

2 0 1 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 $E(X) = \frac{3}{2}$, then the value of $2E(X - 1)$ is

(i) 6

(ii) 5

(iii) 12

(iv) 5

(2)

(b) Find out the odd man out in the following properties of expectations :

(i) $E(aX) = aE(X)$

(ii) $E(aX) = XE(a)$

(iii) $E(a) = a$

(iv) $E(aX + bY) = aE(X) + bE(Y)$

(c) If $n = 32$ and $p = q = \frac{1}{2}$, then standard deviation of binomial distribution is

(i) $2\sqrt{2}$

(ii) 2

(iii) 4

(iv) 36

(d) The standard deviation of the Poisson distribution $P(r) = \frac{e^{-r} r^r}{r!}$ is

(i) r

(ii) r

(iii) \sqrt{r}

(iv) None of the above

(3)

- (e) Normal distribution is
- (i) uniparametric
 - (ii) biparametric
 - (iii) triparametric
 - (iv) None of the above
- (f) For a normal distribution mean = 50, median = 52, whether the data are
- (i) consistent
 - (ii) inconsistent
 - (iii) neither consistent nor inconsistent
 - (iv) None of the above
- (g) The index number $\frac{p_1q_0}{p_0q_0} \times 100$ is given by
- (i) Laspeyres' formula
 - (ii) Fisher's formula
 - (iii) Paasche's formula
 - (iv) Edgeworth-Marshall formula

(4)

(h) The term 'statistic' is used to denote the characteristic of the

(i) population

(ii) sample data

(iii) size of population

(iv) None of the above

(i) In sampling distribution, a finite population of N units, samples of size n can be selected as

(i) ${}^N C_n$

(ii) N^n

(iii) $N - n$

(iv) None of the above

(j) 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

(5)

2. Fill the blanks :

$$\frac{1}{2} \times 10 = 5$$

(a) If $X \sim 4$, then $E(X) = \text{---}$.

(b) Binomial distribution is symmetrical if $p = q = \text{---}$.

(c) Time series consists of --- components.

(d) The standard normal distribution is denoted by --- .

(e) --- index number satisfies both the time and factor reversal tests.

(f) In a simple random sampling --- is an unbiased estimate of population mean.

(g) The maximum height of the normal curve lies at the point --- .

(h) For a binomial distribution given by $b(x; 10, 0.4)$, the mean is --- .

(6)

(i) A continuous random variable can take — value in its interval.

(j) Time reversal test is satisfied if $I_{on} = I_{no}$ —.

3. Write whether the following statements are *True* or *False* : $\frac{1}{2} \times 10 = 5$

(a) $E(X^2) = E(X) \cdot E(X)$.

(b) A binomial distribution is non-parametric.

(c) Binomial distribution is unimodal if np is a whole number and the mean and mode are equal, each being np .

(d) Sampling involves lower cost than complete enumeration.

(e) Census enumeration results are less accurate and reliable.

(f) Secular trend is attached to short-term fluctuations.

(7)

- (g) In SRSWR, the same sampling unit may be included in the sample more than once.
- (h) Index number always involves two periods.
- (i) Marshall-Edgeworth index number does not satisfy time reversal test.
- (j) Increase in population in India represents the secular trend.

SECTION—II

(Marks : 30)

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

- (a) In tossing two coins, let X be the number of heads shown. Find $E(X)$ and $E(X - 1)^2$.
- (b) If x and y are independent random variables, show that
$$E[\{x - E(x)\}\{y - E(y)\}] = 0$$
- (c) A die is rolled three times. What is the probability of 5 coming up at least once?

(8)

- (d) Why are index numbers called economic barometers of a country?
- (e) What are the problems in the construction of index number?
- (f) Explain briefly, how Fisher's ideal index number is constructed. Justify its being called 'ideal'.
- (g) Name the components of a time series.
- (h) What do you understand by 'seasonal variation' in the time series data?
- (i) What are sampling and non-sampling errors?
- (j) Mention the three methods of sampling.

(9)

(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 expectation of sum and product of two variables. 2+2+2=6
- (b) Show that the mean and variance are identical in Poisson distribution. 4
- (c) Find the expected value of the number X shown on the face when a die is thrown. 2½
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) The mean of a binomial distribution is 4 and its standard deviation $\sqrt{3}$. What are the values of n , p and q with usual notation? 3

(10)

GROUP—B

7. (a) An enquiry into the budgets of the middle class families of a certain city revealed that on an average the percentage expenses on the different groups were :

Food—45, Rent—15, Clothing—12, Fuel and light—8, Miscellaneous—20

The group index numbers for the current year as compared with a fixed base period were respectively 410, 150, 343, 248 and 285. Calculate the cost of living index number for the current year.

3

- (b) Prove that the time reversal test is satisfied by the Marshall-Edgeworth index number.

3

- (c) What is time series? Describe the uses of time series. How will you analyze the time series?

$$2+2+2\frac{1}{2}=6\frac{1}{2}$$

8. (a) Name four methods by which one can compute a seasonal index from time series data.

6

- (b) Calculate the Laspeyres' and Paasche's index numbers from the following data and comment on the relative merits of the two :

6½

Commodity	Base Year		Current Year	
	Quantity	Price	Quantity	Price
A	10	0.80	11	0.70
B	8	0.85	9	0.90
C	5	1.30	5.5	0.80

(11)

GROUP—C

9. (a) Explain the two terms 'parameter' and 'statistic' as used in sampling theory. $3+3=6$
- (b) Define 'simple random sampling' and 'stratified random sampling'. What are random numbers and how can you use them? $2+2+2\frac{1}{2}=6\frac{1}{2}$
10. (a) Write a note on the difference between Census and Sample survey. 6
- (b) Explain the concept of standard error. Discuss the role of standard error in large sample theory. $3+3\frac{1}{2}=6\frac{1}{2}$
