	STATISTICS (0135) (E)	
Statistics	**BOARD QUESTION PAPER-9**	**Standard-12**
Time : 3 Hours	**JULY 2022**	Total Marks : 100

Instructions : (1) This question paper contains 6 sections and 61 questions.
                  (2) Answer the questions according to the instructions.
                  (3) The figures against the question indicate the marks.
                  (4) Use of Z-table and simple calculator is allowed.

SECTION-A

❖ **Questions 1 to 20 are multiple choice questions. Choose the correct alternative and write it. Each question carries 1 mark:**   **20**

1. Which prices are considered in the construction of the cost of living index number?

   (A) Market price   (B) Wholesale price (C) Average price   (D) Retail price

2. If production of an item in the year 2018 is 3 times more than the production in the base year then, what will be the index number of production for the year 2018?

   (A) 400   (B) 300   (C) 200   (D) 100

3. If $r(x, y) = -0.5$ then what is the value of $r(x, -y)$?

   (A) 0.5   (B) −0.5   (C) 1   (D) 0

4. Which kind of correlation will you get between the number of units sold and its revenue at constant price?

   (A) Perfect positive   (B) Partial positive

   (C) Perfect negative   (D) Partial negative

5. What is error e in estimation in case of line of regression of Y on X?

   (A) $\hat{y} - \hat{x}$ (B) $x - \hat{x}$ (C) $y - \hat{y}$ (D) $\hat{x} - \hat{y}$

6. Which statistician used term 'regression' for the first time?

   (A) Karl Pearson   (B) Sir Francis Galton

   (C) Spearman   (D) Fisher

7. State the independent variable of time series.

   (A) Y_t (B) S_t (C) X_t (D) t

8. Which of the following variations are due to cyclical component?

   (A) Decrease in the share prices due to recession in share market.

   (B) Rise in demand of sweater during winter

   (C) Decrease in the agricultural produce due to excessive rains

   (D) Continuously decreasing death rate

9. Which event is given by a special subset ϕ of the sample space U?

   (A) Certain Event   (B) Complementary Event of ϕ

   (C) Union of Events U and ϕ (D) Impossible Event

10. If events A and B are independent, which of the following options is true?

(A) $P(A \cap B) = P(A) \times P(B)$ (B) $P(A \cup B) = P(A) + P(B)$

(C) $P(A \cup B) = P(A) \times P(B)$ (D) $P(A \cap B) = P(A) + P(B)$

11. Which variable of the following will be an illustration of discrete variable?

(A) Height of a student   (B) Birth year of a student

(C) Blood pressure of a student (D) Weight of a student

12. State the relation between mean and variance of binomial distribution.

(A) $np < npq$ (B) $np \leq npq$ (C) $np > npq$ (D) $np \geq npq$

13. For the probability distribution of a discrete random variable X. $E(X) = 5$ and $E(X^2) = 35$. What will be the variance of this distribution?

(A) 10   (B) 20   (C) 30   (D) 40

14. What is the area under the normal curve to the right hand side of perpendicular line at $X = \mu$?

(A) 0   (B) 0.5   (C) 1   (D) −0.5

15. Which of the following is approximate value of mean deviation for normal variable?

(A) $\frac{4}{5}\sigma$ (B) $\frac{4}{5}\mu$ (C) $\frac{2}{3}\sigma$ (D) $\frac{2}{3}\mu$

16. If the mean of a normal distribution is 13.25 and its standard deviation is 10 then, which of the following is the value of third quartile?

(A) 6.5   (B) 10   (C) 13.25   (D) 20

17. What is the value of $\lim_{x \to 3} 3x + 1$?

(A) 9   (B) 10   (C) $\frac{4}{3}$ (D) 8

18. What is the modulus form of N (5,0.02)?

(A) $|x + 5| < 0.02$ (B) $|x - 0.02| < 5$

(C) $|x - 5| > 0.02$ (D) $|x - 5| < 0.02$

19. What is the formula for elasticity of demand?

(A) $-\frac{p}{x} \cdot \frac{dx}{dp}$ (B) $\frac{p}{x} \cdot \frac{dx}{dp}$ (C) $-\frac{x}{p} \cdot \frac{dp}{dx}$ (D) $-\frac{p}{x} \cdot \frac{dp}{dx}$

20. What is the derivative of $f(x) = \frac{4}{x^2}$?

(A) $\frac{4}{2x}$ (B) $-\frac{8}{x^3}$ (C) $\frac{8}{x^3}$ (D) 0

SECTION-B

❖ **Answer the following 21 to 30 questions in one sentence each. Each question carries 1 mark:**   **10**

21. Which is the appropriate average for the construction of index number?

22. What is the main limitation of scatter diagram method?

23. State the linear regression model.

24. What is a time-series?

25. Define random experiment.

26. State the relation between the probability of success and failure in Bernoulli trials.

27. "Standard score is independent of unit of measurement". Is this statement true or false?

28. Write the probability density function of normal random variable.

29. If $\lim\limits_{x \to -1} 4x + k = 6$ then find the value of K.

30. What is marginal revenue?

SECTION-C

❖ **Answer Any 7 of the following questions 31 to 39 as directed.**
Each question carries 2 marks :   14

31. The cost of living index numbers and average monthly wage from the year 2015 to 2018 are given as follows.

Each question carries 2 marks :

Find the real wage for each year:

Year	2015	2016	2017	2018
Average Monthly wages (₹)	35,000	40,000	42,000	50,000
Cost of living Index number	120	150	130	160

32. Find the value of r if $Cov(x, y) = 120$, $Sx = 12$, $Sy = 15$.

33. If the regression line of Y on X is $\hat{y} = 11.5 + 0.65x$ and $\bar{y} = 18$, find $\bar{x}$.

34. State the merits of the method of moving average to measure trend.

35. Define :

    (i) Favourable outcomes

    (ii) Union of events

36. Find parameters of the binomial distribution where mean = 4 and variance = 2.

37. If $N(k_1, 0.5) = (19.5, k_2)$ then find the value of k_1 and k_2.

38. Find the value of $\lim\limits_{x \to 2} \dfrac{x^5 - 32}{x - 2}$.

39. Find $f''(0)$, if $f(x) = x^4 - 4x^3 + 3x^2 + x + 1$.

SECTION-D

❖ **Answer Any 8 of the following questions from, 40 to 51 as directed.**
Each question carries 3 marks.   14

40. The chain base index numbers for sales of a certain type of scooter from the year 2015 to 2020 are as follows. Find fixed base index numbers.

Years	2015	2016	2017	2018	2019	2020
Index numbers of sale	110	112	109	108	105	111

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41. Find the index number for the year 2019 with the base year 2014 by weighted average method from the following data of price and weights of five different items.

Item	Weight	Price (₹)	
		Year 2014	Year 2019
A	40	160	200
B	25	400	600
C	5	50	70
D	20	10	18
E	10	2	3

42. To know the relationship between the abilities of the students of a school in the subjects of Statistics and Accountancy, the teachers of both the subjects have taken a sample of eight students and the following information was collected.

Students	1	2	3	4	5	6	7	8
Marks in Statistics (x)	79	37	99	26	76	83	91	63
Marks in Accountancy (y)	86	53	93	62	70	64	88	57

Calculate the rank correlation co-efficient between the marks of statistics and the marks of accountancy.

43. Obtain the regression line of Y on X from the following data

$n = 6$, $\Sigma x = 1020$, $\Sigma y = 990$, $\Sigma(x - 170)^2 = 60$

$\Sigma(y - 165)^2 = 105$, $\Sigma(x - 170)(y - 165) = 45$.

44. The following information is obtained to study the relationship between average rainfall (in cm.) and the yield of maize (in quintal per hectare) in different talukaa of Gujarat.

Particulars	Rainfall (cm) x	Yield of Maize (quintal per hectare) y
Mean	82	180
Variance	64	225
Correlation coefficient 0.82		

Estimate the yield of maize when the rainfall is 60 cm.

45. Fit a linear equation from the following data for variable (y) of a time series.

$n = 6$, $\Sigma y = 501$, $\Sigma ty = 1762$

46. The sample space for a random experiment of selecting number is U = {1, 2, 3, ..., 120) and all the outcomes in the sample space are equiprobable. Find the probability that the number selected is

(1) a multiple of 3.

(2) a multiple of 4.

(3) a multiple of both 3 and 4.

47. The probability that a person from a group reads newspaper X is 0.55, the probability that he reads newspaper Y is 0.69 and the probability that he reads both the newspapers X and Y is 0.27. Find the probability that a person selected at random from this group :

(1) reads at least one of the newspapers X and Y.

(2) does not read any of the newspapers X and Y.

(3) reads only one of the newspapers X and Y.

48. If $P(A) = \frac{2}{3}$, $P(B) = \frac{3}{5}$ and $P(B/A) = \frac{3}{4}$ for two events in the sample space of a random experiment then find $P(A/B)$.

49. The probability distribution of a random variable X is defined as follows :

$$P(x) = \frac{K}{(x+1)!}, \; x = 1, 2, 3; \; K = \text{constant}$$

Hence find : (i) Constant K

(ii) $P(1 < X < 4)$

50. Normally, 40% students fail in one examination. Find the probability that at least 4 students in a group of 6 students pass in this examination.

51. If the daily cost of production for x tons of a commodity is $10x^2 - 1000x + 50,000$ then how many units should be produced for the minimum cost? Also, find the minimum cost.

SECTION-E

❖ **Answer Any 3 of the following questions 52 to 55 as directed.**
Each question carries 4 marks: **12**

52. The average monthly expense of students residing in university hostel is ₹ 2,000 and its standard deviation is ₹ 500. If the monthly expense of students follow normal distribution then

(1) Find percentage of students having expense between ₹ 750 and ₹ 1,250.

(2) Find percentage of students having expense less than ₹ 2,400.

53. The maximum temperature of a city during summer follows normal distribution. On a particular day, the probability that the maximum temperature of the city is more than 31° celsius is 0.3085, whereas the probability that during some other day, the maximum temperature is less than 27° is 0.0668. Find mean and standard deviation of the maximum temperature of the city.

54. Find the value of $\displaystyle\lim_{x \to 0} \frac{\sqrt{3x+x} - \sqrt{3}}{x}$

55. Find the values of x which maximize or minimize $y = 2x^3 - 15x^2 + 36x + 12$. Also, find the maximum and minimum values of y.

SECTION-F

❖ **Answer Any 4 of the following questions 56 to 61 as directed.**
Each question carries 5 marks: **20**

56. Find the Paasche's and Fisher's index numbers for the year 2019 with the base year 2018 using the data given below.

Items		A	B	C	D	E
Year 2018	Price (₹)	100	200	150	180	250
	Total Expenditure	400	500	600	1080	1000
Year 1019	Price (₹)	120	120	160	200	300
	Total Expenditure	720	600	800	1000	1200

57. The details of monthly sale of Laptop (in thousand units) and its profit (in lakh) for the last six months for a company making laptops are given below.

No. of laptops sold (thousand units x)	3	8	12	5	7	5
Profit (lakh ₹) y	6	10	15	10	9	8

Find the correlation coefficient between 'number of laptops sold' and its 'profit".

58. From the following information of a sample of ten students of a school regarding their marks in two subjects Accountancy and Statistics, find the coefficient of correlation between the marks of two subjects.

Marks in Accountancy	60	80	50	80	95	40	70	40	35	90
Marks in Statistics	50	75	60	85	90	40	65	30	45	70

59. The information regarding the experience (in years) of eight workers on a machine and their performance ratings based on the nondefective units they manufactured in every 100 units is as follows.

Experience of workers (years)	5	12	15	8	20	18	22	25
Performance rating	80	82	85	81	90	90	95	97

Obtain the regression line of the performance rating on the experience and estimate the performance rating if a worker has an experience of 17 years.

60. The following data are available for the number of passengers who travelled in the last 5 years by the aircrafts of an airline company. Estimate the trend for the year 2019 by fitting linear trend.

Years	2014	2015	2016	2017	2018
No. of Passengers (thousands)	45	47	44	40	38

61. The average monthly closing price of shares of a company in the year 2019 are given in the following table. Find the trend using four monthly moving averages.

Month	January	February	March	April
Share price	253	231	350	261
Month	May	June	July	August
Share price	262	266	263	261
Month	Sept.	Oct.	Nov.	Dec.
Share price	281	278	278	272

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