2020

STATISTICS

Full Marks : 100

Pass Marks : 33

Time: Three hour

Attempt all questions.

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

For Question Nos. ***1,2, 3*** *and* ***4****, choose the correct answer and rewrite.*

1. The infinite series given by $1+\frac{x}{1!}+\frac{x^2}{2!}+\ldots+\frac{x^r}{r!}+\ldots\ldots$ is known as 1

   A. Logarithmic series

   B. Exponential series

   C. neither exponential nor logarithmic series

   D. combination of exponential and logarithmic series

2. Coefficient of variation of a distribution is given by 1

   A. $\frac{\sigma}{\bar{x}} \times 100$

   B. $\frac{\bar{x}}{\sigma} \times 100$

   C. $\frac{\sigma}{mode} \times 100$

   D. $\frac{mode}{\sigma} \times 100$

3. The business cycle in cyclic variation of a time series has 1

A. two - phase

B. three - phase

C. four - phase

D. five - phase

4. The probability that a specified unit is included in the sample (in the usual notation) is 1

A. $\frac{1}{n}$

B. $\frac{1}{N}$

C. $\frac{1}{{}^{N}C_{n}}$

D. $\frac{n}{N}$

5. Define Singleton Set. 1

6. If $f(x, y, z) = x^2y + y^2z^2 + z^2 + x^2$, then identify the partial derivative f_x, f_y or f_z if the derivative is $2xy + 2x$. 1

7. What is the value of $\lim_{x \to \infty} \left(1+\frac{1}{n}\right)^n$? 1

8. "For a symmetrical distribution, all central moments of odd order are zero." Comment the above statement 1

9. The regression line of y on x is the particular line obtained from scatter diagram, so that the sum of squares of errors parallel to X-axis is maximum. Correct the above statement. 1

10. Why is Fisher's index number called 'ideal' ? Mention only one point. 1

11. The Chain base index formula is wrongly written as 1

$$\text{Chain index} = \frac{\textit{Current year link relative}}{100}.$$

Rewrite the correct formula.

12. Write the error sum of square for finding most plausible values of x and y from the following equations : 1

$2x - y = 5$, $4x + 3y = 7$, $6x + y = 24$.

13. Name the two models commonly used for the decomposition of a time-series into its components. 1

14. Given that Var $(\bar{y})$ in SRSWR = 1.158 and Var $(\bar{y})$ in SRSWOR = 1.458. Analyse the efficiency of the two means. 1

15. Why do we calculate, in general, only the first four moments about mean, of a distribution and not the higher moments ? 2

16. The first four central moments of a distribution are 0, 2, 0 and 12. Comment the nature of the distribution by calculating β_2. 2

17. Can $y = 5 + 2.8x$ and $x = 3 + 0.5y$ be the regression lines of y on x and x on y respectively ?

Explain your answer with suitable argument. 2

18. Interpret the relation between two variables if 2

(i) $r = +1$

and (ii) $r = -1$,

where 'r' is the correlation coefficient.

19. Name the two methods of constructing the cost of living index number. 2

20. Define time-reversal test. 2

21. The annual sales and 3-yearly moving averages in thousand rupees for a trading company are 96, 98 and 93.5, 95 for the years 1975 & 1976 respectively. Calculate the short time fluctuations. 2

22. A simple random sample of size 2 is to be drawn from a normal population consisting of 20 students numbered from 1 to 20. From the Random Number Table, the numbers 92 and 80 are chosen,

what are the unit numbers of the students selected for the sample ? 2

23. From a population consisting of 20 units a simple random sample of size 10 is drawn without replacement.

Find the variance of the sample mean.

Given : mean square of the population $= S^2 = 20$. 2

24. Prove the De-Morgan's Law $(A \cup B)' = A' \cap B'$. 4

25. Prove that the standard deviation is independent of the change of origin. 4

26. Identify the three different types of convexity of the curve by drawing three curves and assign the range or values of the coefficient of Kurtosis β_2 in each curve. 4

27. Two lines of regression are given by $x + 2y = 5$ and $2x + 3y = 8$. Obtain the mean values of x and y. 4

28. Construct Fisher's ideal index from the following data : 4

	Price		Quantity	
Commodity	**1980**	**1982**	**1980**	**1982**
A	4	10	50	40
B	3	8	10	8
C	2	4	5	4

29. Write four important uses of cost of living index number. 4

30. Which component of time series is mainly applicable in the following cases ? 4

(i) Fire in a factory

(ii) An era of prosperity

(iii) Fall in death rate due to advances in the science

(iv) Diwali sales in a departmental store

31. Obtain all the samples of size 2 that can be drawn from the population 8, 3, 1 and 11 without replacement. Calculate the population mean and show that the sample mean is an unbiased estimate of the population mean. 4

32. Find the maximum value of the function $f(x) = x^3 - 6x^2 + 9x + 4$ in the interval $0<x<5$. 6

33. Prove the binomial theorem by the method of mathematical induction 6

$$(a+x)^n = {}^nC_o\, a^n + {}^nC_1\, a^{n-1}x + {}^nC_2\, a^{n-2}x^2 + \cdots + {}^nC_n\, x^n,$$

where a and x are two real numbers and n is a positive integer.

34. Derive the relation between moments about mean in terms of moments about an arbitrary point. 6

35. Show that the Correlation Coefficient between two variables lies between – 1 and + 1. 6

36. Define an index number.

State the problems in the construction of index number. 1+5 = 6

37. The equation $y = a + bx$ is to be fitted to a set of n observations, derive the normal equations by using the principle of least squares to estimate the constants a and b. 6