Total No. of Printed Pages—8

HS/XII/A.Sc/S/21

2021

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 (any *ten*) : 1×10=10

(a) If $E(X)=\frac{9}{2}$, then the value of $E(2X+1)$ is

(i) $\frac{19}{2}$

(ii) $\frac{11}{2}$

(iii) 10

(iv) $\frac{9}{2}$

(b) The mean of a binomial distribution having $n = 8$ and $p = q = \frac{1}{2}$ is

(i) 2

(ii) 4

(iii) 8

(iv) 6

(c) A binomial distribution is

(i) uniparametric

(ii) biparametric

(iii) triparametric

(iv) None of the above

(d) In SWR, where n is sample size and N is the population size, the sampling fraction is

(i) N / n

(ii) n / N

(iii) N^n

(iv) n^N

(e) 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

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

(i) Graphic method

(ii) Moving average method

(iii) Harmonic analysis method

(iv) Least squares method

(g) If X is a random variable, then

(i) $E(X^2) \geq \{E(X)\}^2$

(ii) $E(X^2) = \{E(X)\}^2$

(iii) $E(X^2) \leq \{E(X)\}^2$

(iv) None of the above

(h) Time series consists of

(i) one component

(ii) two components

(iii) three components

(iv) four components

(i) In a normal distribution

(i) mean = median = mode

(ii) mean < median < mode

(iii) mean > median > mode

(iv) None of the above

(j) Decrease in death rate due to advancement in medical science can be classified under the head

(i) random

(ii) cyclical

(iii) seasonal

(iv) trend

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

(i) bias due to substitution

(ii) response bias

(iii) observational bias

(iv) None of the above

(l) In a given business venture, a man can make a profit of ₹ 1,000 with probability 0·8 or take a loss of ₹ 400 with probability 0·2, then the expectation is

(i) ₹ 270

(ii) ₹ 720

(iii) ₹ 40,000

(iv) None of the above

(m) The most important factor(s) causing seasonal variations is/are

(i) growth of population

(ii) depression in business

(iii) weather and social customs

(iv) None of the above

2. Fill in the blanks (any *five*) : 1×5=5

(a) If μ be the expected value of x, then $E(x-\mu) =$ _____.

(b) Normal distribution is a _____ theoretical distribution.

(c) If X and Y are two random variables satisfying $E(XY) = E(X)E(Y)$, then the variables are _____.

(d) If X follows binomial distribution with parameters n and p, then $E\left(\frac{X}{n}\right) =$ _____.

(e) _____ is the difference between the parameter and its estimate obtained from the random sample.

(f) The number of parameters of a normal distribution is _____.

(g) If the trend is absent in the data, then the seasonal indices are computed by the method of _____ averages.

3. State whether the following statements are *True* or *False* (any *five*) : 1×5=5

(a) In sampling distribution, a finite population of 10 units, samples of size 6 can be selected in 60 ways.

(b) The expected value of a constant is the constant itself.

(c) Simple random sampling requires smaller sample size than stratified random sampling for a fixed level of precision.

(d) Trend can be measured by moving average method.

(e) In time-series analysis, the free-hand method can represent both linear and non-linear trends.

(f) Sample error is defined as the difference between the results of a sample and that of a census.

(g) The variance of the binomial distribution is $np^2 - np$.

SECTION—II

(*Marks* : 30)

4. Answer the following questions (any *ten*) : 3×10=30

(a) If X denotes the number of heads appear when two coins are tossed, then by using the laws of expectations, evaluate $E(2X+1)^2$.

(b) State some of the important factors responsible for non-sampling errors in any survey (census or sample).

(c) Write down the properties of normal distribution.

(d) A die is tossed thrice. A success is 1 or 6 on a toss. Find the mean and variance of successes.

(e) Describe the models of a time series.

(f) Distinguish between seasonal variation and cyclical variation.

(g) Define stratified random sampling.

(h) Let X and Y are independent random variables, then show that

$$E[\{X - E(X)\}\{Y - E(Y)\}] = 0$$

(i) Explain the term 'principle of statistical regularity' in sample survey.

(j) Write any three advantages of sample survey over census.

(k) State whether the following statement is True or False and justify :

"The mean of a binomial distribution is 3 and variance is 4."

(l) What is the random variable?

(m) Find the mean of the binomial distribution.

(PART : B—DESCRIPTIVE)

(*Marks* : 50)

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

GROUP—A

5. *(a)* Define expectation of a random variable X. State the theorems on the expectations of sum and product of two variables. 1½+1½+1½=4½

(b) Show that $E(aX) = aE(X)$. 3

(c) If the sum of the mean and variance of a binomial distribution for 5 trials is 1·8, then find the distribution. 5

6. *(a)* Given $E(X+4) = 10$ and $E[(X+4)^2] = 116$. Determine $E(X)$ and $E(X^2)$. 1½+3=4½

(b) For a normal distribution, mean = 57·9765 and 3rd quartile = 60, then find the standard deviation. 3

(c) In binomial distribution, prove that

$$P(X = x+1) = \frac{n-x}{x+1} \cdot \frac{p}{q} \cdot P(X = x)$$ 5

GROUP—B

7. *(a)* Define time series. What are its components? Explain any one of them. 2+2+3=7

(b) Describe the method of moving average for measurement of trend. 5½

8. *(a)* A study of demand (d_i) for last 12 years $(t = 1, 2, 3, \cdots, 12)$ has indicated the following :

$$d_i = 100 (t = 1, 2, \cdots 5)$$
$$= 20 (t = 6)$$
$$= 100 (t = 7, 8, \cdots 12)$$

Compute 5-yearly moving average. 6½

(b) Mention the merits and demerits of moving average method. 6

GROUP—C

9. *(a)* Explain the concept of standard error. Discuss the role of standard error in large sample theory. 3+3½=6½

(b) Prove that in simple random sampling, sample mean is an unbiased estimate of the population mean. 6

10. *(a)* Define simple random sampling (SRS) and stratified random sampling (S_tRS). What are their merits and demerits? 2+2+2+2=8

(b) A population of size 720 was divided into three strata whose sizes were 360, 240 and 120 respectively. A sample size 60 is taken from this population using proportional allocation. Find the sizes of the samples selected from each stratum. 4½

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