

## Semester-V

### PAPER NO-11: STATISTICAL INFERENCE-I (ESTIMATION)

1. Introduction to Estimation Theory
  - 1.1 Parametric space, sample space and point estimation
  - 1.2 Requirement of good estimator
  - 1.3 Unbiasedness
2. Consistency
  - 2.1 Invariance property of consistent estimator
  - 2.2 Sufficient condition for consistency
3. Efficiency
  - 3.1 Minimum variance unbiased estimator (MVU)
  - 3.2 Theorems based on MVU estimators
4. Cramer-Rao (C-R) inequality
  - 4.1 MVB estimator
  - 4.2 Condition for equality in C-R inequality
  - 4.3 Problems based on MVB estimator
5. Sufficiency
  - 5.1 Fisher-Neyman criterion
  - 5.2 Factorization theorem
  - 5.3 Distributions admitting sufficient statistic
  - 5.4 Rao-Blackwell theorem
  - 5.5 Completeness and Lehman-Scheffe theorem
6. Methods of Estimation
  - 6.1 MLE and its properties
  - 6.2 Method of moments
  - 6.3 Method of minimum chi-square
  - 6.4 Method of least-squares
7. Interval estimation
  - 7.1 Confidence interval for the parameters of various distributions
  - 7.2 Confidence interval for Binomial proportion
  - 7.3 Confidence interval for population correlation coefficient for Bivariate Normal distribution
  - 7.4 Pivotal quantity method of constructing confidence interval
  - 7.5 Large sample confidence intervals

### WEEK-WISE DETAILS

#### Week 1: Introduction to estimation theory

- Goon, A.M., Gupta, M.K. and Dasgupta, B (2005): *An Outline Of statistical Theory, Volume II*. 3<sup>rd</sup> Edition, World Press. pp. 41-49.
- Devore, J.L. and Berk, K. N. (2007): *Modern Mathematical Statistics with Applications*, Duxbury, Thomson Press. pp.326-334

#### Week 2: Consistency

- Goon, A.M., Gupta, M.K. and Dasgupta, B (2005): *An Outline Of statistical Theory, Volume II*. 3<sup>rd</sup> Edition, World Press. pp. 82-87
- Panik, M. J. (2005): *Advanced statistics from an elementary point of view*, Academic Press, N.Y. pp. 410-416

- Mukhopadhyay, N. (2000): *Probability and statistical inference*, Marcel Dekker, Inc. pp. 380-381

### **Week 3: Efficiency**

- Goon, A.M., Gupta, M.K. and Dasgupta, B. (2005): *An Outline Of statistical Theory, Volume II*. 3<sup>rd</sup> Edition, World Press. pp. 47-51
- Panik, M.J. (2005): *Advanced Statistics from elementary point of View*, Elsevier Academic Press. pp. 383-394

### **Week 4-5: Cramer-Rao (C-R) inequality**

- Goon, A.M., Gupta, M.K. and Dasgupta, B. (2005): *An Outline Of statistical Theory, Volume II*. 3<sup>rd</sup> Edition, World Press. pp. 51-67.
- Mukhopadhyay, N. (2000): *Probability and statistical inference*, Marcel Dekker, Inc. pp. 365-371

### **Week 6-7: Sufficiency**

- Gun, A.M., Gupta, M.K. and Dasgupta, B. (2005): *An Outline Of statistical Theory, Volume II*. 3<sup>rd</sup> Edition, World Press. pp. 9-25, 78-82, 26-34
- Mukhopadhyay, N. (2000): *Probability and statistical inference*, Marcel Dekker, Inc. pp. 281-309

### **Week 8-10: Methods of estimation**

- Gun, A.M., Gupta, M.K. and Dasgupta, B. (2005): *An Outline Of statistical Theory, Volume II*. 3<sup>rd</sup> Edition, pp. 102-141.
- Panik, M.J. (2005): *Advanced Statistics from elementary point of View*, Elsevier Academic Press. pp. 419-438

### **Week 10-12: Interval estimation**

- Gun, A.M., Gupta, M.K. and Dasgupta, B. (2005): *An Outline Of statistical Theory, Volume II*. 3<sup>rd</sup> Edition, pp. 382-395.
- Mukhopadhyay, N.(2000): *Probability and statistical inference*, Marcel Dekker, Inc. pp. 441-469
- Panik, M.J. (2005): *Advanced Statistics from elementary point of View*, Elsevier Academic Press. pp. 439-473

## **Practical/ Lab work**

### **LIST OF PRACTICALS**

1. Unbiased estimators ( including unbiased but absurd estimators)
2. Consistent estimators
3. Efficient estimators and relative efficiency of estimators.
4. Cramer-Rao inequality and MVB estimators
5. Sufficient Estimators – Factorization Theorem
6. Rao-Blackwell theorem
7. Complete Sufficient estimators
8. Lehman-Scheffe theorem and UMVUE
9. Maximum Likelihood Estimation
10. Invariance property of MLE
11. Consistency of MLE

12. Asymptotic distribution of maximum likelihood estimators
13. Estimation by the method of moments
14. Estimation by the method of minimum Chi-square
15. Confidence interval for the parameters of various distributions
16. Confidence interval for Binomial proportion
17. Confidence interval for the difference of proportions
18. Confidence interval for difference of population means
19. Confidence interval for ratio of variances
20. Confidence interval for population correlation coefficient for Bivariate Normal distribution
21. Confidence interval for large samples