This question paper contains 4+1 printed pages]

Roll No. | | | | | | | | | | |

S. No. of Question Paper : 1169

Unique Paper Code : 237604 G

Name of the Paper : Bio-Statistics

Name of the Course : B.Sc. (Hons.) Statistics

Semester : VI

Duration : 3 Hours Maximum Marks : 75

(Write your Roll No. on the top immediately on receipt of this question paper.)

Attempt *five* questions in all,

selecting *two* from Sections B and C each

Section A is compulsory.

Use of simple calculator is allowed.

Section A

1. (*a*) Define death density function, survival function and hazard function when survival time follows lognormal distribution. Find mean survival time and variation in survival time.

P.T.O.

(*b*) Consider the following two Weibull distributions space as survival models :

(*i*) Scale parameter = 1, shape parameter = 0.5

(*ii*) Scale parameter = 0.5, shape parameter = 2

For each distribution, find :

(1) The mean and variance

(2) Nature of hazard function.

(*c*) For the following survival data, compute estimated survival function, probability density function and hazard function :

Year of follow-up	Number Alive at the Beginning of interval	Number Dying in the interval
0—1	2000	440
1—2	1560	260
2—3	1300	150
3—4	1150	100
4—5	1050	90
5—6	960	80

7,4,4

Section B

2. (*a*) Define type-II random censoring. Under this censoring scheme estimate mean survival time assuming that the survival time follows exponential distribution.

(*b*) Estimate crude probability of death when the joint distribution of d_{i1}, d_{i2}, d_{i3} ....., d_{ik} and l_{i+1} given l_i follows multinomial. Also find $E(Q_{i\delta})$, $Var(Q_{i\delta})$, $Cov(Q_{i\delta}, Q_{i\varepsilon})$ $(\delta \neq \varepsilon)$. 7,8

3. (*a*) Define crude and net probability (type-A and type-B) of death. Stating assumptions, establish the inter-relationship between them.

(*b*) Suppose that two risks R_δ and R_ε $(\delta \neq \varepsilon)$ are operating in the population such that $Q_{i\delta} > Q_{i\varepsilon}$. Show that $q_{i\delta} > q_{i\varepsilon}$. 10,5

4. (*a*) Explain all the phases of clinical drug trials.

(*b*) What is duration of an epidemic ? Obtain mean duration of an epidemic under simple stochastic epidemic model. 9,6

Section C

5. (*a*) Explain life table method to estimate the survival function, also compute the variance of the estimate for survival function.

(*b*) Define partially crude probability of death and show that :

$$Q_{i\delta \cdot \varepsilon} = Q_{i\delta}\left[1 - p_i^{1 - Q_{i\varepsilon}/q_i}\right] \Big/ \left(q_i - Q_{i\varepsilon}\right).$$ 9,6

6. (*a*) Consider the following tumor free time (in days) of 10 rats on a low fat diet. Calculate Kaplan Meier estimate of S(*t*) for all the rats and S.E. of S(*t*) at $t = 84$.

Rat No.	Tumor Free time
4	50
6	56
1	65
7	66
8	73
5	77

3	84
9	86
2	87
10	119

(*b*) If $\lambda_1, \lambda_2, \lambda_3, \ldots\ldots, \lambda_k$ are the death intensities corresponding to risks $R_1, R_2, R_3, \ldots\ldots, R_k$ respectively then the probability of dying due to risk $R_i (i = 1, 2, \ldots\ldots, k)$ is (λ_i/λ), where $\lambda = \sum_i^k \lambda i$. 9,6

7. (*a*) Define survival function, death density function and hazard function. Find :

(*i*) S(*t*) and $f(t)$ when $h(t) = c$

(*ii*) S(*t*) and $h(t)$ when $f(t) = ae^{-t}$.

(*b*) Find death density function when competing risks are dependent. Also obtain the death density function for a bivariate dependent risk model when $\rho\sigma_1 = \sigma_2$. 5,10