(c) General Epidemic model,

(d) Single and triple blinding,

(e) Net Probability of death. (3×5)

[This question paper contains 8 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 3092 **H**

Unique Paper Code : 32377910

Name of the Paper : Survival Analysis and Bio-Statistics (DSE-3(b))

Name of the Course : **B.Sc. (Hons) Statistics under CBCS (LOCF)**

Semester : VI

Duration : 3 Hours Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt **five** questions in all.
3. **Section A** is compulsory. Attempt **four** questions from **Section B**.
4. **All** questions carry equal marks.
5. Use of a non-programmable scientific calculator is allowed.

SECTION A

1. Answer each of the following :

(a) Given the hazard function $\lambda_0 + \lambda_1 t + \lambda_1 t^2$, compute the survival and death-density functions.

(b) Suppose that survival time follows the Weibull distribution with scale parameter 1.0 and shape parameter 0.5. Find mean survival time, variance, and coefficient of variation.

(c) Explain the term clinical trials and give its purpose.

(d) Find the death density function due to risk R_i (i=1,2,...,k) when competing risks are dependent.

(e) Give the objective of Phase III of the clinical trial. Also, give its importance. (3×5)

(b) Suppose that in a study, the efficacy of two drugs A and B are compared; 14 patients with swine flu are given drug A and 15 patients with swine flu are given drug B. The experimenter (in both cases) decides to terminate the study after the recovery of 8 patients. The survival times (in days) are:

Drug A	8	9	10	11	14	18.5	20	22
Drug B	6	7	10	14	15	16	19	22

Assuming that times of remission follow exponential distribution, obtain and compare the mean survival time of drugs A and B and find the variance of the estimated mean survival time. (7,8)

7. Explain the following :

(a) Type-I and Type-II censoring

(b) Phase 2 of clinical drug trials and its importance

$$Q_{i\delta,\epsilon} = Q_{i\delta}(1-(p_i)^{[(q_i-Q_{i\epsilon})/q_i)]} \quad (\delta \neq \epsilon)$$

where notations have their usual meaning.

(7,8)

3. (a) Construct the segregation matrix for the gamete ab. Compute g_1, g_2, g_3 and g_4 for the third and tenth generation for $g_1 = 0.2$, $g_2 = 0.3$, $g_3 = 0.4$, $g_4 = 0.1$ and $\lambda = 0.35$.

(b) What is the duration of an epidemic? Obtain the expression for the r^{th} cumulant of the distribution of the duration of an epidemic under simple epidemic model, where initially there are n susceptible and one infective at t = 0. (7,8)

4. (a) Under the Simple Stochastic epidemic model, find the probability that there are (n – 3) number of susceptible at time t given that there are n (n > 3) number of susceptible and one infective at time t = 0.

(b) Define hazard function. The table given below gives the survival data of 30 patients with diabetes. The survival data are grouped into 5 months. Compute the estimated hazard function. Also, comment on the result for the last cell of the hazard function.

Months	Number of patients surviving at beginning of the interval	Number of patients dying in an interval
0-5	30	10
5-10	20	5
10-15	15	10
≥15	5	2

(9,6)

5. (a) Obtain an estimate of the net probability of death Type B using the maximum likelihood method of estimation.

(b) Consider the following remission times (in months) of 20 patients suffering from cardiovascular disease

4	5	6	7	8+	13	15	16	17	18
20+	25	22	26+	27	28+	35	32	33+	35+

Estimate the mean remission time and variance of the estimated mean remission time if remission times follow an exponential distribution. Find the probability of surviving at least 8 weeks, 20 weeks, and 36 weeks. (7,8)

6. (a) Explain the Kaplan Meier method for estimating survival function. Using this method, estimate the survival function and also compute the variance of the estimated survival function at each time.

SECTION B

2. (a) Define crude probability of death. Given below is the survival history of 400 patients suffering from cancer (R_1), cardiovascular (R_2), and lung ailment (R_3). Compute the crude probability of death due to (i) cancer and (ii) lung infection for the following data :

Age Interval	Number of patients alive at the beginning of the Interval	Number dying in the Interval	Number of deaths due to cancer	Number of deaths due to cardiovascular	Number of deaths due to lung ailment
30-40	400	80	12	14	9
40-50	320	70	8	9	6
50-60	250	55	15	7	5
60-70	195	35	7	4	6

(b) Define partially crude probability of death and prove that