

Paper Code : 8970

April : 2016

T. Y.B. Sc. [Statistics]

ST-304 [Applied Statistics & Elementary O R I]

Time :3 Hours

Marks:75

Instructions:

1. There are FIVE compulsory Questions in this paper. Each question carries 15 marks.
2. Statistical tables & Graph Papers will be provided on request.
3. Use of scientific calculator is allowed.

- Q1 a) Describe the construction and uses of control charts for mean and range. 6
- b) Give the difference between- Process control and product control. 6
- c) A large sample of product gave an “ average fraction defective” of 0.068. Calculate 3 - σ control limits for average fraction defective if the size of each sample sub-group is 200. 3

OR

- Q1 a) What is a Fraction Defective? Discuss the construction of 3- σ control limits and interpretations of such charts. 6
- b) Explain the Chance cause and Assignable cause of variations. 4
- c) Control charts for \bar{X} and R are maintained on the tensile strength in pounds of a certain yarn. The sub-group size is 5. The values of \bar{X} and R are computed for each sub-group. After 25 sub-groups, $\sum \bar{X} = 365$ and $\sum R = 30$. Compute the values of 3 - sigma control limits for \bar{X} and R- charts and estimate value of σ on the assumption that process is in statistical control. 5
- Q2 a) Explain in brief, the following terms occurring in sampling inspection plan- 9
- i. Acceptance Quality Level (AQL),
 - ii. Lot Tolerance Percent Defective (LTPD),
 - iii. Average Outgoing Quality (AOQ)
- b) For a SSP (1000, 100, 1), Using Poisson distribution, if p', AQL and LTPD are 0.01, 0.05 and 0.07 respectively, find- 6
- i. Probability of acceptance,
 - ii. Producer's Risk and

OR

- Q2 a) State the advantages and disadvantages of Acceptance sampling over 100 % inspection. 5
- b) Describe the scheme of double sampling plan. 3
- c) For a DSP (1500, 50, 1, 100, 3), Using Poisson distribution to find probability of acceptance, if $p' = 0.05$. 7
- Q3 a) What is a Linear Programming Problem? State various assumptions of a linear programming problem. Give its mathematical formulation. 6
- b) A toy manufacturer produces two types of dolls, a basic version doll A and a deluxe version doll B. Each doll of type B takes twice as long as one doll of type A. The company have a time to make a maximum of 2000 dolls per day and each type requires equal amount of it .The deluxe version doll B requires a fancy dress of which there are only 600 per day available . If the company makes a profit of Rs. 30 and Rs. 50 per doll respectively on doll A and doll B .How many of each should be produced per day in order to maximize profit? 5
- c) Convert into the dual from the following primal problem. 4
- Minimum $Z = 20 X_1 + 20 X_2$
- Subject to constraints $8 X_1 + 10 X_2 \geq 80$
- $4 X_1 + 2 X_2 \geq 28$
- $6 X_1 + 2 X_2 \geq 36$
- $X_1 \geq 0, X_2 \geq 0$
- Q3 a) Define the following terms- 6
- i) Convex Set,
- ii) Basic Feasible Solution,
- iii) Optimal Solution.
- b) Prove that, 'set of feasible solution is a convex set'. 3
- c) Use Big -M method to solve following L.P.P. 6
- Minimize $Z = 20x_1 + 10x_2$
- Subject to: $36x_1 + 6 x_2 \geq 108$
- $3x_1 + 12x_2 \geq 36$
- $20x_1 + 10x_2 \geq 100, x_1, x_2 \geq 0$

- Q4 a) Explain the steps of Least Cost Method' of Transportation Problem. 5
- b) Give the mathematical formulation of an assignment problem. Show 4
that it as a special case of Transportation Problem.
- c) The following data represents the cost of transporting specific pediatric 6
drug from four different manufacturers A, B, C, and D to 5 chemists C_1 ,
 C_2 , C_3 , C_4 and C_5 . The availability of manufactures and requirements of
the five chemists are table given on the next page. Find an initial basic
feasible solution to the given TP using Vogel's Approximation
methods.

Origin	Chemists					Supply
	C_1	C_2	C_3	C_4	C_5	
A	3	4	6	8	9	20
B	2	10	1	5	8	30
C	7	11	20	40	8	15
D	2	1	9	14	16	13
Demand	40	6	8	18	6	

OR

- Q4 a) Explain the Hungarian method of solving Assignment Problem. 6
- b) Write a note on ' Degeneracy in transportation problem'. 3
- c) A sales manager has to assign salesman to 4 territories. He has 4 6
candidate of varying experience and capabilities and assesses the
possible profits in suitable unit for each salesman in each territory is
given below .

Salesman	Territories			
	1	2	3	4
S_1	25	27	28	37
S_2	28	34	29	40
S_3	35	24	32	33
S_4	24	32	25	28

Find an assignment that maximizes the total profit.

- Q5 a) Define the following terms in network analysis 8
- i. Network , ii. Activity,
- iii. Event , iv. Float of an event.

- b) Seven jobs are to be processed through two machines A and B. 7
Processing times (in hours) are given below:

Jobs	1	2	3	4	5	6	7
Machine A	10	9	7	15	18	20	14
Machine B	12	8	7	12	10	6	13

Determine the optimum sequence for the jobs ,total elapsed time and idle time on each machine

- Q5 a) State various underlying assumption of sequencing problem. 4
b) Give the difference between CPM and PERT. 5
c) Consider a project having the following activities and their time 6
estimates,

Activity	Immidiate Predicessor	EXPECTED TIME (IN DAYS)		
		OPTIMISTIC	MOST LIKELY	PESSIMISTIC
A	-	5	4	6
B	-	12	8	16
C	A	5	4	12
D	B	2	1	3
E	D,A	2	2	2
F	B	5	4	6
G	C,E,F	14	10	18
H	G	20	18	34

- i) For PERT network, find expected task duration and variance of task duration.
ii) Find CP, What is the expected length and variance of the length of CP.