ST. JOSEPH'S COLLEGE (AUTONOMOUS), BENGALURU-27
M. Sc. Statistics - IV SEMESTER
SEMESTER EXAMINATION: JULY 2022
STDE 0420: Survival Analysis

Time- 2 ½ hrs   Max Marks-70

This question paper contains **TWO** printed pages and **TWO** parts

Part A

Answer any 06 questions   **(3*6=18)**

1. Define hazard function and Survival function.
2. Write about IFR and DFR family of distributions.
3. Distinguish between type I censoring and type II censoring.
4. Describe the construction of a likelihood function for the right censoring samples from a continuous distribution.
5. Discuss standard life table.
6. Explain actuarial method to estimate the survival function.
7. Compute Kaplan-Meier estimator for the following data using redistribution to the right algorithm: 6, 8, 13+, 18, 23, 28+, 31, 33+, 34, 45+.
8. Write a note on accelerated failure time model.

Part B

Answer any 04 questions   **(13*4= 52)**

9. a) Check whether Gamma distribution is increasing failure rate or decreasing failure rate distribution?
   b) Briefly outline
      i) likelihood ratio test, ii) Wald's test and iii) Rao's score test. Discuss the difference in these tests.   (5+8)

10. a) Explain type II censoring with an example. Derive maximum likelihood estimator of the survivor function of the exponential distribution with mean θ under type II censoring. Also find 100(1-α) % confidence interval for θ.

    b) Describe random censoring with an example.   (8+5)

11. a) Define Kaplain-Meier(KM) estimator. Show that KM estimator is generalized Maximum likelihood estimator.

    b) Derive Greenwood's formula for variance of the Actuarial estimator.   (8+5)

12. a) State the important properties of Kaplan-Meier (K-M) estimator of s(t). Also establish self-consistency property of K-M estimator.

   b) Define Nelson-Aalen estimator. (8+5)

13. a) Define Cox proportional hazards (PH) model stating the assumptions. Explain the method of partial likelihood for the estimation of regression parameter. State important properties of the estimator.

   b) Show that Cox PH model constitutes Lehmann family of alternatives. (9+4)

14. a) Describe Competing Risk model. Discuss the nonparametric estimation cumulative incidence function.

   b) For the log linear model in the exponential regression, derive maximum likelihood equations for the estimation of the regression parameters.

   (6+7)