

(DMSTT 21)

M.Sc. DEGREE EXAMINATION, DECEMBER 2019.
Second Year
Statistics

STATISTICAL QUALITY CONTROL

Time : Three hours

Maximum : 70 marks

Answer any FIVE questions.

All questions carry equal marks.

1. (a) What do you understand by statistical quality control? Discuss briefly its need and utility in industry. Discuss the causes of variation in quality.
(b) Explain control charts for variables, write the LCL, UCL for \bar{X} , \bar{R} -charts.
2. (a) Explain the construction of a control chart for \bar{X} when
 - (i) the standards for μ and σ are specified as μ' and σ' respectively and
 - (ii) the standards are not specified.
(b) Explain about mid range control chart and standard deviation chart.
3. (a) Derive ARL of a CUSUM chart.
(b) Explain tolerance limits and specification limits.
4. (a) What are attributes? Explain control chart for fraction defective (p-chart).
(b) Write the procedure of c-chart with fixed and varying sample sizes.

5. (a) What is the concept of AQL and LPTD? Explain.
(b) Discuss the analysis of mean for variable data for two factor analysis.
 6. (a) Discuss about the design of single and double sampling plans.
(b) Discuss the ANOM for \bar{X} -chart and P-Chart.
 7. (a) Explain about the designing a single sampling with a specified OC curve.
(b) Discuss the method of sequential sampling plans for attributes.
 8. (a) Explain about the elements of AOQL.
(b) Write procedure of Dodge and Roaming plans.
 9. (a) Discuss about the accepting sampling by variables and also merits and demerits.
(b) Explain about the notion of a sequential sampling plan by variables.
 10. (a) Discuss about chain sampling and continuous sampling.
(b) Explain the role of CSP-2 and CSP-3.
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(DMSTT 22)

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Statistics

OPERATIONS RESEARCH

Time : Three hours

Maximum : 70 marks

Answer any FIVE questions

All questions carry equal marks

1. (a) Define general LPP. Prove that LPP has a feasible solution then it also has a basic feasible solution.
(b) What are artificial variables? Why do we need them? Explain the Big-M method of solving on LPP.
2. (a) What is meant by dual problem? Show that dual of a dual is minimal
(b) Determine the dual and solve the following LPP
Maximize $(z) = 4x_1 + 2x_2$;
Subject to the conditions:
 $x_1 - 2x_2 \geq 2$;
 $x_1 + 2x_2 = 8$;
 $x_1 - x_2 \leq 10$;
 $x_1, x_2 \geq 0$
3. (a) What are inventories? Why do we have them? Explain clearly the different costs that are involved in inventory problems with suitable examples.

- (b) Annual demand for an item is 500 units, ordering cost is Rs.18 per order. Inventory carrying cost is Rs.15 per unit per year, relationship between price and quantity ordered is as follows

Quantity ordered	1 to 15	16 to 149	150 to 549	550 & over
Price per unit (Rs)	10	9	8.75	8.50

Specify optimal order quantity and the corresponding price of this item.

4. (a) Discuss in brief the replacement procedure for items that deteriorate with line.
 (b) Define the terms safety stock and EOQ with help of ideal inventory model.
5. (a) Solve the game graphically:

	Player A	Player B	
		B ₁	B ₂
A ₁		1	2
A ₂		4	5
A ₃		9	-7
A ₄		-3	-4
A ₅		2	1

- (b) Explain various quantitative methods which are useful for decision-making under uncertainty.

6. (a) Solve the following game by linear programming approach

$$\begin{array}{c} \text{Player B} \\ \left(\begin{array}{ccc} 9 & 1 & 4 \\ 0 & 6 & 3 \\ 5 & 2 & 8 \end{array} \right) \\ \text{Player A} \end{array}$$

- (b) Explain difference between pure strategy and mixed strategy.
7. (a) Explain M|M|1 queuing system. Derive the steady state solution for the system. Obtain an expression for the system length.
 (b) Derive the Pollazek-Kinchine formula for the M|G|1 model.
8. (a) Explain the important characteristics of queuing system.
 (b) If for a period of 2 hours in a day (8-10 AM) trains arrive at the yard every 20 minutes but the service time continuous to remaining 36 minutes, then calculate for this period
 (i) The probability that the yard is empty
 (ii) Average system length
 On the assumption that the line capacity of the yard limited to 4 trains only.
9. (a) Explain about the project management by PERT and CPM.
 (b) Considering the following data for the activities of a project.
- | | | | | | | |
|-----------------------|---|---|---|-----|---|---|
| Activity | A | B | C | D | E | F |
| Predecessor | – | A | A | B,C | – | E |
| Duration
(in days) | 2 | 3 | 4 | 6 | 2 | 8 |
- Draw the network and find critical path and project duration.
10. (a) Explain the uses of CPM/PERT.
 (b) The following table gives activities of duration of a construction project work.

Activity	1-2	1-3	2-3	2-4	3-4	4-5
Duration	20	25	10	12	6	10

- (i) Draw the network for the project
 - (ii) Find the critical path.
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ECONOMETRICS

Time: Three hours

Maximum: 70 marks

Answer any FIVE questions.

All questions carry equal marks

1. (a) Explain the simple regression analysis in detail.
(b) Obtain the least square estimator of A in the simple linear model $Y = AX + B$ and show that the least square estimator is BLUE.
2. (a) Write the procedure of log linear regression model.
(b) Explain the properties of the least square estimators.
3. (a) State and prove Gauss Markov theorem.
(b) Explain the classical general linear model and assumptions of the model.
4. (a) Discuss about the properties of OLS estimators.
(b) What is the multiple correlation coefficient (R)? Explain its role in regression model.
5. (a) Explain the role of dummy variables in regression models.

- (b) Explain in detail about the chow-list.
- 6. (a) Discuss about the testing for structural or parameter stability of regression models.
(b) Explain MWD test for choosing between linear and log-normal models.
- 7. (a) Describe an estimation method of GLM under heteroscedasticity error terms.
(b) What are the assumptions of generalized least squares method?
- 8. (a) Explain the nature, sources and consequences of heteroscedasticity.
(b) Define log linear regression model and explain their applications along with suitable examples.
- 9. (a) Explain Durbin-Watson test for detection of auto-correlation in a regression model and discuss the limitations of the test.
(b) Explain qualitative response regression model.
- 10. (a) Explain about the nature and LPM. Explain its features.
(b) Explain about LOGIT Model in detail.

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MULTIVARIATE ANALYSIS

Time : Three hours

Maximum : 70 marks

Answer any FIVE questions.

Answer the following questions.

1. (a) What is the concept of multivariate analysis? Explain.
(b) Obtain maximum likelihood estimators of mean vector in a p -variate normal.
2. (a) Explain sampling distribution of sample mean and sample covariance matrix.
(b) Explain in detail stochastic independence of random vectors.
3. (a) Derive the null distribution of T^2 .
(b) Explain application of T^2 statistic in tests of mean vector for one or more multivariate normal populations.
4. (a) Explain the procedure of MANOVA for one way classification.
(b) Explain the likelihood ratio principle.
5. (a) What is the concept of principle components analysis? Explain.

- (b) What is factor analysis? Explain.
- 6. (a) Discuss about the computation of principle components.
(b) What is the purpose of factor rotation? Explain orthogonal factor rotation and oblique factor rotation.
- 7. (a) Explain the concept of discriminant analysis.
(b) Discuss the Fisher's method for classification into one of several problems.
- 8. (a) Discuss the problem of classification with several multivariate normal population.
(b) Explain Fisher's discriminate function in detail.
- 9. (a) Explain the concept of cluster analysis and similarity measures.
(b) Discuss about the hierarchical clustering method of single linkage.
- 10. (a) Explain the difference between hierarchical and non-hierarchical methods of clustering. Explain K -means method.
(b) Explain the average linkage in detail.
