



Seat No. _____

HA-003-2016052

B. Sc. (Sem. VI) (W.E.F. 2019) Examination

April - 2023

Statistics : Paper - 602

(Statistical Quality Control & Operations Research) (Theory)

Faculty Code : 003

Subject Code : 2016052

Time : $2\frac{1}{2}$ Hours / Total Marks : 70

- Instructions :**
- (1) All the five questions are compulsory.
 - (2) Each question carries 14 marks.
 - (3) Students can carry their own scientific calculator.
 - (4) Graphs and Log table should be provided to students on demand.

- 1 (a) Give the answer of following questions : 4
- (1) _____ distribution is used in the construction of np- chart.
 - (2) _____ distribution is used in the construction of C- chart.
 - (3) C chart is used for number of _____ per unit.
 - (4) In np -chart, if some of the points fall below L.C.L. then it may be considered as a sign of _____.
- (b) Write any **one** : 2
- (1) Write the difference between p - chart and np - chart.
 - (2) The number of defects noticed in 20 cloth pieces are given below :
1, 4, 3, 2, 5, 4, 6, 7, 2, 3, 2, 5, 7, 6, 4, 5, 2, 1, 3, 8
Decide whether the process is in a state of statistical control.

(c) Write any **one** : 3

(1) From a factory producing piston rings, samples of 200 rings are taken daily. The record of defective rings is given below. Draw an appropriate control chart and report on the state of control.

Defective rings = 18, 10, 20, 20, 26, 20, 26, 12, 15, 17, 31, 34, 32, 13 and 10.

(2) Give difference between Variable charts and Attribute charts.

(d) Write any **one** : 5

(1) Ten samples each of size 5 are drawn from a production process. The following table gives the values of \bar{x} and R , obtained from the samples. Draw \bar{x} and R chart and report about the state of control.

$$[A_2 = 0.577, D_3 = 0, D_4 = 2.115]$$

Sample No.	\bar{x}	R
1	9.33	0.22
2	9.22	0.10
3	9.18	0.15
4	9.22	0.28
5	9.07	0.14
6	9.22	0.17
7	9.24	0.19
8	9.13	0.22
9	9.03	0.16
10	9.20	0.19

(2) Explain Theory of Run.

2 (a) Give the answer of following questions : 4

(1) The probability of accepting a lot with fraction defectives p_t is known as _____.

(2) The graph drawn for proportion defectives and average sample number is known as _____ curve.

- (3) _____ curve depicts the probability of accepting a lot of quality.
- (4) The purpose of _____ is to determine whether to accept or reject the product. The whole procedure is called Product control.
- (b) Write any **one** : **2**
- (1) Explain double sampling plan (3000, 100, 1, 154, 3).
- (2) Discuss Single sampling plan.
- (c) Write any **one** : **3**
- (1) For single sampling plan (100, 20, 1) find the probability of accepting the lot if the fraction defective of the lot is 0.02.
- (2) Explain LTPD and Producer risk.
- (d) Write any **one** : **5**
- (1) For single sampling plan (100, 10, 1) AQL = P1' = 0.02 find producer's risk.
- (2) Explain Ideal Operating Characteristic Curve (OC).
- 3** (a) Give the answer of following questions : **4**
- (1) _____ occurs when there is no finite solution in the LP problem.
- (2) The _____ points of the convex set give the basic feasible solution to the linear programming.
- (3) A _____ variable represents amounts by which solution values exceed a resource.
- (4) Entries in the $c_j - z_j$ rows are known as _____ costs.

(b) Write any **one** : 2

- (1) Define: Surplus and Slack variable.
- (2) Solve the following linear programming problem find x_1 and x_2 such that it minimize Objective function
minimize $z = x + y$
Subject to Constraint
 $5x + 10y \leq 50$
 $x + y \geq 1$
 $y \leq 4$
 $x, y \geq 0$

(c) Write any **one** : 3

- (1) Explain feasible solution, basic feasible solution and optimum feasible solution.
- (2) Draw the graph of following linear inequalities and obtain the maximum value of objective function
 $Z = 5x + 7y$.
Subject to Constraint :
 $x + y \leq 4$
 $3x + 8y \leq 24$
 $x \geq 0, y \geq 0$

(d) Write any **one** : 5

- (1) Explain General Mathematical form of LPP.
- (2) A person has to use two types of food F_1 and F_2 . He gets vitamin A, vitamin B and vitamin C from this food. The proportion of vitamins at each of food is as follows :

	Food	
	(in milligram)	
	F_1	F_2
A	1	1
Vitamin B	100	10
C	10	100

He needs minimum 1 mg. of vitamin A, 50 mg. of vitamin B and 10 mg. of vitamin C for balanced diet. The price for each unit of food F_1 is Rs. 1 and for each unit of food F_2 is of Rs. 1.5. How many units of each food is taken as to minimize the cost and to satisfy a balanced diet?

4 (a) Give the answer of following questions : 4

- (1) The conditions are called _____ if, the total capacity (or supply) must equal total requirement (or demand).
- (2) The solution to a transportation problem with m - rows (supplies) and n - columns (destination) is feasible if number of positive allocation are _____.
- (3) The assignment problem requires that only _____ to be assigned to each resource.
- (4) If there were n workers and n jobs there would be _____ solution.

(b) Write any **one** : 2

- (1) Solve the assignment problem that the objective is to minimize the total cost :

		Work		
		A	B	C
Persons	I	20	8	4
	II	16	5	6
	III	10	2	3

- (2) Give one difference between assignment problem and transportation problem.

(c) Write any **one** : 3

- (1) Solve the following transportation problem by Matrix minima method and find Total Cost.

	D ₁	D ₂	D ₃	D ₄	Supply
O ₁	21	16	25	13	11
O ₂	17	18	14	23	13
O ₃	32	27	18	41	19
Requirement	6	10	12	15	43

- (2) Explain General Mathematical Model of Assignment Problem.

(d) write any **one** : 5

- (1) Obtain a solution of following transportation problem by Vogel's method :

	D ₁	D ₂	D ₃	Supply
O ₁	3	7	1	20
O ₂	2	9	12	30
O ₃	10	2	15	50
Requirement	35	15	50	100

- (2) Explain General Mathematical Model of Transportation problem.

5 (a) Give the answer of following questions : 4

- (1) _____ rule of game theory is used for reducing the size of the game.
 (2) _____ is the point of equilibrium.
 (3) _____ game means that the sum of losses to **one** player equal the sum of gains to other.
 (4) The graphical method is useful for the game where the pay of matrix is of the size _____ or _____.

(b) Write any **one** : 2

- (1) Explain Strategy.
 (2) Find the saddle point for the game whose pay off matrix is given by :

		Player - B	
		B ₁	B ₂
Player - A	A ₁	3	7
	A ₂	-5	5

(c) Write any **one** : 3

- (1) Explain Two-Person Zero-Sum Game and the Value of the game.
 (2) Determine whether there is a unique solution of the following game :

		Player - B			
		B ₁	B ₂	B ₃	B ₄
Player - A	A ₁	4	-16	14	-15
	A ₂	-6	7	-4	-6
	A ₃	6	-2	0	-6

(d) Write any **one** :

5

(1) From the following pay-off matrix, give the answer of the following :

- (1) What is the value of the game?
- (2) Saddle point
- (3) Optimal policies for players
- (4) Is the game a fair **one**?

		Player - X		
		X ₁	X ₂	X ₃
Player - Y	Y ₁	30000	-21000	1000
	Y ₂	18000	14000	12000
	Y ₃	-6000	28000	4000
	Y ₄	18000	6000	2000

(2) Find the value of the game by using graphical method :

		Player - B			
		B ₁	B ₂	B ₃	B ₄
Player - A	A ₁	2	2	3	-2
	A ₂	4	3	2	6
