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HS/XII/A. Sc./S/25

2 0 2 5

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) The mean of a binomial distribution is

- (i) n
- (ii) np
- (iii) npq
- (iv) None of the above

(2)

(b) The skewness of the normal distribution is

(i) 1 (one)

(ii) ∞ (infinity)

(iii) -1 (negative one)

(iv) 0 (zero)

(c) The price index number for the current year compared to the base year is denoted by

(i) Q_{10}

(ii) P_{10}

(iii) P_{01}

(iv) Q_{01}

(d) The probability of a specified unit being included in the sample is equal to

(i) N

(ii) n

(iii) $\frac{n}{N}$

(iv) $\frac{N}{n}$

(3)

(e) The additive model for time series analysis is

(i) $Y = T + S$

(ii) $Y = C + S$

(iii) $Y = T + S + C + 1$

(iv) $Y = T + S + C + I$

(f) The time reversal test may be expressed as

(i) $P_{01} = 1$

(ii) $P_{01} \times P_{10} = 1$

(iii) $P_{01} \times P_{10} = 0$

(iv) $P_{10} = 1$

(g) A die is thrown. Let X denote the point on the uppermost face. Then $E(X)$ is

(i) 1

(ii) 21

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

(iv) $\frac{7}{2}$

(4)

(h) The mean and variance of a Poisson distribution are

(i) $(0, 0)$

(ii) $(0, \lambda)$

(iii) (λ, λ)

(iv) $(\lambda, 0)$

(i) If σ^2 is the population variance, then which of the following is correct in case of SRSWR?

(i) $\text{var}(\bar{x}) > \frac{\sigma^2}{n}$

(ii) $\text{var}(\bar{x}) = \frac{\sigma^2}{n}$

(iii) $\text{var}(\bar{x}) < \frac{\sigma^2}{n}$

(iv) $\text{var}(\bar{x}) \neq \frac{\sigma^2}{n}$

(j) The error which arises only in sample survey is termed as

(i) sampling error

(ii) non-sampling error

(iii) Both (i) and (ii)

(iv) Neither (i) nor (ii)

(5)

2. Fill in the blanks :

1×5=5

- (a) If X and Y be two _____ variables, then $E(XY) = E(X) \cdot E(Y)$.
- (b) If the standard deviation of a Poisson variate is 2, the mean of the Poisson variate is _____.
- (c) _____ index is known as 'ideal' formula for constructing index number.
- (d) A sample is a study of _____ of the population.
- (e) An overall tendency of rise or fall in a time series is called _____.

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

1×5=5

- (a) An era of prosperity is a cyclical component of time series.
- (b) Census is superior than sample survey.
- (c) Paasche's index formula does satisfy factor reversal test.
- (d) The mean and standard deviation of standard normal variate are respectively 0 and 1.
- (e) If X is a random variable and c is a constant, then $E(cX) = cE(X)$.

(6)

SECTION—II

(Marks : 30)

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

(a) If a random variable X takes the values 1, 2, 3 with probability

$$P(X = r) = \frac{r}{6}; r = 1, 2, 3$$

find $E(X)$. 3

(b) The random variable X follows binomial distribution with mean 6 and variance 4. Find the probability distribution of X . 3

(c) State the important properties of normal distribution. 3

(d) Write down the formula for the following index numbers : 1×3=3

(i) Laspeyres' price index number

(ii) Paasche's price index number

(iii) Value index number

(e) Mention three uses of index numbers. 1+1+1=3

(f) Which component of time series is mainly applicable in the following cases? 1×3=3

(i) Fire in a factory

(ii) Recession

(iii) An increase in employment of labour during harvest time

(7)

(g) Enumerate the objective of analysis of time series. 3

(h) A simple random sample of 10 households was drawn from a town of 1200 households. The numbers of persons in the selected houses were :

2, 2, 3, 3, 4, 5, 6, 3, 3, 4

Estimate the number of persons in the town. 3

(i) Discuss briefly the basic principles of a sample survey. 3

(j) Explain clearly the following with suitable examples :
1×3=3

(i) Population

(ii) Sample

(iii) Sampling frame

(8)

(PART : B—DESCRIPTIVE)

(Marks : 50)

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

GROUP—A

5. (a) Define a discrete random variable. Give one example. 2

(b) A random variable X has the following distribution :

X	0	1	2	3	4	5
$P(X)$	0.1	0.2	0.3	0.1	—	0.1

Find $P(4)$ and $E(X)$.

1+3=4

(c) Write down three properties of expectation. $\frac{1}{2} + \frac{1}{2} + \frac{1}{2} = 1\frac{1}{2}$

(d) Find the mean and variance of binomial distribution. 5

6. (a) If X follows normal distribution with mean 66 and standard deviation 5, find—

(i) $P(65 < X < 70)$;

(ii) $P(X \geq 72)$.

Given that

$$P(Z \leq 0.8) = 0.7881 \text{ and } P(Z \leq 0.2) = 0.5793 \quad 5$$

(9)

(b) If X has a Poisson distribution and $P(X = 0) = \frac{1}{2}$, what is $E(X)$? 2½

(c) The random variable X has the p.m.f.

$X = x$	0	1	2	3
$p(x)$	$\frac{1}{3}$	$\frac{1}{2}$	$\frac{1}{24}$	$\frac{1}{8}$

Find the expected value of $Y = (X - 1)^2$. 5

GROUP—B

7. (a) Define time series. What are its components? Explain any one of them. 2+2+2=6

(b) Using least squares of method, find the trend values from the following data : 5

Year	1990	1991	1992	1993	1994	1995	1996
Production	83	60	54	21	22	13	23

(c) Define moving average method. 1½

8. (a) Explain briefly the method of computing index number—
(i) by weighted aggregative method;
(ii) by simple aggregative method;
(iii) by simple average of price relative method. 2×3=6

(10)

(b) Construct price index numbers from the following data, using—

(i) Laspeyres' and

(ii) Marshall-Edgeworth : 2+3=5

Commodity	1990		1993	
	Price	Quantity	Price	Quantity
A	6	50	10	56
B	2	100	2	120
C	4	60	6	60
D	10	30	12	24

(c) Why is Fisher's index number formula called an ideal index number formula? 1½

GROUP—C

9. (a) What is a simple random sample? Mention the various methods of drawing a random sample. 1½+3=4½

(b) Define simple random sampling with and without replacement. 3

(c) Prove that in simple random sampling without replacement, sample mean is an unbiased estimate of population mean. 5

(11)

10. (a) What are the errors in a sample survey? Show how non-sampling errors differ from sampling errors.

1+3=4

- (b) What do you mean by stratified random sampling? Describe how you will draw a stratified random sample. Write down the formulae for estimating the population total and population mean by a stratified sample.

2+3+2=7

- (c) What is the total number of samples, when sampling is done without replacement from a population of size N ?

1½
