 LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

**M.Sc.** DEGREE EXAMINATION - **STATISTICS**

SECOND SEMESTER – **APRIL 2012**

# ST 2960 - BIO-STATISTICS

Date : 24-04-2012 Dept. No. Max. : 100 Marks

Time : 9:00 - 12:00

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| SECTION – A |

Answer ALL the questions (10 x 2 = 20 marks)

1. Mention the broad types of observational studies.

2. Explain the term ‘Concurrent Control’ in Clinical Trials.

3. State the need for adjusting rates.

4. Explain the term ‘Prevalence’ of a disease.

5. State the use of Kappa statistic and give its form.

6. Name the two tests used to test equality of means when the same group is measured twice.

7. Express ‘baseline category logit’ in terms of ‘adjacent-categories logits’.

8. Write the link equation for the ‘proportional odds cumulative logit model.

9. State the difference between Actuarial Analysis and Kaplan- Meier Method in survival data

Analysis.

10. Give the estimate for ‘Hazard Rate’ when survival distribution is exponential.

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| SECTION – B |

Answer any FIVE questions (5 x 8 = 40 marks)

11. Describe the different ‘Scales of Measurement’ with examples.

12. The following two-way table is obtained from an experiment conducted to study the effect of

a drug ‘A’ in reducing the risk of a disease:

|  |  |  |  |
| --- | --- | --- | --- |
| Outcome  Risk factor | **Disease** | **No Disease** | **Total** |
| **Drug ‘A’** | 71 | 5448 | 5519 |
| **Placebo** | 119 | 5395 | 5514 |
|  | 190 | 10843 | 11033 |

Compute Experimental Event Rate, Control Event Rate, Relative Risk and Absolute Risk

Reduction and interpret the results.

13. Investigators wished to know if there was a significantly higher Insulin sensitivity among

people with normal weight compared to overweight people. The following measurements on

insulin sensitivity were obtained from 11 normal-weight people and 8 overweight people:

**Normal-Weight subjects:** 0.97, 0.88, 0.66, 0.52, 0.38, 0.71, 0.46, 0.29, 0.68, 0.96, 0.97

**Overweight subjects:** 0.76, 0.44, 0.48, 0.39, 1.10, 0.19, 0.19, 0.19

Carry out Wilcoxon Rank Sum Test and draw your conclusions.

(Cont’d)

14. A medical initiative was started in a certain locality two years ago. Among 300 people in the

locality, 178 supported the initiative at the start of the program but at present the number of

people supporting it is 142. And among the original supporters only 96 continue their support

now while the remaining are opposing it. Form the contingency table to apply McNemar Test

and draw the appropriate conclusion.

15. Discuss the two approaches to compare proportions in two groups.

16. Apply the Levene Test to compare the variances of the two populations (of normal-weight

subjects and overweight subjects) based on the sample observations given in Q. No. (13).

17. Discuss the baseline category logit model for nominal multinomial response variable. Obtain

estimates for probabilities of membership of an individual to the various response categories.

18. For the data in Q.No. (22) apply the Actuarial Method to estimate the survival function for

patients under Therapy ‘B’, considering time-windows of 180 days.

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| SECTION – C |

Answer any TWO questions (2 x 20 = 40 marks)

19. Describe ‘Cohort Studies’, ‘Historical Cohort Studies’ and ‘Clinical Trials with Cross Over’.

Present schematic diagram for each of these designs.

20. (a) The following table gives the data on infant deaths observed in three regions over a time-

period:

. Region A Region B Region C .

. Birthweight Births Deaths Births Deaths Births Deaths

. (in 1000.s) (in 1000’s) (in 1000s) .

< 1500 g 30 1280 60 3605 40 5020

1500-2499 g 45 710 90 1780 70 1960

≥ 2500 g 225 1540 130 1155 110 1220 .

Total 300 3530 280 6540 220 8200 .

Find the ‘Crude Infant Mortality Rate’ for each region. Compute ‘Adjusted Infant Mortality

Rates’ by direct method for Regions B and C treating Region A as reference population.

Supposing that the Age-Group-Wise ‘Specific Infant Mortality Rates’ for B and C are not

available, find ‘Standardized Infant Mortality Ratios’ for these two regions again keeping

A as the reference population.

(b) Explain the Large Sample Sign Test. (12 + 8)

21. The condition of patients brought to the head-injury unit of a hospital are classified into

four categories:

1 – mild injury (not requiring hospitalization)

2 – moderate injury (requiring hospitalisation)

3 – severe injury (requiring intensive care)

4 – very severe injury (resulting in ‘coma’ state / death) (Cont’d)

A continuation-ratio logit model was built based on past data collected from the hospital

and the following logit equations were obtained:

Log = –0.004 + 0.058\*age – 0.003\*BP + 0.128\*DH – 0.573\*DR – 1.14\* D2w – 0.532\*DBlood

Log  = 0.009 + 0.074\*age – 0.014\*BP + 0.421\*DH – 0.718\*DR – 0.92\* D2W – 0.612\* DBlood

Log  = 0.022 + 0.082\*age – 0.037\*BP + 0.613\*DH – 0.838\*DR – 0.23\*D2W – 0.751\*DBlood

where DH indicates injury at home, DR indicates injury while walking on the road, D2W

indicates injury while riding two-wheeler and DBlood indicates the patient was bleeding. BP

is the systolic blood pressure measured at the time of being brought to hospital.

Estimate the probabilities for a 45 year old man, bleeding, with BP = 140 who was injured

while on two- wheeler to be classified into each of the four injured categories.

22. Patients with prostate carcinoma (tumour) are subject to two types of therapy (A and B). The

interest among investigators is on the ‘survival time’ of the patients. Data on 20 patients

observed for a maximum period of 5 years are given below:

|  |  |  |  |
| --- | --- | --- | --- |
| **Patient** | **Days in study** | **Therapy** | **Outcome** |
| Name  Name  Name  Name  Name  Name  Name  Name  Name  Name  Name  Name  Name  Name  Name  Name  Name  Name  Name  Name | 97  159  213  255  303  425  494  620  715  760  895  930  1007  1102  1163  1304  1413  1490  1595  1676 | A  B  A  A  B  B  B  A  B  A  B  A  B  B  A  A  A  A  A  A | Dead  Dead  Dead  Alive  Alive  Alive  Alive  Dead  Alive  Alive  Alive  Alive  Dead  Alive  Dead  Alive  Dead  Alive  Alive  Dead |

Apply the Logrank test to compare the survival distributions of patients under the two therapies.

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