HS/XII/A. Sc/S/24

2 0 2 4

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 $E(X) = \dfrac{9}{2}$, then the value of $E(2X - 1)$ is

　　(i) $\dfrac{9}{2}$

　　(ii) $\dfrac{11}{2}$

　　(iii) 10

　　(iv) 9

　　　　　　　　　　　　　　　　[P.T.O.

(b) A Poisson distribution is

   (i) uni-parametric

   (ii) bi-parametric

   (iii) tri-parametric

   (iv) None of the above

(c) The standard deviation of a binomial distribution is

   (i) $\sqrt{npq}$

   (ii) npq

   (iii) np

   (iv) None of the above

(d) Var(X) is equal to

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

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

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

   (iv) $E(X)^2$

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

   (i) ₹ 270

   (ii) ₹ 720

   (iii) ₹ 40,000

   (iv) None of the above

(f) The index number $\dfrac{p_1 q_0}{p_0 q_0}$ is given by

   (i) Laspeyres' formula

   (ii) Fisher's formula

   (iii) Paasche's formula

   (iv) Marshall-Edgeworth formula

(g) Base period for an index number should be

   (i) a year only

   (ii) a normal period

   (iii) a period at distant past

   (iv) None of the above

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

   (i) secular movement

   (ii) seasonal variation

   (iii) cyclical variation

   (iv) irregular variation

(i) The number of possible samples of size n out of population of size N without replacement is

   (i) $^N C_n$

   (ii) $(N)_n$

   (iii) n^2

   (iv) $n!$

(j) A sample consists of

  (i) all units of population

  (ii) 50% unit of population

  (iii) 5% unit of population

  (iv) any fraction of population

2. Fill in the blanks : 1×5=5

(a) If x_i is a random variable with probability $f(x_i)$, then its expectation is _____.

(b) The expected value of the number X shown on the face when a die is thrown is _____.

(c) For a binomial distribution given by $b(x, 10, 0\ 4)$, the mean is _____.

(d) Time series consists of _____ components.

(e) In simple random sampling, _____ is an unbiased estimate of population mean.

3. Write whether the following statements are *True* or *False* :

1×5=5

(a) Mean < variance is a binomial distribution.

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

(c) The standard normal distribution is denoted by $N(0, 1)$.

(d) Trend is attached to short-term fluctuation.

(e) In SRSWR, the same sampling unit may occur more than once.

(**5**)

SECTION—II

(*Marks* : 30)

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

(a) If X and Y are independent random variables, then show that $E[\{X - E(X)\}\{Y - E(Y)\}] = 0$.

(b) Suppose 8% of the people are left-handed. What is the probability that 2 or more of a random sample of 25 are left-handed? (Given $e^{-2} = 0\cdot135$)

(c) In tossing two coins, let X be the number of heads shown. Find $E(X)$ and $E(X - 1)^2$.

(d) The mean and variance of a binomial distribution are 4 and 4/3 respectively. Find $P(X \geq 1)$.

(e) 10 eggs are drawn successively from a lot containing 10% defective eggs. Find the probability that there is at least one defective egg.

(f) Discuss the uses of index number.

(g) Distinguish between seasonal and cyclical variation.

(h) Show that in SRSWOR, the sample mean is an unbiased estimate of population mean.

(i) What do you mean by 'family budget enquiry'?

(j) Why is index number called an 'economic barometer'?

(**6**)

(PART : B—DESCRIPTIVE)

(*Marks* : 50)

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

GROUP—A

5. *(a)* Define mathematical expectation of a random variable.

If X and Y are two independent random variates, then prove that $E(XY) = E(X)E(Y)$.   2+4=6

(b) What is Bernoulli's trial? In a series of n Bernoulli's trial with constant probability of success p and failure q, $q = 1 - p$, obtain the probability of X success.   1½+3=4½

(c) Prove that

$$E[(X - C)^2] = \text{Var}(X) + [E(X) - C]^2$$

where C is a constant.   2

6. *(a)* In a college, there are 500 students, 40% students are girls. 10 students are selected at random. X denotes the number of girls among the selected students. Find the value of $P(X = 4)$.   4

(b) State under what condition Poisson distribution can be obtained from Binomial distribution.   1½

(c) If X follows Poisson distribution and

$$P(X = 0) = P(X = 1) = a$$

then show that $a = \dfrac{1}{e}$.   3

(7)

(d) The number of mistakes counted in a 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 :

  (i) There is no mistake

 (ii) There are two or more mistakes

(Given $e^{-2\cdot8} = 0\cdot061$)   4

GROUP—B

7. *(a)* What are the components of a time series? Discuss each of them citing suitable examples.   1½+5=6½

(b) Find a 3-year moving average from the following data :   2

Year	1930	1931	1932	1933	1934	1935	1936	1937	1938	1939
Index No.	158	147	144	140	141	143	147	154	156	158

(c) Discuss the advantages of the method of moving average in measuring trend.   4

8. *(a)* Write a note on the choice of the base year in the construction of index number.   4

(b) Explain the time reversal and factor reversal tests of an index number. Show that Fisher's index number satisfies both the tests of an index number.   2+4=6

(c) What is the cost of living index number?   2½

GROUP—C

9. *(a)* Discuss the advantages of sampling over complete enumeration. 6½

(b) What is stratified random sampling? Discuss the advantages of stratified random sampling over simple random sampling. 2+4=6

10. *(a)* Write a brief note on the errors that creep up in sample survey. 6½

(b) Write short notes on the following : 2+2+2=6

  (i) Parameter

  (ii) Statistic

  (iii) Pilot survey

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