LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

M.Sc. DEGREE EXAMINATION – **STATISTICS**

FOURTHSEMESTER – APRIL 2018

16PST4MC03- BIOSTATISTICS AND SURVIVAL ANALYSIS

Date: 23-04-2018   Dept. No.   Max. : 100 Marks
Time: 01:00-04:00

Section – A

Answer all the questions   **10 X 2 = 20 marks**

1. Define the terms control and placebo used in medical research.

2. Differentiate between case control and cohort studies.

3. Write any two advantages of cross sectional studies.

4. Write the formula for absolute and relative risk reduction.

5. Provide the McNemar test statistic for comparing paired proportions.

6. Define survival time and give an`example.

7. Write the definition of survival and hazard function.

8. Define positive and negative predictive value.

9. Give the Cox proportional hazards model.

10. Define Wald statistic and likelihood ratio used in Cox PH model.

Section – B

Answer any five questions   **5 X 8 = 40 marks**

11. Explain meta analysis with an illustration.

12. A Biopsy `is conducted to decide whether a person has cancer or not. The following is the result of the experiment.

		Biopsy	
		Cancer	No Cancer
Actual	Disease present	15	9
	Disease absent	2	92

Find (i) Sensitivity and Specificity (ii) Positive and Negative predictive value

(iii) LR^+ and LR^-.

13. Explain Receiver Operating Characteristic Curve.

14. Explain Bartlett's test used for testing the equality of variances.

15. Explain Type II and progressively censoring of data with an example each.

16. Suppose the following remission times are observed from 10 patients with solid tumors

Six patients relapse at 3, 6.5 , 6.5, 10 , 12 and 15 months. One patient.is lost to follow up

at 8.4 monthsand three patients are still in remission at the end of the study after 4, 5.7and

10 months. Estimate the survival function using Kaplan-Meier and draw the curve.

17. If the survival time follows the Weibull distribution, find the survival function and draw the curves for $\lambda = 1$ and r = 0.5 , 1,2 and 4.

18. Explain the maximum likelihood estimation of parameters of a Cox PH model.

Section –C
Answer any two questions 2 X 20 = 40 marks

19.Explain the following:
   (i) Trials with independent concurrent control.
   (ii) Randomized and Non-randomized trials
   (iii) Trials with self control
   (iv) Trials with external control
   (v) Uncontrolled studies   (5 x 4 = 20 marks)

20. Survival times of two groups are given each with 25 participants. Draw Kaplan Meier curves
    for two groups .
    Group 1 : 12.3+   5.4   8.2   12.2+ 11.7   10   5.7   9.8   2.6   11   9.2
                1.1+   6.6   2.2   1.8   10.2   10.7   11.1   5.3   3.5   9.2   2.5
                8.7   3.8   3
    Group 2 : 5.8   2.9   8.4   8.3   9.1   4.2   4.1   1.8   3.1   11.4   2.4
                1.4   5..9   1.6   2.8   4..9   3.5   6.5   9.9   3.6   5.2   8.8
                7.8   4.7   3.9

21. The following are the body weights (grams) and total surface area(cm^2) of 9 laboratory
    animals:
    Body weight(X): 660.2   706.0   924.0   936.0   992.1   888.9   999.4   890.3   841.2
    Surface area(Y) : 781.7   888.7   1038.1 1040.0   1120.0 1071.5 1134.5 965.3   925.0
    Compute Theil's slope estimator and Diet'z two intercept estimators.

22.(a) Explain the graphical approach of log-log plots to check for the Cox PH assumption.
    (b) We consider the survival data for 137 patients from the Veteran' s Administration Lung
        Cancer Trial cited by Kalbfleisch and Prentice in their book (The Statistical Analysis of
        Survival Time Data,Wiley,1980) . The variables in this data set are listed as follows:
                                                                                .

Variable#	Variable name	Coding
1	Treatment	Standard= 1 ,test =2
2	Cell type 1	Large= 1,other = 0
3	Cell type 2	Adeno =1 ,other =0
4	Cell type 3	Small =1 , other = 0
5	Cell type 4	Squamous = 1, other = 0
6	Survival time	(Days) integer counts
7	performance status	0 = worst , …, 100 = best
8	Disease duration	(Months) integer counts
9	Age	(Years) integer counts
10	Prior Therapy	none = 0 , some = 10
11	Status	0 = censored , 1 = died

---For these
data, a Cox model was fitted yielding the following edited computer results:

Response: survival time

Variable name	Coef.	Std.Err.	p > |z|	Haz.Ratio	[95% Conf. .interval]	
1 Treatment	0.290	0.207	0.162	1.336	0.890	2.006
3 Adeno cell	0 789	0.303	0.009	2.200	1.216	3.982
4 Small cell	0.457	0.266	0.086	1.579	0.937	2.661
5 Squamous cell	-4.000	0.283	0.157	0.671	0.385	1.167
7 Perf.status	-0.033	0.006	0.000	0.968	0.958	0.978

8 Disease dur.	0.000	0.009	0.992	1.000	0.982	1.018
9 Age	-0.009	0.009	0.358	0.991	0.974	1.010
10 Prior therapy	0.007	0.023	0.755	1.007	0.962	1.054

Log likelihood   = -475.180

    (i)   State the Cox PH model used to obtain the above computer results.

    (ii)   Using the printout above , what is the hazard ratio that compares persons with adeno cell type

             with persons with large cell type? Explain your answer using the general hazard ratio formula for the Cox PH model.

    (iii)   Using the printout above , what is the hazard ratio that compares persons with adeno cell type with persons with squamous cell type? Explain your answer using the general hazard ratio formula for the Cox PH model.

    (iv)   Based on computer results , is there an effect of treatment on survival time? Explain briefly.

    (v)   Give an expression for the estimated survival curve for a person who was given the test treatment and who had a squamous cell type ,where the variables to be adjusted are performance status, disease duration, age and prior therapy.   **(10 + 10) marks.**