

ii) Each question carries *ten* marks. $4 \times 10 = 40$

80. Two persons A and B appeared for an interview for a job. The probability of selection of A is $\frac{1}{3}$ and that of B is $\frac{1}{2}$. Find the probability that

i) both of them will be selected

ii) only one of them will be selected.

iii) none of them will be selected.

[Turn over

81. In a normal distribution 31% of the items are under 45 and 8% are over 64. Find the mean and variance of the distribution.

82. The means of two large samples 1000 and 2000 items are 67·5 cm and 68·0 cm respectively. Can the samples be regarded as drawn from the population with standard deviation 2·5 cm ? Test at 5% level of significance.

83. Certain pesticide is packed into bags by a machine. A random sample of 10 bags is drawn and their contents are found to weigh (in kg) as follows :

    50 49 52 44 45 48 46 45 49 45.

    Test, if the average packing can be taken to be 50 kg.

84. Three varieties of coal were analysed by four chemists and the ash-content in the varieties was found to be as under :

Varieties	Chemists			
	1	2	3	4
A	8	5	5	7
B	7	6	4	4
C	3	6	5	4

Carry out an analysis of variance.

85. Fit a straight line trend by the method of least squares for the following data :

Year :	1983	1984	1985	1986	1987	1988
Sales (Rs. in lakhs)	3	8	7	9	11	14

Also estimate the sales for the year 1991.

86. A canteen prepares a food at a total average cost of Rs. 4 per plate a at a price of Rs. 6. The food is prepared in the morning and is sold durin same day. Unsold food during the same day is spoiled and is to be thrown away. According to the past sale, number of plates prepared is not less than 50 or greater than 53. You are to formulate the

i)   action space

ii) states of nature space

iii) pay-off table

iv) loss table.

_____

88. A canteen prepares a food at a total average cost of Rs. 4 per plate and sells it at a price of Rs. 6. The food is prepared in the morning and is sold during the same day. Unsold food during the same day is spoiled and is to be thrown away. According to the past sale, number of plates prepared is not less than 50 or greater than 55. You are to formulate the

    i.   action space

    ii.   states of nature space

    iii.   pay-off table

    iv.   loss table.