

**HS/XI/A.Sc./S/19****2019****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' distinct objects, taken 'r' at time is denoted by

(i)  ${}^nC_r$

(ii)  ${}^nP_r$

(iii)  ${}^nC_n$

(iv) None of the above.

**b.** The general term in the Binomial expansion of  $(1-x)^n$  is

(i)  $(-1)^r \cdot {}^nC_r x^r$

(ii)  $(-1)^n \cdot {}^nC_r x^r$

(iii)  $(-1)^r \cdot {}^nC_r x^n$

(iv) None of the above.

**c.** If  $f(x) = (x+1)$  and interval of difference is unity. Then  $\Delta^2 f(x)$  is

(i) 1

(ii) 2

(iii) 0

(iv) None of the above.

**d.** Newton's backward interpolation formula is used to interpolate

(i) near beginning

(ii) near central position

(iii) near end

(iv) None of the above.

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- e.** A die is tossed once. The probability of getting an even number is

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

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

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

(iv) None of the above.

- f.** If  $E_1$  and  $E_2$  are mutually exclusive events. Then

(i)  $P(E_1 \cup E_2) = 0$

(ii)  $P(E_1 \cap E_2) = 0$

(iii)  $P(E_1 - E_2) = 0$

(iv) None of the above.

- g.** The marks obtained by 15 students in a class are 12, 14, 07, 09, 23, 11, 08, 13, 11, 19, 16, 24, 17, 03, 20. Then the mean of their marks is

(i) 12.4

(ii) 13.4

(iii) 12.8

(iv) 13.8

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- h.** The range of the numbers 70, 75, 60, 22, 58, 80, 36 is

(i) 58

(ii) 48

(iii) 68

(iv) None of the above

- i.** If Total Fertility Rate ( $TFR$ ) = 5000 per thousand, male and female ratio is 60 : 40. Then Gross Reproduction Rate ( $GFR$ ) is

(i) 2 per woman

(ii) 3 per woman

(iii) 1 per woman

(iv) None of the above.

- j.** Mean is a measure of

(i) Location

(ii) Dispersion

(iii) Correlation

(iv) None of the above.

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

(a) If  $\log_{\sqrt{2}}(x+1) = 6$ . Then the value of  $x =$  \_\_\_\_\_.

(b) If  $f(x) = x(x-1)(x-2)$  and  $h = 1$ , Then  $\Delta f(x) =$  \_\_\_\_\_.

(c) If  $A$  and  $B$  are two events, such that  $P(A) = \frac{1}{2}, P(B) = \frac{1}{2}$  and  $P(A \cap B) = \frac{1}{4}$ . Then  $P(A \cup B) =$  \_\_\_\_\_.

(d) In asymmetrical distribution the mode and mean are 32.1 and 35.4 respectively. Then the median = \_\_\_\_\_.

(e) The ratio of number of females to number of males is called \_\_\_\_\_.

3. State whether the following statements are *True* or *False* :  $5 \times 1 = 5$

(a)  $3 \log 2 + \log 5 = \log 30$ .

(b) If  $h = 1$ , then  $\Delta^n(ax^n + bx^{n-1}) = a \underline{n}$

(c) If  $E_1$  and  $E_2$  be any two events such that  $E_1 \subseteq E_2$ , then  $P(E_1) \leq P(E_2)$ .

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(d) Histogram is a graph of cumulative frequencies of a frequency distribution of continuous series.

(e) If  ${}^{12}C_r = {}^{12}C_3$ , then  $r = 9$ .

SECTION — II

( Marks : 30 )

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

(a) Find the coefficients of  $x^7$  in the expansion of  $\left(x^2 + \frac{1}{x}\right)^{11}$ .

(b) If  ${}^{2n}C_3 : {}^nC_3 = 11:1$ , then find the value of  $n$ .

(c) Show that  $\Delta \log f(x) = \log \left\{ 1 + \frac{\Delta f(x)}{f(x)} \right\}$ , where  $h = 1$

(d) Prove that  $\Delta^2 \left( \frac{1}{x} \right) = \frac{2}{x(x+1)(x+2)}$ , where  $h = 1$

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(e) If  $A$  and  $B$  are two events such that  $P(A)=0.4$ ,  $P(A \cup B) = 0.7$  and  $P(B)=k$ . Then find the value of  $k$  such that  $A$  and  $B$  are independent.

(f) Two coins are tossed simultaneously. Find the probability of getting at least one head.

(g) Find the mean of first  $n$  natural numbers.

(h) Calculate mode from the following frequency distribution :

Marks	0-20	20-40	40-60	60-80	80-100
No. of Students	5	15	30	12	8

(i) Find the median of the following frequency distribution.

Number	5	10	15	20	25	30
Frequency	2	5	12	14	15	11

(j) Write a short note on Crude Birth Rate (CBR).

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( PART : B — DESCRIPTIVE )

( Marks : 50 )

Answer **four** questions, taking atleast **one** from each Group.

GROUP — A

5. (a) (i) Find how many arrangements can be made with the letters of the word 'MATHEMATICS'.  
 $2 + 4 = 6$

(ii) In how many of them are the vowels together?

(b) Using the Binomial theorem, find the value of  $(102)^6$ . 4

(c) If  $\log(m+n) = \log m + \log n$ , show that  $m = \frac{n}{n-1}$ .  $2\frac{1}{2}$

6. (a) Using Newton's Forward Interpolation Formula, find the value of  $f(14)$  from the following data. 6

$x$	:	12	16	20	24
$f(x)$	:	1	5	10	17

(b) Show that the first difference of  $f(x) = 5x + 4$  at  $x = 2$  is 5, interval of difference being unity. 3

- (c) Define the operator  $E$  and show that  $E = 1 + \Delta$ .  $3\frac{1}{2}$

## GROUP — B

7. (a) State and prove the addition Theorem of Probability for two events A and B.  $2 + 3 = 5$
- (b) Three coins are tossed. Express the following events by appropriate sets  $4$
- $A$  : Certain event.  
 $B$  : Event that exactly one head appears.  
 $C$  : Event that head appears more than once.  
 Examine if A and B are exhaustive events.
- (c) If A and B are two independent events, prove that  $\bar{A}$  and  $\bar{B}$  are also independent.  $3\frac{1}{2}$
8. (a) A die is thrown twice and the sum of the numbers appearing is observed to be 8. What is the conditional probability that the number 5 has appeared at least once?  $5\frac{1}{2}$
- (b) Let A and B be any two events such that  $2P(A) = P(B) = \frac{5}{13}$  and  $P(A/B) = 2$ . Find the value of  $P(A \cup B)$ .  $3$

- (c) If three fair coins are tossed. Find the probability that the outcomes are all tails if atleast one of the coins shows a tail.  $4$

## GROUP — C

9. (a) Prove that (i)  $AM \geq GM \geq HM$ . (ii)  $AM \times HM = (GM)^2$   $6$
- (b) Draw a histogram and frequency polygon from the following data.  $6\frac{1}{2}$

Wages	10-15	15-20	20-25	25-30	30-35	35-40	40-45
No. of Workers	50	140	110	150	120	100	80

10. (a) Define (i) Crude Death Rate (CDR) (ii) Specific Death Rate (SDR) and (iii) Standardised Death Rate (SDR).  $2 + 2 + 2 = 6$
- (b) Calculate General Fertility Rate (GFR), Age-Specific Fertility Rate (ASFR) and Total Fertility Rate (TFR) from the following data.  $6\frac{1}{2}$

Age Group	No. of women (in '000)	No. of live Births (in '000)
15-19	55	20
20-24	70	180
25-29	65	200
30-34	64	170
35-39	60	120
40-44	58	60
45-49	50	10

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