(English Version)

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. *For Section-A, only the first written answers will be considered for evaluation.*
5. *For questions having diagram, graph and map, alternative questions are given at the end of the question paper in a separate section for visually challenged students.*

SECTION – A

I. Choose the correct answer from the choices given : $(5 \times 1 = 5)$

1) Life expectancy of a newborn baby

a) Mortality b) Longevity

c) Fertility d) Fecundity

2) The weights used in the construction of Marshall-Edgeworth's price index number

a) q_0 b) q_1

c) $\left(\frac{q_0 + q_1}{2}\right)$ d) $(q_0 + q_1)$

3) The variance of a χ^2- distribution with 12 degrees of freedom is 24. Then its mean is

a) 72 b) 2

c) 0.5 d) 12

4) Type I error is

a) Rejecting H_0 when it is true

b) Accepting H_0 when it is true

c) Rejecting H_0 when it is not true

d) Accepting H_0 when it is not true

5) The game is said to be fair, if the value of the game is

a) $V > 0$ b) $V = 0$

c) $V < 0$ d) $V \neq 0$

Fill in the blanks by choosing the appropriate answer from those given in the brackets : $(5 \times 1 = 5)$

$\left(\frac{1}{2},\ d_2\sigma',\ \text{Geometric mean},\ \sqrt{\frac{PQ}{n}},\ \text{first},\ \overline{R}\right)$

6) The best average used in the construction of index number _____.

7) Binomial distribution is positively skewed when $p <$ _____

8) Standard error of the sample proportion is _____

9) For R-chart if σ' is known, then _____ is the central line.

10) The feasible solution to the L.P.P exists in _____ quadrant.

III. Match the following. $(5 \times 1 = 5)$

A	B
11) Deaths of new born babies within 28 days	a) Lepto Kurtic ($\beta_2 > 3$)
12) Index number which doesn't satisfy unit test	b) $1 - \beta$
13) Student's t-distribution curve	c) C_2
14) Power of a test	d) Neonatal deaths
15) Shortage cost	e) Simple aggregative price index number
	f) P (Type I error)

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

16) Write one use of vital statistics.

17) Define secular trend.

18) A normal variate has mean 150 and variance 25. Find the standard deviation.

19) Define rejection region.

20) When is the solution to the transportation problem said to be non-degenerate?

SECTION – B

V. Answer **any five** of the following questions : **(5 × 2 = 10)**

21) Define irregular variation and give an example.

22) Write two conditions for applying binomial expansion method of interpolation and extrapolation.

23) Write down the Bernoulli distribution probability mass function with the parameter $p=\frac{2}{5}$.

24) If z_1 and z_2 are two independent S.N.Vs then name the distribution of $(z_1^2 + z_2^2)$ and write its mean.

25) Define parameter and statistic.

26) Given : $n_1 = 100$, $n_2 = 60$, $P_1 = 0.4$ and $P_2 = 0.8$. Find S.E. $(p_1 - p_2)$.

27) In statistical quality control, what are defect and defectives?

28) Given : $R = 5000$ items/year, $C_3 = ₹\ 50$/cycle, $C_1 = ₹\ 2$/item/year. Calculate minimum average inventory cost.

SECTION – C

VI. Answer **any four** of the following questions : **(4 × 5 = 20)**

29) Construct a suitable index number for the following data and comment.

Item	Price (in ₹)		Quantity 2023
	2018	2023	
Rice	20	40	10
Wheat	25	32	3
Ragi	18	30	5
Oil	80	100	3

30) Interpolate the value of Y when $X = 25$, using Newton's forward difference method for the following data.

X	10	20	30	40
Y	13	15	19	25

31) In a class 60% of the students are boys. In a random sample of 5 students, find the probability that (a) 2 are boys (b) atleast one is a boy.

32) A box contains 5 blue and 7 pink marbles. 5 marbles are drawn at random. What is the probability that the sample contains 2 pink marbles? Also find the mean number of pink marbles.

33) A sample of 100 students is chosen from a large group of students. The average height of these students is 162 cm. and standard deviation is 8 cm. At $\alpha = 5\%$, can we reasonably assume that the average height of large group of students is 160 cm?

34) Five students were given an intensive coaching and 2 tests were conducted before and after coaching, the change in their marks are as follows :

2, 0, 5, –2, 3

Do the scores after coaching show an improvement? Use $\alpha = 5\%$.

35) For the following transportation problem, find the initial basic feasible solution by North-West corner rule. Compute the total transportation cost.

		Dealers			Availability
		D_1	D_2	D_3	
Factory	O_1	8	4	12	50
	O_2	10	5	6	20
	O_3	7	15	3	10
Demand		40	20	20	

36) The price of a machine is ₹ 3,000. Its maintenance cost and resale value at different ages are given below :-

Year	1	2	3	4	5	6
Maintenance cost (₹)	1000	1100	1150	1300	1500	1900
Resale value (₹)	1750	1250	850	600	500	450

What is the annual average cost? When the machine be replaced?

VII. Answer **any two** of the following questions. **(2 × 5 = 10)**

37) The daily wages of workers of a factory are normally distributed with mean ₹ 500 and standard deviation ₹ 40. Find the probability of worker whose daily wage will be (a) more than ₹ 530 (b) between ₹ 380 and ₹ 460.

38) Following expected frequencies are obtained after fitting binomial distribution by estimating the parameter.

O_i	29	37	45	62	50	27
E_i	7	35	75	81	43	9

Test whether binomial distribution is a good fit at $\alpha = 1\%$.

39) In a fish net manufacturing process, the average number of defects per square meter is known to be 3. Determine the control limits for the number of defects.

40) Solve the following linear programming problem graphically.

Maximise $Z = 5x + 10y$

Subject to constraints : $5x + 4y \leq 40$

$3x + 4y \geq 24$

and $x \geq 0, y \geq 0$.

SECTION – D

VIII. Answer **any two** of the following questions : **(2 × 10 = 20)**

41) Calculate gross reproduction rate and net reproduction rate for the following data and comment on the result.

Age group (in years)	Female population	Female births	Survival ratio
15-19	50,000	1,000	0.91
20-24	60,000	7,000	0.90
25-29	45,000	8,000	0.89
30-34	40,000	5,000	0.88
35-39	30,000	3,000	0.87
40-44	25,000	1,000	0.86
45-49	20,000	100	0.85

42) a) Compute the cost of living index number for the following data. **(5)**

Group	Weight	Price (in ₹)	
		Base Year	Current Year
Food	5	1600	2400
House rent	10	4000	5000
Clothing	3	800	1000
Fuel and lighting	4	100	400
Others	5	1600	2000

b) Compute value index number from the following data. Comment on the result. (5)

Item	2018		2020	
	Price (₹)	Quantity (kg)	Price (₹)	Quantity (kg)
A	50	8	60	10
B	80	4	100	5
C	70	6	60	6
D	30	5	50	7

43) Fit a second degree parabola of the type $y = a + bx + cx^2$ by the method of least squares to the following time series. Estimate the value for 2020.

Year	2010	2012	2014	2016	2018
Value	14	12	11	10	13

SECTION – E

(For Visually Challenged Students only)

40) Write the procedure of solving linear programming problem graphically.