

**W1-2-60-1-6**

**JOMO KENYATTA UNIVERSITY OF AGRICULTURE AND TECHNOLOGY**

**UNIVERSITY EXAMINATIONS 2014/2015**

**YEAR IV SEMESTER I EXAMINATION FOR DEGREE OF MASTER OF SCIENCE IN APPLIED STATISTICS**

**STA 3114: SURVIVAL AND CLINICAL DATA ANALYSIS**

**DATE:DECEMBER 2014 TIME: 3 HOURS**

**INSTRUCTIONS:** Answer question one and any other three.

QUESTION ONE (40 MARKS)

a. Briefly explain various types of censoring and the forms in which censoring can occur. (10 marks)

b. Show that the probability that an individual lives longer that t1+t2 years given he has attained t1 years is equal to the unconditional probability that he survives at least t2 years in and only if the survival distribution is of exponential form.

 (5 marks)

c. The data below give the times of remission (in weeks) of two groups of Leukaemia patient ?? to a treatment or a control group.

|  |  |
| --- | --- |
| 1 drug -6-MP | 6\*, 6,6,7,9\*, 10 10\*, 11\*, 13 |
|  | 16, 17\*, 19\*, 20\*,22, 23, 25\*, 32\* |
|  | 32\*, 34\*, 35\* |
|  | [\* indicates a censured value) |
|  |  |
| 2 control | 1, 1, 2, 2, 3, 4, 4, 5, 5, 8, 8, 8,  |
|  | 12, 15, 17, 11, 11, 12, 22, 23 |

Obtain the Kaplan Meier survivor function for the data (obtaining separate functions for control and drug patients. (12 marks)

d. The table below gives details of a proportional hazards model filtered to some data obtained patients being treats for kidney failure where survival time is in terms of time to relapse.

|  |  |  |  |
| --- | --- | --- | --- |
| Variable | Coefficient  | Standard error | X2 statistic (using LRT) |
| Treatment | -1.63 | 0.75 | 4.71 |
| 0= Treat A |  |  |  |
| 1= Treat B |  |  |  |
|  |  |  |  |
| Age (years) | -0.03 | 0.024 | 0.01 |
|  |  |  |  |
| Sex | 0.67 | 0.32 | 3.91 |
| 0 =female |  |  |  |
| 1=male |  |  |  |
|  |  |  |  |
| Obesity  | 0.0092 | 0.0045 | 4.4 |
| No |  |  |  |
| 1=yes |  |  |  |
|  |  |  |  |
| Duration of symptoms | -0.003 | 0.075 | 0.01 |
| Prior to treatment |  |  |  |
| (months) |  |  |  |

Describe the effects of treatment and additional covariables on time to relapse, giving point and interval estimates of hazards ratios where appropriate. (13 marks)

QUESTION TWO (20 MARKS)

Derive a clinical life table for the survive data of patients with angine?? as given below

|  |  |  |
| --- | --- | --- |
| Survival time (years) | Number of patients known | Number of patients lost  |
|  | To survive at beginning of  | To follow up |
|  | Interval. |  |
| 0-1 | 2418 | 0 |
| 1-2 | 1962 | 39 |
| 2-3 | 1697 | 22 |
| 3-4 | 1523 | 23 |
| 4-5 | 1329 | 24 |
| 5-6 | 1170 | 107 |
| 6-7 | 938 | 133 |
| 7-8 | 722 | 102 |
| 8-9 | 546 | 68 |
| 9-10 | 427 | 64 |
| 10-11 | 321 | 45 |
| 11-12 | 233 | 53 |
| 12-13 | 146 | 33 |
| 13-14 | 95 | 27 |
| 14-15 | 59 | 23 |
| 15-16 | 30 |  |

 (20 marks)

QUESTION THREE (20 MARKS)

In an accelerate life survival model for survivor function for an individual with covariate x satisfies s(t:x)=s0(t eBx)

where s0(t) is some baseline survivor function.

i. Show that the corresponding hazards function satisfied h(t:x)=eBu)

 where h0(t) is the baseline hazard function for s0(t) (5 marks)

ii. In a trial where n independent patients with covariate values x1 x2,.. xn enter at the same time, suppose that all death times are observed and that s0(t)=e- t(t>0). Show that the survival time T has an exponential term and is proportional hazard form. (5 marks)

iii. Show that the obstruction of the time to the first death in the trail is exponential with mean

 [ (5 marks)

iv. Show that the probability that the 5th patient is the first to die is given by

  (5 marks)

QUESTION FOUR (20 MARKS)

The table below gives some details of fitting a proportional hazards regression model to times to recurrence of a certain disease. The data were obtained during a randomized clinical trial of a new treatment. The factors investigated were treatment (coded by x1=0 for placebo xy=1 for treatment) stage of disease (coded by x2=0) for stage 1, x2=1 for stage II x2=2 for stage III) and the interaction between treatment any stage of disease (coded by x3 where X3=X1 x X2.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Variable  | Coefficient | Standard error |
| Treatment | X1 | -0.18 | 0.10 |
| Stage | X2 | +0.32 | 0.21 |
| interaction | X3 | -0.66 | 0.11 |

i. Specify the form of the proportional hazards model used for this analysis in terms of baseline hazard function h0 (t) and the covariates.

ii. Describe in detail the effects of those factors on the time to recurrence of the disease.

iii. Show diagrammatically the form of the relationship between the survivor functions and the stages of the disease for the two different treatment groups.

QUESTION FIVE (20 MARKS)

A clinical trial to evaluate the efficiency of maintained chemotherapy for acute myelogenous leukemia (AML0 was conducted. After reaching a state of remission through treatment by chemotherapy, the patient who entered the study were randomized into two groups. The first group received maintaainance chemotherapy. The second group or control group did not. The objective of the trial was to see if maintenance chemotherapy prolonged the time until relapse i.e for a preliminary during the course of the trial the date was as follows

maintained group

9,13,13+, 18, 23, 28+, 31, 34, 45+ 48, 16+

Non –maintained group

5, 5, 8, 8, 12, 16,+, 23, 27, 30, 33, 43, 45

a. For a maintained group compute the approximate standard error of 5(24)

 (5 marks)

b. For a non maintained group compute

 i.  (7 marks)

 ii.  (8 marks)