Royal science school Dhoraji

Subject: STAT | Round Test | Date: 21/01/2025

Standard: 12 | Marks: 100

Chapter: Full syllabus | Exam Time: 3 hours

Section - A

Choose the correct option from those given below each question. (Each question carries 1 Marks) (20)

01. If the purchasing power of money is 0.75 in the year 2016 with respect to the base year 2015, then what will be the price index number for the year 2016?
    A. 275 B. 133.33 C. 750 D. 175

02. By which method is the cost of living numberconstructed?
    A. By family budget method B. By Marshal's method
    C. By Paasche's method D. By method of total expenditure

03. Which method is useful to compare the long term variations in the values of the variable?
    A. Paasche's method B. Fixed base method C. Laspeyre's method D. Chain base method

04. In context with correlation, what do you call the graph, if the points of paired observations (x, y) are shown in a graph?
    A. Frequency curve B. Scatter diagram C. Histogram D. Circle diagram

05. If r (- x, y) = - 0.5, then what is the value of r(x, - y)?
    A. 0 B. 1 C. - 0.5 D. 0.5

06. Which of the following is correct?
    A. $b_{yx} = r \cdot \frac{s_x}{s_y}$
    B. $b_{yx} = r \cdot \frac{s_y^2}{s_x^2}$
    C. $b_{yx} = \frac{cov(x,y)}{s_y^2}$
    D. $b_{yx} = r \cdot \frac{s_y}{s_x}$

07. The best fitted line of regression can be obtained by which method?
    A. Bowley's Method B. Maximum Square Method C. Karl Pearson's Method D. Least Square Method

08. Which type of variations are produced in the time series variable due to seasonal component?
    A. Regular B. Long-term C. Zero D. Irregular

09. The trend equation obtained from a time series from January 2016 to December 2016 is $\hat{y}$ = 30.1+1.5 t. find the value of trend for April 2016.

A. 33.1 B. 36.1 C. 34.6 D. 30.1

10. Which event is given by a special subset ∅ of the sample space U?

A. Union of events U and ∅ B. Complementary event of ∅

C. Certain event D. Impossible event

11. What Is the other name of the classical definition of probability?

A. Geometric definition B. Statistical definition

C. Axiomatic definition D. Mathematical definition

12. The binomial distribution has mean 5 and variance $\frac{10}{7}$. What will be the type of this distribution?

A. Nothing can be said about the distribution

B. Symmetric

C. Negatively skewed

D. Positively skewed

13. A random variable X assume the values -1, 0 and 1 with respective probability $\frac{1}{5}, K$ and $\frac{1}{3}$, where $0 < k < 1$ and X does not assume any value other than these values. What will be the value of E (X)?

A. $\frac{3}{15}$ B. $\frac{2}{15}$ C. $\frac{3}{5}$ D. $\frac{2}{5}$

14. In a binomial distribution, if p = q. then it is.....

A. Negatively skewed distribution. B. Positively skewed distribution

C. Skewed distribution D. Symmetrical distribution

15. What is the value of $\lim_{x \to 4} \sqrt{4x + 9}$?

A. 25 B. 5 C. 7 D. $\frac{7}{4}$

16. What is the modulus form of 0.3 neighbourhood of 3?

A. $|x+3|<0.3$ B. $|x - 0.3|<3$ C. $|x - 3|<0.3$ D. $|x - 3|>0.3$

17. What are the necessary and sufficient conditions for a function to be minimum at x = a?

A. f'(a) <0, f"(a) > 0 B. f'(a) = 0, f"(a) > 0 C. f'(a) > 0, f"(a) > 0 D. f'(a) = 0. f"(a) <0

18. What are the conditions of revenue function R to be maximum?

A. $\frac{dR}{dx} > 0, \frac{d^2R}{dx^2} < 0$

B. $\frac{dR}{dx} > 0, \frac{d^2R}{dx^2} > 0$

C. $\frac{dR}{dx} = 0, \frac{d^2R}{dx^2} < 0$

D. $\frac{dR}{dx} = 0, \frac{d^2R}{dx^2} > 0$

19. What is differentiation?

A. A science B. A method C. A technique D. A process

20. What is called the symbol C_t in the time series?

A. Irregular component B. Cyclical component C. Seasonal component D. Trend

Section - B

▸ **Answer the following questions in one sentence. (Each question carries 1 Marks)** (10)

21. Which method is more suitable to compare the changes in a variable at two different time periods?
22. What is tie in observation?
23. What is cause and effect relationship?
24. If $u = \frac{x-5}{3}, v = \frac{y-8}{5}$ and $b_{yx} = 0.9$, find the value of b_{vu}.
25. State the names of methods of measuring trend.
26. Write the sample space for randomly selecting one minister and one deputy minister from four persons.
27. What is a dichotomous experiment?
28. The extreme quartiles of normal distribution are 20 and 30. Find its mean.
29. Express closed-open interval in set form.
30. How will be the first order derivative of a function at x = a if function is decreasing at x=a?

Section - C

▸ **Write the answers to any 7 (seven) questions out of the 9 questions from 31 to 39 below. (2 marks each)** (14)

31. State the main difference between explicit weight and implicit weight.
32. Find the value of r if $Cov(x,y) = 120, S_x = 12, S_y = 15$.
33. If the regression line of Y on X is $\hat{y} = 35 + 2x$ and Coy (x, y) = 50, find the standard deviation of X.
34. Obtain the linear equation for trend for a time series with n = 8, Ey=344, Ety = 1342
35. Find the probability of getting R in the first place in all possible arrangements of each and every letter of the word RUTVA.
36. Find parameters of the binomial distribution where mean = 4 and variance = 2.
37. For a normal variable, mean deviation is 48 and its third quartile is 120. Estimste its first quartile.
38. If $N(k_1, 0.5) = (19.5, k_2)$, then find the values of k_1 and k_2
39. Define derivative.

Section - D

▸ **Write the answers to any 8 (eight) questions out of the 12 questions from 40 to 51 given below. (3 marks each)** (24)

40. Find the real wages for the worker class of a city from the following data about their average monthly wage and the cost of living index number (base year

2001). Find the purchasing power of money in the year 2015 by taking the base year 2001 and state the importance of this answer.

Year	2010	2011	2012	2013	2014	2015
Average monthly wage (₹)	15,000	15,600	16,200	17,000	18,000	20,000
Cost of living index number	192	203	228	268	270	287

41. The index numbers of average closing prices of shares of a certain company in different months with the base January 2014 are as follows. Find the chain base index numbers.

Month	January '14	February '14	March '14	April '14	May '14	June '14
Fixed base index number	100	104	105	108	109	127

42. Write the properties of correlation coefficient.
43. Explain the statement, “There is a cause and effect relationship between two variables” by giving a suitable example. Also define independent variable and dependent variable.
44. Fit a linear equation from the following data for variable (y) of a time series:
$n = 4, \sum y = 270, \sum ty = 734$
45. 80 % customers hold saving account and 50 % customers hold current account of a nationalised bank. 90 % of the customers hold at least one of the saving account and the current account. If one of the account holders randomly selected from this bank holds a current account, find the probability that he holds a saving account.
46. A factory runs in two shifts. The sample data about the quality of items produced in these shifts are shown in the following table :

Quality	Shift		Total
	I	II	
Defective items	24	46	70
Non-defective items	2176	2754	4930
Total	2200	2800	5000

One item is randomly selected from the production of the factory.
(1) If the item is taken from the production of the first shift then find the probability that it is defective.
(2) If the item is defective then find the probability that it is taken from the production of the first shift.

47. If three events A, B and C of a random experiment are independent events and P(A) = 0.2, P(B) = 0.3 and P(C) = 0.5, then find $P(A \cup B \cup C)$.

48. Find constant C for the following discrete probability distribution. Hence obtain mean and variance of this distribution.
$p(x) = C \cdot 4^P_x, x = 0, 1, 2, 3, 4$

49. Define normal distribution and state the characteristics of normal curve.

50. Obtain $\frac{dy}{dx}$ for $y = 3x^2 - 2x^3 + x^2 - 8x + 7$. Also obtain its value at x = 1.

51. The probability that a bomb dropped from a plane over a bridge will hit the bridge is $\frac{1}{5}$. 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.

Section - E

▸Answer any 3 (three) questions out of 4 questions from 52 to 55 given below as required. (4 marks each) (12)

52. Find the value of the following : $\lim_{x \to 2} [\frac{1}{x-2} - \frac{2}{x^2 - 2x}]$

53. Age of 500 employees working in a private company follows normal distribution with mean 40 years and standard deviation 6 years. The company wants to reduce its staff by 25 % in the following manner:
(1) To retrench 5 % of the employees having minimum age.
(2) After retrenching 5 % of employees having minimum age, next 10% of the employees are to be transferred to another company.
(3) To retire 10 % of employees having maximum age.
From this information, find the age of employees who are to be retrenched, transferred and retired from the company.

54. If the probabilities for standard normal variable Z are as under then obtain the value of Z-score (z_1) :
(1) Area to the left of Z= z_1 is 0.10.
(2) Area to the right of Z= z_1 is 0.90.

55. In a factory, production cost per hundred tons of steel is $\frac{1}{10}x^3 - 4x^2 + 50x + 300$. Determine the production for minimum cost.

Section - F

▸Write the answers to any 4 (four) questions out of the 6 questions from question number 56 to 61 given below. (5 marks each) (20)

56. Compute Laspeyre's, Paasche's and Fisher's index numbers for the year 2016 from the data given below by taking 2015 as the base year.

Item	Unit	Price (₹)		Quantity	
		Year 2015	Year 2016	Year 2015	Year 2016
A	20 Kilogram	300	440	5 Kilogram	8 Kilogram
B	Quintal	500	700	10 Kilogram	15 Kilogram
C	Kilogram	60	75	1200 Gram	2000 Gram
D	Meter	14.25	15	15 Meter	25 Meter
E	Litre	32	36	18 Litre	30 Litre
F	Dozen	30	36	8 Pieces	10 Pieces

57. In order to study the relation between the sales (in crore ₹) and the profit (in thousand ₹) for truck tyre manufacturing companies, the following information is obtained for the last year.

Sales (crore ₹) x	1.6	2.2	1.9	2.0	2.3	1.7	2.4	1.8	2.1
Profit (thousand ₹) y	4200	5500	6000	6200	6100	4900	5900	5000	6700

Find the correlation coefficient between the sales and the profit from it.

58. To know the relation between the average monthly income (in ₹) and income due to overtime of workers (in), the following information is obtained from six different factories of an area manufacturing similar kind of products. Find the correlation coefficient between the average monthly income and income due to overtime.

Year	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
Average Monthly Income (₹) x	14,900	15,100	15,000	15,500	15,700	15,800
Income due to overtime (₹) y	100	105	115	160	220	255

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
No. 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 find the error in estimating Y for X = 7.

60. The data about Cost Inflation Index (CII) declared by the central government are as follows. The year 1981 - 82 is the base for this index. Find the estimate of this index for the year 2015 - 16 by fitting the linear equation to these data.

Year	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15
CII	551	582	632	711	785	852	939	1024

61. The average monthly closing prices of shares of a company in the year 2016 are given in the following table. Find the trend using four monthly moving averages.

Month	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Share price (Rs)	253	231	350	261	262	266	263	261	281	278	278	272

ANSWERS

Subject: STAT | Round Test | Date: 21/01/2025

Standard: 12 | Marks: 100

Chapter: Full syllabus | Exam Time: 3 hours

Section - A

▸ **Choose the correct option from those given below each question. (Each question carries 1 Marks)** (20)

01. 133.33
02. By family budget method
03. Fixed base method
04. Scatter diagram
05. - 0.5
06. $b_{yx} = r \cdot \frac{s_y}{s_x}$
07. Least Square Method
08. Regular
09. 36.1
10. Impossible event
11. Mathematical definition
12. Negatively skewed
13. $\frac{2}{15}$
14. Symmetrical distribution
15. 5
16. $|x - 3| < 0.3$
17. f'(a) = 0, f"(a) > 0
18. $\frac{dR}{dx} = 0, \frac{d^2R}{dx^2} < 0$
19. A technique
20. Cyclical component

Section - B

▸ **Answer the following questions in one sentence. (Each question carries 1 Marks)** (10)

21. A method of ratio is more suitable to compare the changes in a variable at two different time periods.
22. When in the data of two variables two or more observations are of same values, there is tie in observation.
23. Out of two related variables, due to the cause if there is increase or decrease in the values of the one variable and the result is increase or decrease in the

value of another variable, then we can say that there exists cause and effect relationship between two variables.

24. $b_{vu} = b_{yx} \frac{cy}{cx} = 0.54$
25. The methods of measuring trend are: (1) Graphical method, (2) Least square method and (3) Moving average method.
26. U = {(a, b), (a, C), (a, d), (b, a), (b, C), (b, d), (c, a), (c, b), (c, d), (d, a), (d, b), (d, c)}
27. An experiment with two outcomes as success and failure is called dichotomous experiment.
28. 25
29. Closed-open interval [a, b)=$\{ x \mid a \leq x < b, x \in R \}$.
30. If at x = a function is decreasing, then the first order derivative of a function at x = a is negative, i.e., f'(a) <0.

Section - C

▸ Write the answers to any 7 (seven) questions out of the 9 questions from 31 to 39 below. (2 marks each) (14)

31.

Explicit weight	Implicit weight
Explicit weights are determined according to the importance of the items. For example, in food items if wheat is twice important than rice, then explicit weight of wheat is two and that of rice is one.	Implicit weight is implied in the selection of items. The weight is considered according to the varieties of the items selected. For example, if in food items, four varieties of wheat is selected then weight of wheat is four.
Explicit weight can be expressed directly in numbers,	Implicit weight cannot be expressed in numbers.
This is the direct method of assigning weight. Hence, it is decided by the two methods : (1) Total expenditure method and (2) Family budget method.	This is an indirect method of assigning weight. Hence, there is no other method of determining it.

32. r = 0.67
33. s_x =5
34. $\hat{y}$ = 65.05 - 4.9
35. P(A) = $\frac{1}{5}$
36. n = 8, p = $\frac{1}{2}$
37. 40
38. k_1 = 20 and k_2 =20.5

39. Let f: $A \to R$ and $a \in A$, where A an open interval of R. If h is made very small and $\lim_{h \to 0} \frac{f(a+h)-f(a)}{h}$ exists, then this limit a function f is called derivative at x = a. It is denoted by f'(a).
Thus, f'(a) = $\lim_{h \to 0} \frac{f(a+h)-f(a)}{h}$
For any value of x f the domain of f,
f'(x) = $\lim_{h \to 0} \frac{f(x+h)-f(x)}{h}$
If y = f(x), then f'(x) is denoted by $\frac{dy}{dx}$

▸ **Write the answers to any 8 (eight) questions out of the 12 questions from 40 to 51 given below. (3 marks each)** (24)

40. We can say that the purchasing power of money in the year 2015 with the base year 2001 = 0.35.
41. Chain base index number = 100, 104, 100.96, 102.86, 100.93, 116.51
42. The properties of correlation coefficient are as follows:
1) The value of correlation coefficient r lies in the interval — 1 to 1.
(2) The correlation coefficient r is free from unit of measurement, i.e., it does not have any unit of measurement.
3) The correlation coefficient between variables X and Y is same as that of between Y and X, i.e., r (x, y) = r.(y, x).
(4) The value of correlation coefficient r does not change with the change of origin and scale, i.e., r (x, y) = r (u, v) $u = \frac{x-A}{c_x}, v = \frac{x-b}{c_y}$. c_x <0, c_y >0 and A,B,C_x , C_y are constant.
(5) The correlation coefficient r is an absolute measure.
(6) If the sign of any one of two variables is changed then the sign of the correlation coefficient also changes, i.e., r (-x, y) = - r (x, y); r(x, - y)= -r(x, y).
(7) If the signs of both the variables are changed then the sign of the correlation remain unchanged. i.e., r (-x, -y) = r (x, y).
43. When due to relationship between two random variables, changes in the values of one variable results in the changes in the values of the other variable and it is possible to estimate what type of changes and how much changes occur in the values of one variable, due to changes in the values of other variable and if we get the estimate of the value of one variable for the given value of another variable then such relationship between two variables is called cause and effect relationship.
For example, knowing the relation between income and expenditure, we can estimate the increase in expenditure due to certain increase in the income. Also it is possible to get the estimate of expenditure for a fixed income.
Here, income is a cause variable and expenditure is an effect variable. Hence, there is cause and effect relationship between income and expenditure.
Independent Variable : Out of two related variables a variable in the form of cause is called an independent variable. It is denoted by symbol X.
Dependent Variable: Out of two related variables, a variable in the form of an effect is called a dependent variable. It is denoted by symbol Y.
44. $\hat{y}$ = 38+11.8t

45. $\frac{4}{5}$

46. $P(D \mid A) = \frac{3}{275}$

    $P(A \mid D) = \frac{12}{35}$

47. 0.72

48. C = $\frac{1}{65}$
    mean = μ = $\frac{196}{65}$
    variance = V(X) = $\frac{3964}{4225}$

49. The distribution of a normal variable X is called Normal distribution. It is denoted by N(μ , σ^2)
    The characteristics of normal curve:
    (1) It is completely bell-shaped.
    (2) It is asymptotic to X-axis, I.e., the tails of the curve never touch X-axis.
    (3) The total area of the region bounded by normal curve and X-axis = Total probability 1
    (4) It is symmetric about the sides of mean μ of normal variate. So the area of the regiol of normal curve on both the sides of X = μ is equal to 0.5.
    (5) $P[\mu \leq X \leq a]$ is the area of region bounde by X-axis and two perpendicular lines at X = μ and X = a.
    (6) To find the area under the normal curve the normal variable is transformed to standan normal variable Z and readymade table is used.

50. $\frac{d^2y}{dx^2} = 26$

51. 0.3447

Section - D

▸ Answer any 3 (three) questions out of 4 questions from 52 to 55 given below as required. (4 marks each) (12)

52. $\frac{1}{2}$

53. (i) 30.13
    (ii) 33.79
    (iii) 47.68

54. (1) for Z_1 = -1.28, P($Z \leq Z_1$) = 0.10
    (2) for Z_1 = -1.28, P($Z \leq Z_1$) = 0.90

55. $x = \frac{50}{3}$

Section - E

▸ Write the answers to any 4 (four) questions out of the 6 questions from question number 56 to 61 given below. (5 marks each) (20)

56. Laspeyre's index numbers = 115.95

    Paasche's index numbers = 115.68

    Fisher's index numbers = 115.80

    Thus, it can be said that there is (115.8-100) = 15.8% rise in the prices in the year 2016 as compared to the year 2015.

57. r = 0.71
58. r = 0.96
59. $\hat{y}$ = 3.67 + 0.9x

    Putting X = 7, $\hat{y}$ = 9.97

    e = -0.97

60. $\hat{y}$ = 447.2 + 69.4t, for the year 2015 - 16 $\hat{y}$ = 1071.8
61.

Month	Jan	Feb	March	April	May	June	July	Aug	Sep	Oct	Nov	Dec
Four yearly moving average	-	-	274.88	280.38	273.88	263	265.38	368.25	272.63	275.88	-	-