2017

STATISTICS

Full Marks : 100

Pass Marks : 33

Time : Three Hours and *Fifteen Minutes

*(*15 minutes are given as extra time for reading questions)*

*Attempt **all** questions.*

The figures in the right margin indicate full marks for the questions.

For Question Nos. **4, 12, 17, 23, 29** and **32** *choose the correct answer and rewrite.*

1. Define mutually exclusive events.   1

2. For two events A and B, we have $P(A \cup B) = P(A) + P(B) - P(A \cap B)$.
   Generalise for three events A, B and C.   1

3. State and prove the additive law of probability.   6

4. The probability that neither X nor Y occurs is   1

   A. $P(X \cap Y)$

   B. $P(\bar{X} \cap \bar{Y})$

C. $P(\bar{X} \cup \bar{Y})$

D. $P\{(X \cup Y) - (X \cap Y)\}$

5.   An urn contains 6 white and 4 black balls. If 4 balls are drawn at random from this urn, find the probability of getting exactly 2 white and 2 black balls.   6

6.   Prove that the mathematical expectation of the product of two independent random variables is equal to the product of their expectations.   4

7.   Draw the Venn-diagram of $A \cup B$, when A and B are disjoint sets.   1

8.   Define the operator Δ .   1

9.   The relation between the operators Δ and E is wrongly written as $\Delta \equiv 1 + E$. Write the correct relation.   1

10.   State and prove the Newton's forward interpolation formula.   6

11.   Evaluate : (i) $\Delta^2 \left(ae^{3x} \right)$ 3+3=6

      and   (ii) $\left(\dfrac{\Delta^2}{E} \right) x^2$,

      the interval of differencing being unity.

12.   Newton's backward interpolation formula is applicable only when the interval of differencing of the successive values of the argument are equal and the value to be interpolated lies   1

      A.   towards the beginning of the given set of data.

B.   towards the end of the given set of data.

C.   in the middle of the given set of data.

D.   None of the above.

13.   Define Numerical integration.   1

14.   Establish Simpson's $\frac{1}{3}rd$ rule of numerical integration from the general quadrature formula.   6

15.   Evaluate $\int_{1}^{4} 2x\, dx$ by Simpson's $\frac{3}{8}$th rule of numerical integration by taking 4 ordinates.   3

16.   Define Bernoulli trial.   1

17.   Number of telephone customers arriving at a Super Market per hour is an example of   1

A.   Binomial distribution.

B.   Normal distribution.

C.   Poisson distribution.

D.   Nonc of the above.

18.   In the usual notation, the values of n and p in a binomial distribution are 15 and 0.6 respectively. Find the values of the mean and the variance of the distribution.   4

19. Derive the recurrence relation for moments of the Poisson's probability distribution. 3

20. The p.d.f. of Normal distribution with mean 12 and variance 25 is wrongly written as $f(x) = \dfrac{1}{4\sqrt{2\pi}} e^{-\frac{1}{2}\left(\frac{x-12}{25}\right)^2}, -\infty < x < \infty$

   Rewrite the correct p.d.f. of Normal distribution. 1

21. Define:

   (i) Positive Class frequencies, *(ii)* Negative Class frequencies and *(iii)* Contrary frequencies. $1 \times 3 = 3$

22. Define an attribute. If there are two attributes A and B, write down all possible classes of 'zero', 'first' and 'second' order and write the total number of class frequencies of all orders and frequencies of second order for 4 attributes.
   $1+3+2=6$

23. With three attributes *A, B* and *C*, the total number of ultimate class frequencies is 1

   A. 3

   B. 3^2

   C. 3^3

   D. 2^3

24. In the usual notations,

   $N = 1500$, $(AB) = 500$, $(\alpha) = 800$, $(B) = 600$, test whether the attributes *A* and *B* are independent, positively or negatively associated. 4

25. Write down the formula for the co-efficient of contingency. 1

26. Define: $1\frac{1}{2}+1\frac{1}{2}=3$

   (i) Type-I error and (ii) Type-II error.

27. If 't' is an unbiased estimate for the parameter θ, then $E(t) > \theta$. Is the statement true ? If not, write the correct statement. 1

28. Draw a rough probability curve of χ^2 (chi-square) distribution of n degrees of freedom and $\chi_n^2(\alpha)$ be the value of χ^2 for n degrees of freedom such that the area to the right of this point is α.

   Identify the rejection and acceptance regions and also critical value from the curve. 4

29. The probability level below which a given hypothesis is rejected is called

   1

   A. degrees of freedom

   B. tests of significance

   C. null-hypothesis

   D. level of significance.

30. Two random samples of sizes 7 and 5, drawn from two normal populations are characterised as follows:

Sample	Sample means	Sum of Square of deviation from mean
I	14	18
II	11	22

Test the hypothesis that the means of the two populations could be equal at 5% level of significance.

$$\left[\text{Given,} \sqrt{\frac{35}{12}} = 1 \cdot 71, \ t_{0 \cdot 05} \ \text{for} \ 10 \ \text{d.f.} = 2 \cdot 23 \right]$$

6

31. Define Vital Statistics. Write *any three* uses of Vital Statistics.   1+3=4

32. In theory, the Net reproduction ranges from

    A.   0 to 2 per annum

    B.   0 to 3 per annum

    C.   0 to 4 per annum

    D.   0 to 5 per annum   1

33. Define: (i) Crude birth rate (CBR) and (ii) Crude death rate (CDR)   2+2=4

34. State *any three* assumptions which are used in the construction of life tables.

3

35. Fill in the blanks of the following table which are marked with question marks:

3

Age (x)	l_x	d_x	p_x	L_x
20	520	?	?	?
21	480	—	—	—

———————