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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

(2)

- (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

(3)

(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

(4)

(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 μ 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.

(5)

- (c) The total number of samples when sampling is done without replacement from a population of size n is nC_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.

(6)

- (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

(7)

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

(8)

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 σ have usual meanings. 6

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