HS/XI/A.Sc./S/18

2018

STATISTICS

Full Marks : 100

Time : 3 hours

The figures in the margin indicate full marks for the questions

General Instructions :

(i) Write all the answers in the Answer Script.

(ii) Attempt Part ——A Objective Questions serially.

(iii) Attempt all parts of a question together at one place.

(PART : A — OBJECTIVE)

(*Marks : 50*)

SECTION – I

(*Marks : 20*)

1. Choose and write the correct answer : $1 \times 10 = 10$

    a. The number of all Permutations of n differents things taken all at a time is

       (i) ^nP_n

       (ii) ^nc_r

       (iii) n^n

       (iv) None of these

    b. The $(r+1)^{th}$ term in the expansion of $(x+y)^n$ is

       (i) $^nC_r \, x^{n-r}.y^r$

       (ii) $^nC_n \, x^{n-r}$

       (iii) $^nC_n \, x^n y^n$

       (iv) None of these.

    c. The relation between E and Δ is

       (i) $E = 1 + \Delta$

       (ii) $\Delta = 1 + E$

       (iii) $\Delta^2 = 1 + E$

       (iv) None of these

    d. The Value of $\Delta^2 e^x$, taking the interval of difference to be h is

       (i) $e^x (e^h - 1)^2$

       (ii) $e^x (1 - e^h)$

       (iii) $e^h (e^x - 1)$

       (iv) None of these

e. Three unbiased coins are tossed once. The Probability of getting all tails are

(i) $\dfrac{1}{8}$

(ii) $\dfrac{3}{8}$

(iii) $\dfrac{1}{4}$

(iv) $\dfrac{3}{4}$

f. It $P(E)$ is the Probability of an event, then

(i) $P(E) < O$

(ii) $O \leq P(E) \leq 1$

(iii) $-1 \leq P(E) \leq 1$

(iv) $P(E) > 1$

g. The mean of 7 variates is 12. If six of them are 5, 13, 9, 17, 14 and 10. Then the 7th variate is

(i) 16

(ii) 20

(iii) 11

(iv) None of these

h. For the set of observations, given that median = 8 and mode = 4 then mean is

(i) 10

(ii) 20

(iii) 32

(iv) None of these

i. Vital Statistics is mainly concerned with

(i) births

(ii) deaths

(iii) marriages

(iv) All the above.

j. Gross reproduction rate is defined as

(i) $\dfrac{\text{Total fertility } \times \text{ Female births}}{\text{Total births}}$

(ii) $\dfrac{\text{Total births}}{\text{Female Population.}}$

(iii) $\dfrac{\text{Total fertility} \times \text{Total births}}{\text{Female births.}}$

(iv) None of these

2. Fill in the blanks : $1 \times 5 = 5$

(a) If $^nC_7 = {}^nC_5$, then $^nC_1$ is ————.

(b) If $f(x) = 3^x$ and $h = 1$ then the value of $\Delta f(x)$ is ————.

(c) If A and B are two events then $P\left(\frac{B}{A}\right)$ = ————.

(d) The ratio of births to deaths in a year is called ————.

(e) The mean of first 5 natural numbers is————.

3. State whether the following statements are *True* or *False*.

$1 \times 5 = 5$

(a) $\Delta[cf(x)] = c \, \Delta f(x)$, where c is a constant.

(b) The number of combinations of n different things taken r $(\leq n)$ at a time is defined as $^nC_r = \dfrac{n!}{r!(n-r)!}$

(c) For the sure event S, $P(S) = 0$

(d) Geometric Mean cannot be calculated if any value of the set is Zero.

(e) For comparing the health conditions of two towns we have to calculate standardised death rate.

SECTION — II

(*Marks : 30*)

4. Answer the following questions : $3 \times 10 = 30$

(a) How many words can be formed of the letters of the word "MBOSE" ?

(b) If the 21st and 22nd terms in the expansion of $(1 + x)^{44}$ are equal, then find the value of x.

(c) If $f(x) = (1-x)(1-2x)(1-3x)$, then find the value of $\Delta^3 f(x)$.

(d) Prove that $E\Delta = \Delta E$, where E and Δ are usual notations in finite difference.

(e) If X and Y are two events such that $P(X) = \dfrac{1}{2}$, $P(X \cup Y) = \dfrac{7}{10}$, $P(X \cap Y) = \dfrac{1}{10}$, then find $P(Y)$ and $P\left(\dfrac{X}{Y}\right)$.

(f) Define : (i) Random experiments.

(ii) Compound Probability.

(g) What are the characteristics for an ideal measure of central tendency?

(h) Calculate the standard deviation of 3, 6, 8, 12, 8, 6, 15, 8, 9, 7.

(i) Write three uses of vital statistics.

(j) Give short note on Mortality Rate.

(PART : B — DESCRIPTIVE)

(*Marks : 50*)

Answer any **four** questions, taking atleast **one** from each group.

GROUP — A

5. (a) In how many ways can a cricket team be selected from 17 players in which 5 players can bowl? Each cricket team must include 2 bowlers. 5

(b) Find the value of n such that $^nP_5 = 42.\ ^nP_3$. 4

(c) Find the term independent of x in the expansion of $\left(x^2 + \dfrac{1}{x}\right)^9$ 3 ½

6. (a) Write down Newton's forward interpolation formula. Find the cubic polynomial interpolation which takes on the values
$f(0) = 5$, $f(1) = 1$, $f(2) = 9$,
$f(3) = 25$ and $f(4) = 55$. $2\frac{1}{2} + 5 = 7\frac{1}{2}$

(b) Evalute : $\dfrac{\Delta^2}{E} x^3$ 2

(c) Show that $\Delta^2 \log x = \log \left\{1 - \dfrac{1}{(x+1)^2}\right\}$ if $h = 1$ (unity). 3

GROUP — B

7. (a) State and prove the theorem on total probability [only for two events]. 5

(b) Let X and Y are two events, such that
$P(X) = \dfrac{1}{2}$, $P(Y) = \dfrac{1}{2}$ and $P(X \cap Y) = \dfrac{2}{3}$

Find (i) $P(\overline{X})$

(ii) $P(\overline{X} \cap \overline{Y})$ 4

(c) For any event E, Prove that $P(E^c) = 1 - P(E)$.　　3 ½

8. (a) If A and B are events with $P(A) = \dfrac{3}{8}$, $P(B) = \dfrac{5}{8}$ and

$P(A \cup B) = \dfrac{3}{4}$, find $P\left(\dfrac{A}{B}\right)$ and $P\left(\dfrac{B}{A}\right)$. Are A and B independent?　　2 + 2 + 2 = 6

(b) What is the chance that a leap year selected at random will contain 53 sundays?　　3 ½

(c) In a nursery school a boy is asked to write an integer within 31 to 70. Find the probability that he will write a number which is a multiple of 6.　　3

GROUP — C

9. (a) Explain the term "classification" and "tabulation" and point out their importance in a Statistical investigation.　　6

(b) Find the mode from the following data:　　6 ½

Class Intervel	0–10	10–20	20–30	30–40	40–50
Frequency	5	6	8	30	10

10. (a) Define crude death rate and point out its limitations. Explain clearly the standardized death rate, including the method of computation. Why is a standardized death rate needed?　　6 ½

(b) What do you understand by term "Vital Statistics"? How are such statistics collected and what are their defects? What suggestions can you give for their improvement?　　6

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