	STATISTICS (0135) (E)	
Statistics	BOARD QUESTION PAPER-8	Standard-12
Time : 3 Hours	MARCH 2022	Total Marks : 100

Instructions : (1) This question paper contains 6 sections and 61 questions.
(2) Use of simple calculator is allowed.
(4) Use of Z-table is allowed.

SECTION-A

❖ **Choose the correct alternative from the following multiple choice type questions and write it. Each question carries 1 mark:**   **20**

1. The price of an item increased by 4.5 times in the current year as compared to the base year. What will be the price index number?

   (A) 45   (B) 450   (C) 550   (D) 350

2. If the purchasing power of money is 0.75 in the year 2021 with respect to the base year 2020 then what will be the price index number for the year 2021?

   (A) 750   (B) 175   (C) 133.33   (D) 275

3. What is the range of the correlation coefficient r ?

   (A) $-1 < r < 1$ (B) 0 to 1   (C) $-1 \leq r \leq 1$ (D) -1 to 0

4. 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

5. The regression line always passes through which point?

   (A) $(\bar{x}, y)$ (B) $(0, \bar{y})$ (C) $(\bar{x}, 0)$ (D) $(0,0)$

6. What is coefficient of determination in the study of regression for two variables?

   (A) Product of two standard deviation   (B) Square of correlation coefficient

   (C) Square of covariance   (D) Product of two variances

7. Which variation is shown in 'decrease in production of company' due to strike?

   (A) Random   (B) Trend   (C) Seasonal   (D) Cyclical

8. Which method of finding trend is best to eliminate the effect of repetitive short-term variations?

   (A) Graphical method   (B) Method of least squares

   (C) Karl Pearson's method   (D) Method of moving average

9. What is the other name of the classical definition of probability?

   (A) Mathematical Definition   (B) Axiomatic Definition

   (C) Statistical Definition   (D) Geometric Definition

10. If $P(A/B) = P(A)$ and $P(B/A) = P(B)$ then what type of events are A and B?

    (A) Independent events   (B) Complementary events

    (C) Certain events   (D) Impossible events

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

    (A) Height of a student   (B) Weight of a student

    (C) Blood pressure of a student   (D) Birth year of a student

12. 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) 40   (B) 30   (C) 20   (D) 10

13. For a positively skewed Binomial Distribution with $n = 10$, which of the following values might be the value of mean?

    (A) 5   (B) 3   (C) 9   (D) 7

14. Which of the following are mean and variance of standard normal variable?

    (A) Mean=0, variance = 1   (B) Mean = 1, variance = 0

    (C) Mean 0, variance = 0   (D) Mean 1, variance = 1

15. What is the area under the normal curve to the left hand side of perpendicular line μ?

    (A) 0   (B) 0.5   (C) 1   (D) –0.5

16. If the distribution of normal variable is shown as N (20, 4) then which of the following intervals includes 99.73% of observations?

    (A) (18, 22)   (B) (16, 24)   (C) (14, 26)   (D) (12, 28)

17. What is the value of $\lim\limits_{x \to -2} 10$?

    (A) 10   (B) –2   (C) 8   (D) Indeterminate

18. What is the value of $\lim\limits_{x \to 3} \dfrac{x^4 - 81}{x - 3}$.

    (A) 192   (B) 324   (C) 36   (D) 108

19. If $y = ax + b$, a and b are constant then what will be $\dfrac{dy}{dx}$?

    (A) a (B) b (C) b (D) 0

20. If u and v are two functions of x then what is the formula of derivative of their product?

    (A) $u\dfrac{du}{dx} + v\dfrac{dv}{dx}$ (B) $u\dfrac{dv}{dx} - v\dfrac{du}{dx}$

    (C) $\dfrac{du}{dx} \times \dfrac{dv}{dx}$ (D) $u\dfrac{dv}{dx} + v\dfrac{du}{dx}$

SECTION-B

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

21. Name the important basic tests of index numbers.

22. What is the main limitation of scatter diagram method to find correlation coefficient?

23. Give the name of a method to obtain the best fitted regression line.

24. What is a time-series?

25. State the formula for the probability of occurrence of at least one event out of three events A, B and C.

26. Define Bernoulli trials.

27. Give the values of the constants used in probability density function of normal variable.

28. What percentage of area is covered under the normal curve within the range $\mu - 2\sigma$ to $\mu + 2\sigma$?

29. Define the δ neighbourhood of a.

30. Find $\frac{dy}{dx}$ if $y = 6x^3 + \frac{7}{2}x^2 + \frac{6}{5}x - 8$.

SECTION-C

❖ **Answer the following questions as directed (Any seven out of nine).**
Each question carries 2 marks :   **14**

31. The wholesale price index numbers of the year 2020 and 2021 are found to be 150.2 and 165.7 respectively. Find the rate of inflation using index numbers of both the years.

32. If $n = 10$, Cov $(x, y) = -30$, S.D. of X = 5 and variance of Y = 144 then find Correlation Coefficient.

33. The fitted regression line of Y on X is $\hat{y} = 23.2 - 1.2x$ and one of the observations used in fitting of the line is (6, 17). Find the error in estimating Y for X – 6.

34. State the limitations of graphical method to measure trend.

35. Find the probability of getting D in the first place in all possible arrangements of each and every letter of the word DHYAN.

36. The mean and variance of a binomial distribution are 3.9 and 2.73 respectively. Find the number of Bernouli trials conducted in this distribution.

37. Express $|x + 1| < 0.5$ in neighbourhood and interval form.

38. Explain the meaning of $x - 0$.

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

SECTION-D

❖ **Answer the following questions as directed (Any Eight Out of Twelve).**
Each question carries 3 marks.   **24**

40. The details of expenditure on clothing for the worker class of a region are as follows. Find the index number for clothing by Family Budget Method.

Item	Saree	Dhoti	Shirting	Other
Unit	Piece	Piece	Meter	Meter
Quantity in year 2020	5	8	20	15
Price in year 2020 (₹)	300	70	32.40	20.90
Price in year 2021 (₹)	400	100	38	23.80

41. Calculate the real wages of a worker class from the following data about their monthly wages.

Year	2016	2017	2018	2019	2020	2021
Average Monthly wages (₹)	15,000	18,000	19,000	20,000	22,000	25,000
Cost of living Index number (Base year 2014)	120	180	205	220	235	260

42. Ten students were ranked on the basis of their proficiency in sports and general knowledge. The rank correlation coefficient obtained from the data was found to be 0.2 later on, it was noticed that the difference in the ranks of the two attributes for one of the students was taken as 3 instead of 2. Find the correct value of rank correlation coefficient.

43. The following information is obtained for monthly advertisement cost and the sales of the last year for a company providing online shopping.

Particulars	Advertisement cost (Ten thousand)	Sales (Lakh ₹)
Mean	10	90
Standard Deviation	3	12
$r = 0.8$		

Obtain the regression line of the sales on the advertisement cost.

44. If $b_{yx} = 0.8$ then find the value of by for the following u and v.

(i) $u = x - 105$ and $v = y - 90$

(ii) $u = \dfrac{x - 1400}{100}$ and $v = \dfrac{y - 750}{50}$

(iii) $u = 10(x - 4.6)$ and $v = y - 75$.

45. Obtain the linear equation for trend for a Time Series with $n = 8$, $\Sigma y = 344$, $\Sigma ty = 1342$.

46. If two balanced coins are tossed, then find the probability of

(1) getting one head and one tail

(2) getting at least one head.

47. A number of selected from the natural number 1 to 100. Find the probability of the event that the selected number is a multiple of 3 or 5.

48. For three mutually exclusive and exhaustive events A, B and C in the sample space of a random experiment $2P(A) = 3P(B) = 4P(C)$. Find $P(B \cup C)$.

49. State properties of binomial distribution (Any six).

50. The probability that a bomb dropped from a plane over a bridge will hit the bridge is $\dfrac{1}{5}$. Two bombs are enough to destroy the bridge. If 6 bombs are dropped on the bridge, find the probability that the bridge will be destroyed.

51. If $y = \dfrac{2x^2 + 3x + 4}{x^2 + 5}$ the find $\dfrac{dy}{dx}$.

SECTION-E

❖ **Answer the following questions as directed (Any Three Out of Four).**
Each question carries 4 marks: 12

52. (A) For a normal distribution, the first quartile and the mean deviation are 20 and 24 respectively. Obtain an estimate of the value of mode.

   (B) The monthly production of units in a factory is normally distributed with mean u and standard deviation σ. The Z scores corresponding to the production of 2400 units and 1800 units are 1 and −0.5 respectively. Find its mean and standard deviation.

53. The weight of randomly selected 500 adult persons from a region of a city follows normal distribution. The average weight of these persons in 55 kg and its standard deviation is 7 kg :

   (i) Estimate the number persons having weight between 41 kg to 62 kg.

   (ii) Estimate the percentage of persons having weight less than 41 kg.

54. Find the value of $\displaystyle\lim_{x \to -3} \frac{2x^2 + 7x + 3}{3x^2 + 8x - 3}$.

54. A producer produces x units at cost $200x + 15x^2$. The demand function is P = 1200 - 10x. Find the profit function and how many units should be produced for maximum profit.

SECTION-F

❖ **Solve the following questions as directed (Any Four Out of Six).**
Each question carries 5 marks: 20

56. Compute Laspeyre's, Paasche's and Fisher's index number for the year 2021 from the data given below.

Item	Quantity		Price (₹)	
	Year 2021	Year 2020	Year 2021	Year 2020
A	25 kg	32 kg	42	45
B	15 litre	20 litre	28	30
C	10 pieces	20 pieces	30	25
D	8 metre	15 metre	20	25
E	30 litre	36 litre	60	65

57. From the following information, find correlation coefficient between heights and weights.

Height (cm) x	155	165	158	162	153	160
Weight (kg) y	53	63	56	60	52	60

58. From the following information of heights of husband and wife, Calculate the rank correlation coefficient between their heights.

Height of husband (cms)	156	153	185	157	163	191	162
Weight of wife (cms)	154	148	162	157	162	170	154

59. The monthly sale of different types of laptops (in hundred units) and its profit (in lakh ₹) for the last six months for a company is given below :

Month	1	2	3	4	5	6
Number of laptops sold (hundred units x)	5	7	5	12	8	3
Profit (lakh ₹ y)	8	9	10	15	10	6

Obtain the regression line of Y on X. Also, estimate Y for X=7.

60. The information about death rate of a state in different years is given in the following table. Fit a linear equation to find trend and hence estimate the death rate for the year 2023.

Year	2015	2016	2017	2018	2019	2020	2021
Death rate	7.6	6.9	7.1	7.3	7.2	6.9	6.9

61. Find the trend using four monthly moving averages for the following data showing monthly sales (in lakhs ₹) of a shop.

Month	Sales (lakh ₹)
March	5
April	3
May	7
June	6
July	4
August	8
September	9
October	10
November	8
December	9

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