(DMSTT 21)

M.Sc. (Final) Final Year DEGREE EXAMINATION, DEC. - 2012

Statistics

Paper - I : STATISTICAL QUALITY CONTROL

Time : 03 Hours **Maximum Marks : 100**

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*Answer any **Five** questions*

***All** questions carry equal marks*

1) a) What do you understand by statistical quality control? Discuss its need and utility in industry. Discuss the causes of variation in quality.

b) Examine the justification for using in the control charts, the three sigma limits without paying regard to the actual distribution of the quality characteristic. Define O.C. function and explain its use.

2) a) What is median control chart? Discuss its role with reference to specification, production and inspection. Comment on the statement that even if the sample points are with in control limits, the chart may indicate a tendency for lack of control.

b) Define average run length. Discuss its merits and demerits. Give any four situations where individual measurements arise for process monitoring.

3) a) Explain natural tolerance limits and specification limits. How do you decide whether a process needs adjustment or not based on these limits?

b) The following number of defects were found on articles being produced when inspected eight times in a day on three days :
2, 4, 7, 3, 1, 4, 8, 9; 3, 5, 7, 11, 6, 4, 9, 9; 6, 4, 3, 9, 7, 4, 7, 12

Draw a suitable control chart and comment on your findings. If the times of inspection on the first day were 0800, 0905, 1010, 100, 1230, 1335, 1420 and 1530 hours respectively. Comment on the irregularity of inspection spacing.

4) a) Explain the statistical basis and construction of p and np charts. How is the choice between p and np charts made? Given that the process fraction defective is 0.02 and n is 25, calculate the control limits for p and np charts.

b) A company manufactures four models of radius and receives quite a few complaints from customers. In order to improve the quality of radius, the management decides to use control chart technique for the defects observed at the final testing. The number

of radius manufactured daily is not constant. Suggest a procedure to set up control chart or charts for controlling the defects giving clearly the assumptions made and the statistical concepts used.

5) a) Discuss V - mask procedure. Why it is not the best representation of CUSUM.

b) Discuss the analysis of mean for one-factor and two factors.

6) a) Explain ANOM for X and P charts and their use.

b) Explain :

i) V - mask procedure and ii) E WMA with suitable examples

7) a) What do you understand by acceptance sampling procedure? State its uses giving illustrations. Explain the principles and the procedures of

i) Lot quality protection and ii) Average quality protection.
assured to consumers by sampling inspection plans.

b) Describe the method of double sampling plan and derive its O.C, A.O.Q, ASN and ATI.

8) a) For lot of size N = 2000, the following single sampling is being used for major defects n = 225, c = 14. It is designed to use for minor defects, a single sampling plan having the same sample size and an AOQL as close to 4% defective as possible but not greater than 4%. What sampling plan should be used and what is the actual A.O.Q.L. of the plan chosen?

b) Discuss the MIL STD 105 E acceptance sampling system.

9) a) Explain the role of continuous sampling plans with suitable examples.

b) Explain the variable sampling plans with a specified OC curve with suitable examples.

10) a) Explain chain sampling and skiplot sampling plans and give two applications each.

b) What is total quality management? Discuss the techniques for total quality management. Explain the basis of six sigma.

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Total No. of Questions : 10] **[Total No. of Pages : 02**

M.Sc. (Final) DEGREE EXAMINATION, DEC. - 2012
Final Year
STATISTICS
(Paper - II) : OPERATIONS RESEARCH

Time : 03 Hours **Maximum Marks : 100**

*Answer any **Five** questions*
All questions carry equal marks

Q1) a) Define the general linear programming problem. Explain the two-phase method.

b) Solve the following L.P.P :

Maximize $z = 2x_1 + x_2 + 3x_3$

Subject to $x_1 + x_2 + 2x_3 \leq 5$

$2x_1 + 3x_2 + 4x_3 = 12$

$x_1, x_2, x_3 \geq 0.$

Q2) a) Explain Big-M method.

b) Use dual simplex method to solve :

Minimize $z = x_1 + x_2$

Subject to $2x_1 + x_2 \geq 2$

$-x_1 - x_2 \geq 1$

$x_1, x_2 \geq 0$

Q3) a) What are inventories? When do we have them? What are the objectives that should be fulfilled by an inventory control system? Explain in detail what constitutes the ordering cost and carrying cost.

b) Explain the problem of replacement of items whose maintenance costs increase with time; and the value of money also changes with time.

Q4) a) Explain the i) individual replacement and ii) group replacement policies.

b) Explain the problem of EOQ with finite rate of replenishment.

Q5) a) Explain i) pure and mixed strategies ii) maxmin and minmax principle and iii) dominance property.

For any 2 × 2 two - person - zero sum game without any saddle point derive the optimum mixed strategies and find the value of the game.

b) Use algebraic method to solve the following game :

$$\begin{pmatrix} 3 & -2 & 4 \\ -1 & 4 & 2 \\ 2 & 2 & 6 \end{pmatrix}$$

Q6) a) Explain the graphical method of solving 2 × n and m × 2 games.

b) Solve the following game for the player B by simplex method :

$$\begin{array}{cc} & \begin{matrix} B \\ 1 \quad 2 \quad 3 \end{matrix} \\ \begin{matrix} A \\ 1 \\ 2 \\ 3 \end{matrix} & \begin{pmatrix} 3 & -1 & -3 \\ -3 & 3 & -1 \\ -4 & -3 & 3 \end{pmatrix} \end{array}$$

Q7) a) Explain the 'queueing system'. What are its characteristics? Show that the number of arrivals to a system in time t has poisson distribution.

b) Explain $M|E_k|1$ system. Derive the steady state solution of the system. Find the expected number of phases in the system.

Q8) a) Obtain the steady state solution of M|M|1 system with infinite capacity obtain the waiting time distribution for the model.

b) Explain M|G|1 system. Derive the Pollaczeck - Khinchine formula.

Q9) a) Distinguish between CPM and PERT. Explain total and free floats. Summarise the rules for drawing network diagrams.

b) A small project is composed of the following activities and the time estimates :

Activity :	1 - 2	2 - 3	2 - 4	3 - 4	4 - 5	5 - 6
Optimistic :	0.7	3.8	5.2	2.1	0.7	0.7
Most likely :	1.0	5.6	7.6	2.7	3.4	1.0
Pessimistic :	1.3	9.8	12.4	6.1	3.7	1.3

What is the probability that the project will be completed two weeks earlier than expected?

Q10) a) Explain the basic steps in PERT/CPM techniques. Explain the time calculations in networks.

b) A project has the following details :

		Activity time (in weeks)		
Activity	Predecessor	Optimistic	Most likely	pessimistic
A	-	1	3	5
B	-	2	4	6
C	A	3	5	7
D	A	5	6	7
E	C	5	7	9
F	D	6	8	10
G	B	7	9	11
H	E, F, G	2	3	4

i) Construct PERT network diagram and compute the expected completion time.

ii) Calculate total and free floats for each of the non-critical activities.

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Statistics

Paper - III : ECONOMETRICS

Time : 03 Hours **Maximum Marks : 100**

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*Answer any **Five** questions*

***All** questions carry equal marks*

1) a) Explain in detail the simple linear model. Obtain the least square estimators of the parameters involved in the model.

b) Explain log-linear and semi-log models. Give their applications. Discuss the estimation of these models.

2) a) State and prove the properties of least square estimators.

b) Explain 'testing the significance of X' in the simple linear model.

3) a) Explain in detail the general linear model. Discuss the problem of prediction when the explanatory variables are uncertain.

b) Obtain the estimator of the variance of the disturbance term in the general linear model.

4) a) State and prove Gauss-Markov theorem.

b) Develop the test procedure for testing the significance of a subset of parameters in the general linear model.

5) a) Explain the method of estimation subject to linear restrictions. Explain the chow test.

b) Explain MWD test.

6) a) What are dummy variables? Explain their use in seasonal adjustment procedures.

b) What is meant by structural change? Explain the tests of structural change with a K-variable model.

7) a) What is the problem of heteroscedasticity? What are its consequences? Describe Bartlet's test.

b) Explain the types of multocollinearity. What are its implications for estimation of regression coefficients of the independent variable?

8) a) Explain Aitken's model and obtain the BLUE of the parameters. Also explain the suitable transformation to obtain the Gauss-Markov model from Aitken's model.

b) Discuss the sources of non-spherical disturbances. Describe Goldfeld-quandt test.

9) a) What is meant by autocorrelation? What are its consequences? Discuss Coehran-Orcutt procedure.

b) Explain probit model. Discuss a method of estimating it.

10) a) Define auto-correlation. Out line the estimation procedure if the disturbances of the linear model follow ARCD process.

b) Explain logit model. Explain a method of estimating it. Give the applications of the logit model.

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STATISTICS

Paper - IV : MULTIVARIATE ANALYSIS

Time : 03 Hours **Maximum Marks : 100**

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*Answer any **Five** questions*

All questions carry equal marks

1) a) Obtain the mean and variance of a linear combination of p-random variables.

b) Define multivariate normal distribution. Obtain the maximum likelihood estimators of the mean vector and the covariance matrix.

2) a) Derive the sampling distributions of the sample mean vector and the covariance matrix.

b) Show that several linear combinations of a multivariate normal vector X are normally distributed.

3) a) Explain the test for the significance of the mean vector of a multivariable normal distribution.

b) Explain MANOVA for one way classification.

4) a) Establish the relation between Hotelling's T_2 and Wilk's lambda.

b) Develop a test statistic for testing the difference between two mean vectors from multivariate populations.

5) a) What are principal components? Prove that principal components are uncorrelated and have variances equal to the eigen values of the variance covariance matrix.

b) Explain the orthogonal factor model. Explain the principal component method.

6) a) Explain the principal component analysis. In the usual notation determine the proportion of total variance due to the K_{th} principal component.

b) What is factor analysis? What is its purpose? Explain the factor model. What are communalities? Explain varimax criterion.

7) a) What are the goals of discriminant analysis. Explain Fisher's discriminant function for separation of two populations.

b) Discuss the optimal rules for classification with several populations.

8) a) Explain in detail Fisher's linear discriminant function.

b) What are linear discriminant scores? Explain Fisher's method for discriminating among several populations.

9) a) What is cluster analysis? What are its objectives? Explain the similarity measures and association measures and their use.

b) Explain

i) Single linkage and ii) K-means method

10) a) Explain cluster analysis and give its applications. Explain the common similarity coefficients for clustering items.

b) Explain the hierarchical clustering methods.