1059

B.A./B.Sc. (General) Sixth Semester

Statistics

Paper-303: Statistical Quality Control and Computational Techniques

Time allowed: 3 Hours | Max. Marks: 65

NOTE: *Attempt five questions in all, including Question No. I which is compulsory and selecting two questions from each Unit. Use of electronic calculator with four basic mathematical operations and upto one memory is allowed. Statistical tables and log tables will be provided on request.*

x-x-x

Q1: (a) Answer the following:

(i)What benefits are expected out of the use of control charts.

(ii)How are control charts be prepared.

(iii)What are the limitations of statistical quality control.

(iv)What are the assumptions of interpolation techniques. (4x2)

(b) Answer the following questions:

(i) Define interpolating polynomial and truncation error.

(ii) Show that $E = (1 - \nabla)^{-1}$. Where ∇ is the backward difference operator such that $\nabla f(x) = f(x) - f(x - h)$ (2x 2.5)

UNIT – I

Q2:

(a)Distinguish between process control and product control. If the average fraction defectives of a large sample of a product is 0.1537, calculate the control limits. (Given that sub-group size is 2000). What modifications do you need if the subgroup size is not constant.

(b)A machine is set to deliver packets of a given weight. 10 samples of size 5 were recorded. Given below is the relevant data.

Sample no.	1	2	3	4	5	6	7	8	9	10
Mean $\bar{X}$	15	17	15	18	17	14	18	15	17	16
Range (R)	7	7	4	9	8	7	12	4	11	5

Calculate the values for the central line and the control limits for the Mean – chart and Range-chart. Also comment on the state of and control.

Conversion factors for n = 5 are $A_2 = 0.58, D_3 = 0, D_4 = 2.11$ (2 x 6.5)

Q3. (a) Explain the meanings of LTPD, AQL, producer's risk, consumer's risk and explain their relevance in determining an appropriate sampling inspection scheme for acceptance of lots.

(b) A daily sample of 30 times was taken over a period of 14 days in order to establish attributes control limits. If 21 defectives were found, what should be the upper and lower control limits of the proportion of defectives? (2 x 6.5)

Q4 (a) What is quality control? Describe control charts for $\bar{X}$ and σ and also derive the expressions for their limits. What are the advantages of σ - chart over R-chart.

(b) The past records of a factory using quality control methods show that on the average 4 articles produced are defective out of a batch of 100. What is the maximum number of defective articles likely to be encountered in the batch of 100, when the production process is in a state of control. (8,5)

P.T.O.

Q5:(a)Under the assumption that all rejected lots are completely inspected and all defective items discovered during inspection are replaced by good ones, describe a procedure to determine a single sampling plan which requires minimum inspection of a specified process average and which guarantees a specified AOQL.

(b) Obtain the expressions for ATI, ASN and OC functions under double sampling plan. Also discuss various approximations used to evaluate the OC functions. (8,5)

UNIT II

Q6: (a) Construct the difference table for the sequence of values

$f(x) = (0,0,0,\epsilon,0,0,0)$, where ϵ is an error.

Also show that the error spreads and increases in magnitude as the order of differences is increased. The errors in each column have binomial coefficients.

(b) Define Iteration methods. Prove Gauss-Seidel Iteration Method. (7,6)

Q7:(a) Prove that Newton – Gregory formula is a particular case of Newton's divided difference formula.

(b)Prove that the third divided difference with arguments a,b,c,d of the function 1/x is equal to -1/abcd, and hence show in general that

$$f(x_1, x_2, \dots, x_{p+1}) = \frac{(-1)^p}{x_1 x_2 \dots x_p x_{p+1}}$$ (6, 7)

Q8:(a) What is the difference between simplex solution procedure for maximization and minimization problem? Using the concept of net contribution, explain why the criterion for optimality for maximization problem is different from minimization problem.

(b)Consider the problem:

Minimize $Z = x_2 - 3x_3 + 2x_5$

subject to $x_1 + 3x_2 - x_3 + 2x_5 = 7$

$-2x_2 + 4x_3 + x_4 = 12$

$-4x_2 + 3x_3 + 8x_5 + x_6 = 10$

$x_1, x_2, x_3, x_4, x_5, x_6 \geq 0$

Convert it into a maximization problem and solve by using simplex method. (7,6)

Q9:(a) Describe a general transportation problem. Explain how to determine an initial basic feasible solution to the problem using Vogel's method.

(b)Find the initial basic feasible solution to the following transportation problem using north – west corner rule.

	1	2	3	4	5	Available
A	4	3	1	2	6	80
B	5	2	3	4	5	60
C	3	5	6	3	2	40
D	2	4	4	5	3	20
Required	60	60	30	40	10	200 Total

(6,7)

x-x-x