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HS/XII/A.Sc./S/26

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STATISTICS

(FOR CANDIDATES WITH INTERNAL ASSESSMENT—NEW COURSE)

Full Marks : 80

(FOR CANDIDATES WITHOUT INTERNAL ASSESSMENT—OLD COURSE)

Full Marks : 100

Time : 3 hours

The figures in the margin indicate full marks for the questions.

General Instructions :

The question paper consists of three parts.

(i) Part—A : Consists of two Sections.

Section—I : Consists of multiple-choice and very short answer-type questions of 1 mark each.

Section—II : Consists of short answer-type questions of 2 marks each.

(ii) Part—B : Consists of long answer and very long answer-type questions. This part is divided into three groups, A, B and C, where internal choices is provided in each group.

(iii) Part—C : This part is only for Repeaters/Improvement. Internal choices are provided in the questions.

(iv) Write all the answers in the Answer Script.

(v) Attempt all parts of a question together at one place.

(2)

(PART : A—OBJECTIVE)

(Marks : 32)

SECTION—I

(Marks : 16)

1. Choose and write the correct answer :

1×8=8

(a) If X is a random variable, then the standard deviation is given by

(i) $E^2(X) - E(X^2)$

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

(iii) $[E(X^2) - \{E(X)\}^2]^{1/2}$

(iv) $\{E(X^2)\}^2 - E(X^2)$

(b) If for a random variable X , $E(X) = 12$, then the value of $E(2X - 3)$ is

(i) 27

(ii) 36

(iii) 30

(iv) 45

(3)

(c) If X is a random variable, then which of the following is correct?

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

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

(iii) $E^2(X) = E(X^2)$

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

(d) A discrete distribution having the same mean and variance is

(i) binomial distribution

(ii) normal distribution

(iii) Poisson distribution

(iv) hypergeometric distribution

(e) If X follows Poisson distribution such that $P(X=1) = 2P(X=2)$, then the value of λ is

(i) 0

(ii) $1/2$

(iii) 1

(iv) 2

(4)

(f) If $n = 36$ and $p = q = \frac{1}{2}$, then the standard deviation of binomial distribution is

(i) 2

(ii) $\sqrt{2}$

(iii) 3

(iv) $\sqrt{3}$

(g) Time reversal test is satisfied if

(i) $I_{on} - I_{no} = 0$

(ii) $I_{on} = I_{no}$

(iii) $I_{on} = \frac{1}{I_{no}}$

(iv) $I_{on} = I_{no}$

(h) The possible outcomes of a random experiment are called

(i) event

(ii) sample space

(iii) sample point

(iv) None of the above

(5)

2. Fill in the blanks :

1×4=4

- (a) If X is a random variable, then $V(aX + b)$ _____
where a and b are constants.
- (b) Binomial distribution is symmetrical if _____.
- (c) In SRSWR, the sample mean \bar{x} is an unbiased estimator of _____.
- (d) The term 'statistic' is used to denote _____.

3. State whether the following statements are True or False :

1×4=4

- (a) If X and Y are two random variables, then covariance between them is given by $\text{cov}(X, Y) = \text{cov}(Y, X)$.
- (b) In a sampling distribution, a finite population of N unit samples of size n can be selected as N ways.
- (c) Moving average method can be used to determine only trend.
- (d) Cyclical variations refer to the movements which occur after a time interval of more than one year.

(6)

SECTION—II

(Marks : 16)

4. Answer the following questions (any *eight*) : 2×8=16

(a) A binomial variate X has mean 6 and variance 4.
Find n and p .

(b) Find the fallacy if any in the following statement,
by giving proper justification :

“The mean of a binomial distribution is 20 and
its standard deviation is 6.”

(c) The random variable X has the following
distribution :

X	:	1	2	3
$P(X)$:	$\frac{1}{6}$	$\frac{1}{3}$	$\frac{1}{2}$

Find the variance of X .

(d) If $P(X = x) = \frac{1}{4}$, $x = 1, 2, 3, 4$, then find $E(X)$.

(e) Mention two applications of index numbers in
Economics.

(f) A random sample of size 16 is drawn from
a population with standard deviation 8. Find the
standard error of the sample mean.

(g) Define the term reversal test for index numbers.

(7)

- (h) What are the objectives of time series analysis?
- (i) "Index numbers are economic barometers." Explain.
- (j) Define time series and state one use of time series analysis.

(PART : B—DESCRIPTIVE)

(Marks : 48)

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

GROUP—A

5. (a) For a binomial distribution with

$$f(x) = {}^8C_x \left(\frac{1}{3}\right)^x \left(\frac{2}{3}\right)^{8-x}, \quad x = 0, 1, 2, \dots, 8$$

Find $E(X - 1)$ and $V(X - 1)$. 4

Or

If $E(X) = 6$ and $V(X) = 4$ for a random variable X , then find $E(2X - 3)$ and $V(2X - 3)$.

- (b) Show that $V(aX) = a^2V(X)$, where a is a constant and X is a random variable. 4
- (c) If the sum of the mean and variance of a binomial distribution for 5 trials is 1.8, then find the distribution. 4

(8)

6. (a) Define Poisson distribution and binomial distribution. When does a binomial distribution or a Poisson distribution tend to a normal distribution? 5
- (b) A random variable X is such that $P(X = 1) = 2P(X = 2)$. Find $P(X = 0)$. 2
- (c) A random variable X is normally distributed with mean 10 and standard deviation 4. Find $P(6 \leq X \leq 14)$. Given $P(z \leq 1) = 0.843$, $P(z \leq -1) = 0.1587$. 5

GROUP—B

7. (a) Calculate the cost of living index number from the following data : 5

Items	Base year	Current year	Weight
	Price	Price	
Food	40	48	4
Clothing	15	18	2
Fuel	10	12	1
Rent	20	25	2
Misc.	12	15	1

- (b) Show that Fisher's ideal index number satisfies the factor reversal test. 5
- (c) Define sample and sampling. 2

(9)

8. (a) Discuss the difference between seasonal and cyclical variations. 6
- (b) List the methods to measure the trend in a time series. Mention one advantage and one disadvantage of the moving average method. 2+2+2=6

GROUP—C

9. (a) State two advantages of simple random sampling. 2+2=4
- (b) A simple random sample of 4 shops from a market of 400 shops recorded sales as 12, 18, 24, 30 thousand rupees. Estimate the total sale of the market. 4
- (c) Write short notes on any *two* of the following : 2×2=4
- (i) Sampling error
 - (ii) SRSWOR
 - (iii) Judgement sampling
10. (a) Prove that in simple random sampling, sample mean is an unbiased estimate of the population. 6
- (b) Distinguish between sampling and non-sampling errors. 6

(10)

(PART : C)

(Marks : 20)

(These questions are for Repeaters/Improvement Candidates only)

11. Choose and write the correct answer (any *four*) : $1 \times 4 = 4$

(a) Which of the following is not correct?

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

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

(iii) $E(a) = a$

(iv) $E(aX + bY) = a E(X) + b E(Y)$

(b) Normal distribution is

(i) uniparametric

(ii) biparametric

(iii) triparametric

(iv) None of the above

(c) Least square method is one of the best ways of obtaining

(i) trend values

(ii) data components

(iii) population size

(iv) None of the above

- (d) A player rolls one fair die. If the die shows an odd number, the player wins the value that appears on the die, else loses half the value that appears on it. The expected gain of the player is

(i) $\frac{1}{2}$

(ii) 0

(iii) $\frac{1}{2}$

(iv) 1

- (e) In case of SRSWR, $V(\bar{x})$ equals to

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

(ii) $\frac{1}{n}$

(iii) $\frac{\sqrt{2}}{n}$

(iv) $\frac{2}{\sqrt{n}}$

- (f) Sampling which provides for a known non-zero equal chance of selection is

(i) systematic sampling

(ii) convenience sampling

(iii) quota sampling

(iv) purposive sampling

(12)

12. Answer any *two* of the following questions : 2×2=4

- (a) In a binomial distribution, prove that mean > variance.
- (b) If X follows binomial distribution with mean 4 and variance 2, then find $P(X = 5)$.
- (c) If $f(x) = \frac{1}{4}$, $x = 2, 4, 8, 16$, then find $E(X)$, where $f(x) = P(X = x)$.
- (d) Given $E(X - 4) = 10$ and $E[(X - 4)^2] = 116$. Determine $E(X^2)$.

13. (a) Find the mean and variance of a Poisson distribution. 7

- (b) Explain briefly how Fisher's ideal index number is constructed and justify it being called 'ideal'. 3+2=5

Or

14. (a) Assuming a four-yearly cycle, calculate the trend by method of moving average for the following data : 6

Year	Sales (in crore)
1961	50
1962	52
1963	55
1964	47
1965	51
1966	54
1967	56
1968	57
1969	59
1970	61

- (b) Show that Laspeyre's index number and Paasche's index number do not satisfy time reversal test. 6
