

Total No. of Printed Pages—8

**HS/XII/A.Sc/S/20**

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**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 : 1×10=10

(a) If the mean of a binomial distribution having  $n = 8$  is 4, then the value of  $p$  is

(i) 32

(ii)  $\frac{1}{3}$

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

(iv) 16

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(b) In sampling distribution, a finite population of 12 units, samples of size 7 can be selected in

(i) 792 ways

(ii) 704 ways

(iii) 84 ways

(iv) 868 ways

(c) The equality of mean and variance of a discrete distribution indicates that the distribution is

(i) Poisson

(ii) binomial

(iii) normal

(iv) hypergeometric

(d) The variance of the binomial distribution is

(i)  $np$

(ii)  $npq$

(iii)  $\sqrt{npq}$

(iv)  $nq$

(e) The bias which has its origin in sampling only is

(i) bias due to substitution

(ii) response bias

(iii) observational bias

(iv) None of the above

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(f) Changes that take place as a result of natural calamities are classified under the head

- (i) secular movement
- (ii) seasonal variations
- (iii) cyclical variations
- (iv) irregular variations

(g) Index number must satisfy

- (i) only time reversal test
- (ii) only factor reversal test
- (iii) Both test in (i) and (ii)
- (iv) Both test in (i) and (ii) are not necessary

(h) If  $Z = 2 + 3X + 5Y$  and  $E(X) = 1$ ,  $E(Y) = 2$  then the value of  $E(Z)$  is

- (i) 10
- (ii) 15
- (iii) 13
- (iv) 12

(i) The following is not a method for measuring trend :

- (i) Graphic method
- (ii) Moving average method
- (iii) Harmonic analysis method
- (iv) Least squares method

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- (j) The term parameter is used to denote the characteristic of the
- (i) population
  - (ii) size of population
  - (iii) sample size
  - (iv) None of the above

2. Fill in the blanks :

1×5=5

- (a) If  $\mu$  is the expected value of  $x$ , then  $E(x - \mu) = \underline{\hspace{2cm}}$ .
- (b) If  $x_j$  is a random variable with the probability of  $f(x_j)$ , then its expectation is  $\underline{\hspace{2cm}}$ .
- (c) The sum of probabilities in a Poisson distribution is  $\underline{\hspace{2cm}}$ .
- (d) If the trend is absent in the data, then the seasonal indices are computed by the method of  $\underline{\hspace{2cm}}$  averages.
- (e) Simple random sampling is not suitable if the population is  $\underline{\hspace{2cm}}$ .

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

1×5=5

- (a) Simple random sampling requires smaller sample size than stratified random sampling for a fixed level of precision.
- (b) Fisher's index number is the geometric mean of Laspeyres' and Paasche's indices.

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- (c) The total number of samples when sampling is done without replacement from a population of size  $n$  is  ${}^n C_n$ .
- (d) In time-series analysis, the free-hand method can represent both linear and non-linear trends.
- (e) The number of parameters of a normal distribution is one.

SECTION—II

( Marks : 30 )

4. Answer the following questions : 3×10=30

- (a) In a binomial distribution, prove that mean > variance.
- (b) If  $X$  follows a binomial distribution with mean 4 and variance 2, find  $P(X = 5)$ .
- (c) If  $X$  and  $Y$  are independent random variables, then show that  $E[\{X - E(X)\}\{Y - E(Y)\}] = 0$ .
- (d) The number of mistakes counted in 100 typed pages of a typist revealed that he made 2.8 mistakes on an average per page. Find the probability that in a page typed by him there are two or more mistakes. (Given that  $e^{-2.8} = 0.061$ ).
- (e) "Index numbers are very useful for studying the economic and business activity, but they have their own limitations." Mention any three of these limitations.

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- (f) Explain briefly how Fisher's ideal index number is constructed. Justify it being called 'ideal'.
- (g) For a basket of commodities the price of each commodity in the year 2016 is three times the price in the base year. What is Paasche's price index for the year 2016?
- (h) Write down the properties of normal distribution.
- (i) State some of the important factors responsible for non-sampling errors in any survey (census on sample).
- (j) Distinguish between seasonal variation and cyclical variation.

( PART : B—DESCRIPTIVE )

( Marks : 50 )

Answer **four** questions, taking at least **one** from each Group

GROUP—A

5. (a) (i) Define random variable and probability distribution. 1+1=2
- (ii) Three coins are tossed. Find the probability distribution of the number of heads. 2½
- (b) Find the mean and variance of a Poisson distribution. 4
- (c) The mean and variance of a binomial distribution are 4 and 4/3. Find  $P(X \geq 1)$ . 4

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6. (a) State the distinctive features of the binomial, Poisson and normal probability distributions. When does a binomial or a Poisson distribution tend to a normal distribution? 6½
- (b) Find the mean of binomial distribution. 3
- (c) For a binomial distribution, the mean is 6 and the standard deviation is  $\sqrt{2}$ . Find the values of  $n$ ,  $p$ ,  $q$  with usual notations. 3

GROUP—B

7. (a) What is time series? What is the need to analyse a time series? 1+3=4
- (b) What are the different types of index numbers? Discuss the mains steps followed in the construction of cost of living index number (CLIN)? 2+3=5
- (c) Calculate the cost of living index number (CLIN) from the following table : 3½

<i>Items</i>	<i>Price</i>		<i>Weight</i>
	<i>Base Year</i>	<i>Current Year</i>	
Food	39	47	4
Fuel	8	12	1
Clothing	14	18	3
House Rent	12	15	2
Miscellaneous	25	30	1

8. (a) Discuss the differences between seasonal and cyclical variations. 6½
- (b) Show that Fisher's index number satisfies both time and factor reversal tests. 6

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GROUP—C

9. (a) Write short notes on the following : 2½×4=10
- (i) Sampling error
  - (ii) SRSWOR
  - (iii) SRSWR
  - (iv) Judgement sampling
- (b) What are the principles of sample survey? 2½
10. (a) Prove that in simple random sampling, sample mean is an unbiased estimate of the population. 6½
- (b) Show that

$$V(\bar{x})_{\text{SRSWOR}} = \frac{\sigma^2}{n} \cdot \frac{N-n}{N}$$

where  $\bar{x}$  and  $\sigma$  have usual meanings. 6

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