

### STATISTICS (31)

**Duration: 3 Hrs 15 Min.**

**Max. Marks: 80**

- Instructions:**
1. Statistical table and graph sheets will be supplied on request.
  2. Scientific calculators are allowed.
  3. All working steps should be clearly shown.
  4. Only the first written answers will be considered for Section-A.

#### SECTION – A

**I. Choose the correct answer from the choices given:**

**5 × 1 = 5**

1. The expected number of years that a new born baby would live is called
  - a) Cohort
  - b) Radix
  - c) Longevity
  - d) Survival ratio
2. The prices of items increased by 10% in 2012 as compared to 2010. Then the index number for the year 2010 is
  - a) 110
  - b) 10
  - c) 100
  - d) 0

3. Following is the probability distribution of a binomial variate:

|      |        |      |       |      |        |
|------|--------|------|-------|------|--------|
| X    | 0      | 1    | 2     | 3    | 4      |
| P(X) | 0.0625 | 0.25 | 0.375 | 0.25 | 0.0625 |

The mode of the distribution is

- a) 4
  - b) 2
  - c) 3
  - d) 1
4. There are four possible decisions under the testing of null hypothesis ( $H_0$ ):
    - i) Accept  $H_0$  when it is true
    - ii) Reject  $H_0$  when it is not true
    - iii) Accept  $H_0$  when it is not true
    - iv) Reject  $H_0$  when it is true
 The correct decisions are
    - a) i and ii
    - b) iii and iv
    - c) i and iii
    - d) ii and iv
  5. The cost associated with the maintenance of an inventory until they are sold or used is called
    - a) Capital cost
    - b) Setup cost
    - c) Shortage cost
    - d) Holding cost.

**II. Fill in the blanks by choosing the appropriate word from those given in the brackets:**

(Chance, Fisher's, Balanced, Parameter, Strategy, Bell)

**5 × 1 = 5**

6. Both time reversal test and factor reversal tests are satisfied by \_\_\_\_\_ index number.
7. The t-curve is \_\_\_\_\_ shaped.
8. A statistical constant of the population is called a \_\_\_\_\_.
9. A small amount of variation for which no specific cause can be attributed is termed as \_\_\_\_\_ cause of variation.
10. The \_\_\_\_\_ of a player is the pre-determined rule by which a player determines his course of action.

**III. Match the following:**

**A**

11. N.R.R. per woman = 1.2
12. Index numbers
13. The range of Bernoulli distribution
14.  $H_1: \mu > 50$
15. Shortages are allowed

**B**

- (a) Inventory Model II
- (b)  $X = 0, 1$
- (c) Population increases
- (d) Economic barometers
- (e)  $H_0: \mu = 50$
- (f) Histogram

**IV. Answer the following questions:  $5 \times 1 = 5$**

16. Define fertility.
17. Which variation of time series is predictable?
18. Write the relation between mean and variance of a Bernoulli distribution.
19. Define null hypothesis.
20. When is a transportation problem balanced?

**SECTION – B**

**V. Answer any FIVE of the following questions:**

**$5 \times 2 = 10$**

21. Diagrammatically represent 'Business Cycle' with stages.
22. Write two assumptions of interpolation and extrapolation.
23. Find the mean of a Hyper geometric distribution whose parameters are  $a = 4$ ,  $b = 6$  &  $n = 5$ .
24. Find the standard deviation of a chi-square distribution with 8 d.f.
25. A random sample of size 36 is drawn from a population whose standard deviation is 4. Compute standard error of the sample mean.
26. Define 'point estimation' and 'interval estimation'.
27. If  $P' = 0.02$  and  $n = 25$ , calculate upper control limit for np-chart.
28. Test whether solution for the following T.P. is non-degenerate?

|   |    |    |    |
|---|----|----|----|
|   | 10 | 12 |    |
| 2 |    | 3  |    |
|   |    | 15 | 20 |
|   |    | 4  | 6  |
|   |    |    | 14 |
|   |    |    | 7  |

**SECTION – C**

**VI. Answer any FOUR of the following questions:**

**$4 \times 5 = 20$**

29. Calculate the cost of living index number for the following data. Comment on the result.

| Items    | Prices (Rs.) |      | Weights |
|----------|--------------|------|---------|
|          | 2012         | 2018 |         |
| Food     | 4000         | 6000 | 15      |
| Clothing | 2500         | 3500 | 08      |
| Housing  | 6000         | 9000 | 12      |
| Fuel     | 1000         | 1500 | 10      |
| Others   | 1600         | 2000 | 15      |

30. Following is data regarding annual life insurance premium. Using binomial expansion method estimate the premium at the age 30 and 45 years.

|                  |      |      |    |      |      |    |
|------------------|------|------|----|------|------|----|
| Age (in Years)   | 20   | 25   | 30 | 35   | 40   | 45 |
| Premium (in Rs.) | 1426 | 1581 | -  | 1996 | 2256 | -  |

31. The probability that a team winning the game is  $\frac{3}{5}$ . If this team participates in 6 games, then find the probability that it wins in i) all the games ii) more than one game.

32. Fit a Poisson distribution for the following data.

|                             |    |    |    |   |            |
|-----------------------------|----|----|----|---|------------|
| Number of mistakes per page | 0  | 1  | 2  | 3 | 4 and more |
| Number of pages             | 20 | 45 | 30 | 5 | 0          |

33. Test whether there is any significant difference in the population proportions at 5% level of significance, from the following data.

|           |      |            |
|-----------|------|------------|
|           | Size | Proportion |
| Sample I  | 100  | 0.02       |
| Sample II | 200  | 0.01       |

34. From the following  $2 \times 2$  contingency table test whether result depends on family condition of the students are independent. (Use 1% L.O.S.)

|        |      |                  |     |
|--------|------|------------------|-----|
|        |      | Family condition |     |
|        |      | Good             | Bad |
| Result | Pass | 10               | 15  |
|        | Fail | 15               | 10  |

35. Solve the following game using the principle of dominance. Is the game fair?

|            |                |                |                |                |
|------------|----------------|----------------|----------------|----------------|
|            |                | Player – B     |                |                |
|            |                | B <sub>1</sub> | B <sub>2</sub> | B <sub>3</sub> |
| Player – A | A <sub>1</sub> | 4              | -1             | 2              |
|            | A <sub>2</sub> | 0              | 3              |                |
|            | A <sub>3</sub> | -5             | 1              |                |

36. The purchase price of a machine A is Rs. 5000. Its resale value and maintenance costs are as follows:

|                        |      |      |      |      |      |
|------------------------|------|------|------|------|------|
| Year                   | 1    | 2    | 3    | 4    | 5    |
| Maintenance cost (Rs.) | 100  | 200  | 330  | 510  | 860  |
| Resale value (Rs.)     | 3000 | 2500 | 2000 | 1500 | 1000 |

What would be the optimum replacement period?

**VII. Answer any TWO of the following questions:**

**2×5 = 10**

37. Height of a group of candidates who attended the Agniveer army selection camp follows normal distribution with mean and S.D of height of candidates is 160cm and 3.9cm respectively. The minimum required height for Agniveer army selection is 165cm. Show that only 10% of the above group is eligible.

38. A machine is designed so as to fill the bottles with mean 1litre of cold pressed ground nut oil. A sample of 26 bottles when measured had a mean content of 998 ml. with S.D. of 5 ml. Test at 5% level of significance whether the machine is functioning properly.

39. Following table gives mean ( $\bar{x}$ ) and Range (R) of samples of size 5 each.

|                    |    |    |    |    |    |    |
|--------------------|----|----|----|----|----|----|
| Sub group number   | 1  | 2  | 3  | 4  | 5  | 6  |
| Mean ( $\bar{x}$ ) | 52 | 49 | 53 | 48 | 51 | 47 |
| Range (R)          | 9  | 11 | 10 | 12 | 8  | 10 |

Find the control limits for drawing  $\bar{x}$ - chart.

40. F1 and F2 are two types of foods are used to get minimum supplements of vitamins B and C. Using graphical method for the following Linear Programming Problem model, find how much quantities of foods are needed to optimize the cost:

$$\begin{aligned} \text{Minimize } Z &= 10x + 5y \\ \text{Subject to } 2x + 3y &\geq 12 \\ 2x + y &\geq 8 \\ \text{and } x &\geq 0, y \geq 0 \end{aligned}$$

**OR**

**(For Visually challenged students only)**

There are two types of foods F1 and F2 each containing different proportions of vitamins B and C. Food F1 contains 2 units of vitamin B and 2 units of vitamin C. Food F2 contains 3 units of vitamin B and 1 unit of vitamin C. The minimum daily requirement of vitamins B and C for a person is 12 and 8 units respectively. One unit of food F1 costs Rs.10 and one unit of food F2 costs Rs. 5. Formulate the L.P.P. to optimize the expenditure.

### SECTION – D

**VIII. Answer any TWO of the following questions:**

**2×10 = 20**

41. Calculate the standardized death rates for both Localities A and B from the following data. State which locality is healthier?

| Age-group<br>(in years) | Locality - A |        | Locality - B |        | Standard<br>Population |
|-------------------------|--------------|--------|--------------|--------|------------------------|
|                         | Population   | Deaths | Population   | Deaths |                        |
| 0 – 10                  | 6,000        | 60     | 7,000        | 84     | 4,000                  |
| 10 – 20                 | 10,000       | 80     | 15,000       | 90     | 16,000                 |
| 20 – 60                 | 20,000       | 240    | 25,000       | 250    | 18,000                 |
| 60 & above              | 4,000        | 120    | 3,000        | 120    | 2,000                  |

42. Calculate the Laspeyre's, Paasche's and Dorbish- Bowley's price index numbers from the following data.

| Items | Base Year     |          | Current Year  |          |
|-------|---------------|----------|---------------|----------|
|       | Price (in Rs) | Quantity | Price (in Rs) | Quantity |
| Rice  | 50            | 10       | 60            | 08       |
| Wheat | 40            | 08       | 45            | 12       |
| Dhal  | 100           | 03       | 160           | 02       |
| Oil   | 80            | 02       | 120           | 03       |

43. a) Following data shows the sales figures of a company. Mention the trend by calculating three yearly moving averages.

| Year                    | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|-------------------------|------|------|------|------|------|------|------|
| Sales (in thousand Rs.) | 120  | 104  | 130  | 126  | 145  | 131  | 132  |

- b) Following are the figures of production (in thousand quintals) of a sugar factory. Fit a straight line trend of the type  $Y = a + b x$  to this data.

| Year       | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 |
|------------|------|------|------|------|------|------|------|
| Production | 80   | 90   | 92   | 83   | 94   | 99   | 92   |

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ವಿಷಯ: ಸಂಖ್ಯಾಶಾಸ್ತ್ರ (31)

ಸಮಯ: 3ಗಂಟೆ 15ನಿಮಿಷ.

ಗರಿಷ್ಠ ಅಂಕಗಳು: 80

- ಸೂಚನೆ: 1. ಸಾಂಖ್ಯಿಕ ಕೋಷ್ಟಕ ಮತ್ತು ಅಲೇಖ ಕಾಗದಗಳನ್ನು ಕೇಳಿದಾಗ ನೀಡಲಾಗುವುದು.  
 2. ವೈಜ್ಞಾನಿಕ ಕ್ಯಾಲ್ಕುಲೇಟರ್‌ಗಳನ್ನು ಬಳಸಬಹುದು.  
 3. ಕಾರ್ಯದ ಎಲ್ಲಾ ಹಂತಗಳನ್ನು ಸ್ಪಷ್ಟವಾಗಿ ತೋರಿಸಬೇಕು.  
 4. A - ವಿಭಾಗದಲ್ಲಿನ ಪ್ರಶ್ನೆಗಳಿಗೆ ಪ್ರಥಮವಾಗಿ ಬರೆದ ಉತ್ತರಗಳನ್ನು ಮಾತ್ರ ಪರಿಗಣಿಸಲಾಗುವುದು.

ವಿಭಾಗ - A

I. ಸರಿಯಾದ ಉತ್ತರವನ್ನು ಆಯ್ಕೆಮಾಡಿ ಬರೆಯಿರಿ:

5 × 1 = 5

1.  $\int_{-1}^1 x^2 dx = \frac{1}{3} [x^3]_{-1}^1 = \frac{1}{3} (1 - (-1)^3) = \frac{1}{3} (1 + 1) = \frac{2}{3}$

a)  $\frac{1}{3}$                       b)  $\frac{2}{3}$                       c)  $\frac{1}{2}$                       d)  $\frac{2}{5}$
2. 2010 ರಿಂದ 2012 ರ ವರೆಗೆ ಉತ್ಪಾದಿಸಿದ ಉತ್ಪನ್ನಗಳ ಮೌಲ್ಯದ ವಿಸ್ತಾರಿತ ಮಧ್ಯಮ ಉತ್ಪಾದನೆಯು 2010 ರ ಉತ್ಪಾದನೆಯ ಮೌಲ್ಯದ 110% ಆಗಿದೆ.

a) 110                      b) 10                      c) 100                      d) 0
3.  $M = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix}$  ಮತ್ತು  $N = \begin{bmatrix} 9 & 8 & 7 \\ 6 & 5 & 4 \\ 3 & 2 & 1 \end{bmatrix}$  ಆಗಿರಲಿಕ್ಕೆ  $M + N$  ನ ಅಂಶಗಳ ಮೊತ್ತವನ್ನು ಕಂಡುಹಿಡಿಯಿರಿ.

|      |        |      |       |      |        |
|------|--------|------|-------|------|--------|
| X    | 0      | 1    | 2     | 3    | 4      |
| P(X) | 0.0625 | 0.25 | 0.375 | 0.25 | 0.0625 |

a) 4                      b) 2                      c) 3                      d) 1
4.  $H_0: \mu = 10$  ಮತ್ತು  $H_1: \mu > 10$  ಆಗಿರುವ ಒಂದು ಏಕ-ನಿರೀಕ್ಷಿತ ಪರೀಕ್ಷೆಯಲ್ಲಿ,  $Z = \frac{\bar{X} - \mu_0}{\sigma/\sqrt{n}}$  ನಡುವೆ ಸಂಬಂಧವನ್ನು ಕಂಡುಹಿಡಿಯಿರಿ.

i)  $Z = 1.96$  ಆಗಿದ್ದರೆ  $\alpha = 0.05$  ಆಗಿರುತ್ತದೆ.  
 ii)  $Z = 1.64$  ಆಗಿದ್ದರೆ  $\alpha = 0.05$  ಆಗಿರುತ್ತದೆ.  
 iii)  $Z = 1.96$  ಆಗಿದ್ದರೆ  $\alpha = 0.01$  ಆಗಿರುತ್ತದೆ.  
 iv)  $Z = 1.64$  ಆಗಿದ್ದರೆ  $\alpha = 0.01$  ಆಗಿರುತ್ತದೆ.

a) i ಮತ್ತು iii                      b) iii ಮತ್ತು iv                      c) i ಮತ್ತು ii                      d) ii ಮತ್ತು iv
5.  $\int_0^1 x^2 dx = \frac{1}{3} [x^3]_0^1 = \frac{1}{3} (1 - 0) = \frac{1}{3}$

a)  $\frac{1}{3}$                       b)  $\frac{1}{2}$                       c)  $\frac{2}{3}$                       d)  $\frac{1}{4}$

II. ಆವರಣದಲ್ಲಿರುವ ಸರಿಯಾದ ಉತ್ತರವನ್ನು ಆರಿಸಿ, ಬಿಟ್ಟು ಸ್ಥಳ ತುಂಬಿರಿ:

5 × 1 = 5

(ಆಕಸ್ಮಿಕ, ಫಿಶರನ, ಸಮತೋಲನ, ಪ್ರಾಚಲ/ನಿಯತಾಂಕ, ತಂತ್ರ, ಗಂಟೆ)

6.  $\int_0^1 x^2 dx = \frac{1}{3} [x^3]_0^1 = \frac{1}{3} (1 - 0) = \frac{1}{3}$
7.  $t = \frac{\bar{X} - \mu_0}{\sigma/\sqrt{n}}$  ನಡುವೆ ಸಂಬಂಧವನ್ನು ಕಂಡುಹಿಡಿಯಿರಿ.
8.  $\int_0^1 x^2 dx = \frac{1}{3} [x^3]_0^1 = \frac{1}{3} (1 - 0) = \frac{1}{3}$
9.  $\int_0^1 x^2 dx = \frac{1}{3} [x^3]_0^1 = \frac{1}{3} (1 - 0) = \frac{1}{3}$
10.  $\int_0^1 x^2 dx = \frac{1}{3} [x^3]_0^1 = \frac{1}{3} (1 - 0) = \frac{1}{3}$

III. ಹೊಂದಿಸಿ ಬರೆಯಿರಿ:

5 × 1 = 5

- |                                     |                                    |
|-------------------------------------|------------------------------------|
| A                                   | B                                  |
| 11. $\int_0^1 x^2 dx = \frac{1}{3}$ | a) $\int_0^1 x^2 dx = \frac{1}{3}$ |





39. F1 ಉತ್ಪಾದನೆಯು F2 ಜಾಸ್ತಿ ಜಗತ್ತಿನಲ್ಲಿ ಉತ್ಪಾದಿಸಿದಾಗ  $C = 10x + 5y$  ಮತ್ತು  $2x + y \geq 8$  ಆಗಿರುತ್ತದೆ.  $x \geq 0, y \geq 0$  ಆಗಿರುತ್ತದೆ.  $Z = 10x + 5y$  ಅನ್ನು ಗರಿಷ್ಠಗೊಳಿಸಲು  $x$  ಮತ್ತು  $y$  ನ ಮೌಲ್ಯಗಳನ್ನು ಕಂಡುಹಿಡಿಯಿರಿ.

$$Z = 10x + 5y$$

$$2x + y \geq 8$$

$$x \geq 0, y \geq 0$$

ಅಥವಾ (ದೃಷ್ಟಿ ವಿಕಲಚೇತನ ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ ಮಾತ್ರ)

F1 ಉತ್ಪಾದನೆಯು F2 ಜಾಸ್ತಿ ಜಗತ್ತಿನಲ್ಲಿ ಉತ್ಪಾದಿಸಿದಾಗ  $C = 10x + 5y$  ಮತ್ತು  $2x + y \geq 8$  ಆಗಿರುತ್ತದೆ.  $x \geq 0, y \geq 0$  ಆಗಿರುತ್ತದೆ.  $Z = 10x + 5y$  ಅನ್ನು ಗರಿಷ್ಠಗೊಳಿಸಲು  $x$  ಮತ್ತು  $y$  ನ ಮೌಲ್ಯಗಳನ್ನು ಕಂಡುಹಿಡಿಯಿರಿ.

ವಿಭಾಗ - D

VIII. ಈ ಕೆಳಗಿನ ಯಾವುದಾದರೂ ಎರಡು ಪ್ರಶ್ನೆಗಳಿಗೆ ಉತ್ತರಿಸಿ: 2 × 10 = 20

40. F ಉತ್ಪಾದನೆಯು F2 ಜಾಸ್ತಿ ಜಗತ್ತಿನಲ್ಲಿ ಉತ್ಪಾದಿಸಿದಾಗ  $C = 10x + 5y$  ಮತ್ತು  $2x + y \geq 8$  ಆಗಿರುತ್ತದೆ.  $x \geq 0, y \geq 0$  ಆಗಿರುತ್ತದೆ.  $Z = 10x + 5y$  ಅನ್ನು ಗರಿಷ್ಠಗೊಳಿಸಲು  $x$  ಮತ್ತು  $y$  ನ ಮೌಲ್ಯಗಳನ್ನು ಕಂಡುಹಿಡಿಯಿರಿ.

| ಉತ್ಪಾದನೆಯ ಮಟ್ಟ | ಉತ್ಪಾದನೆಯ ಮಟ್ಟ |                | ಉತ್ಪಾದನೆಯ ಮಟ್ಟ |                | ಉತ್ಪಾದನೆಯ ಮಟ್ಟ |
|----------------|----------------|----------------|----------------|----------------|----------------|
|                | ಉತ್ಪಾದನೆಯ ಮಟ್ಟ | ಉತ್ಪಾದನೆಯ ಮಟ್ಟ | ಉತ್ಪಾದನೆಯ ಮಟ್ಟ | ಉತ್ಪಾದನೆಯ ಮಟ್ಟ |                |
| 0 - 10         | 6,000          | 60             | 7,000          | 84             | 4,000          |
| 10 - 20        | 10,000         | 80             | 15,000         | 90             | 16,000         |
| 20 - 60        | 20,000         | 240            | 25,000         | 250            | 18,000         |
| 60 ಉತ್ಪಾದಿಸಿ   | 4,000          | 120            | 3,000          | 120            | 2,000          |

41. F ಉತ್ಪಾದನೆಯು F2 ಜಾಸ್ತಿ ಜಗತ್ತಿನಲ್ಲಿ ಉತ್ಪಾದಿಸಿದಾಗ  $C = 10x + 5y$  ಮತ್ತು  $2x + y \geq 8$  ಆಗಿರುತ್ತದೆ.  $x \geq 0, y \geq 0$  ಆಗಿರುತ್ತದೆ.  $Z = 10x + 5y$  ಅನ್ನು ಗರಿಷ್ಠಗೊಳಿಸಲು  $x$  ಮತ್ತು  $y$  ನ ಮೌಲ್ಯಗಳನ್ನು ಕಂಡುಹಿಡಿಯಿರಿ.

| ಉತ್ಪಾದನೆಯ ಮಟ್ಟ | ಉತ್ಪಾದನೆಯ ಮಟ್ಟ |                | ಉತ್ಪಾದನೆಯ ಮಟ್ಟ |                |
|----------------|----------------|----------------|----------------|----------------|
|                | ಉತ್ಪಾದನೆಯ ಮಟ್ಟ | ಉತ್ಪಾದನೆಯ ಮಟ್ಟ | ಉತ್ಪಾದನೆಯ ಮಟ್ಟ | ಉತ್ಪಾದನೆಯ ಮಟ್ಟ |
| CQ             | 50             | 10             | 60             | 08             |
| ಉತ್ಪಾದಿಸಿ      | 40             | 08             | 45             | 12             |
| ಉತ್ಪಾದಿಸಿ      | 100            | 03             | 160            | 02             |
| JuB            | 80             | 02             | 120            | 03             |

42. a) F ಉತ್ಪಾದನೆಯು F2 ಜಾಸ್ತಿ ಜಗತ್ತಿನಲ್ಲಿ ಉತ್ಪಾದಿಸಿದಾಗ  $C = 10x + 5y$  ಮತ್ತು  $2x + y \geq 8$  ಆಗಿರುತ್ತದೆ.  $x \geq 0, y \geq 0$  ಆಗಿರುತ್ತದೆ.  $Z = 10x + 5y$  ಅನ್ನು ಗರಿಷ್ಠಗೊಳಿಸಲು  $x$  ಮತ್ತು  $y$  ನ ಮೌಲ್ಯಗಳನ್ನು ಕಂಡುಹಿಡಿಯಿರಿ.

| ಉತ್ಪಾದನೆಯ ಮಟ್ಟ      | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|---------------------|------|------|------|------|------|------|------|
| ಉತ್ಪಾದಿಸಿ (A: gAgE) | 120  | 104  | 130  | 126  | 145  | 131  | 132  |

b) MAz APAS ಆಗಿರುತ್ತದೆ.  $Y = a + bX$  ರೂಪದಲ್ಲಿ  $Y = a + bX$  ನಲ್ಲಿ  $a$  ಮತ್ತು  $b$  ನ ಮೌಲ್ಯಗಳನ್ನು ಕಂಡುಹಿಡಿಯಿರಿ.

| ಉತ್ಪಾದನೆಯ ಮಟ್ಟ | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 |
|----------------|------|------|------|------|------|------|------|
| GvAE           | 80   | 90   | 92   | 83   | 94   | 99   | 92   |