



# LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

## M.Sc. DEGREE EXAMINATION - STATISTICS

SECOND SEMESTER – APRIL 2013

### ST 2960 - BIO-STATISTICS

Date : 07/05/2013  
Time : 9:00 - 12:00

Dept. No.

Max. : 100 Marks

#### SECTION – A

Answer ALL the questions

(10 x 2 = 20 marks)

1. What is a Case-Control' Study?
2. Explain 'Meta Analysis'.
3. Define 'Infant mortality rate'.
4. Define 'morbidity rates' and distinguish them from 'mortality rates'.
5. Define 'Relative Risk Reduction'.
6. What is a 'paired design'?
7. State the McNemar statistic for a 2 x 2 contingency table using appropriate notations.
8. State the purpose of Levene test and explain the procedure.
9. Write the link equation for the 'proportional odds cumulative logit model.
10. State the use of Actuarial Analysis.

#### SECTION – B

Answer any FIVE questions

(5 x 8 = 40 marks)

11. Explain the 'Direct Method' of adjusting rates.
12. The following two-way table is reported from an experiment carried out to study the effect of a drug 'A' in reducing the risk of a disease:

	Outcome		
Risk factor	Disease	No Disease	Total
Drug 'A'	36	2724	2760
Placebo	59	2698	2757
	95	5422	5517

Compute EER, CER, RR and ARR and interpret.

13. Explain 'non-normal numerical variables' and transformations for normality with figurative descriptions.
14. Schizophrenic patients in a psychiatric ward were studied regarding factors that can influence their views on others. Specifically, the feelings of the patients about the emotional support they receive from the staff of the ward is an important outcome. The investigators wanted to know whether exposure to comedy movies would modify the patients' assessment of staff support. At the onset of the study, seventeen patients were asked to mention the number of staff members who 'support' them emotionally. Then, for about three months, the patients were shown comedy movies and after that each of them were asked the same question. The data are summarized below:

Patient No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Before	2	0	0	0	2	3	3	3	0	2	1	1	0	0	3	0	0
After	2	0	3	1	5	2	2	10	0	4	1	4	0	0	4	1	4

Carry out the Wilcoxon signed-rank test and draw your conclusions.

15. Explain the z-test and the chi-square test for comparing proportions in two groups.
16. Depict the flow chart depicting the prediction rule in cumulative ratio logit models.
17. Describe 'Censoring' and 'Progressive Censoring' with figurative descriptions.
18. Obtain the Kaplan-Meier estimates of survival for the patients who did not stop dialysis, using the data in Q.No. (22).

**SECTION – C**

Answer any TWO questions  
marks)

(2 x 20 = 40

19. (a) Describe the different scales of measurement with examples.  
(b) Present a schematic tree on the different types of study designs in medical research.  
(8 + 12)
20. (a) Give the motivation for and the definition of 'Kappa' Statistic and mention the guidelines for its interpretation.  
(b) Fifteen persons were examined physically and their actual status 'Labrum Normal' (denoted as -) and 'Labral Tears' (denoted as +) were recorded. Then the MRIs of those 15 people were taken. Two radiologists who had no knowledge of the actual status of the subjects interpreted the MRIs independently. Their conclusions and the actual status of the persons are reported below:

S.No.	Actual	Radiologist A's finding	Radiologist B's Finding
1	+	+	+
2	+	+	+
3	+	-	+
4	+	-	+
5	+	+	+
6	+	+	-
7	+	-	+
8	+	-	+
9	+	-	-
10	-	-	-
11	-	-	-
12	-	-	+
13	-	-	+
14	-	+	-
15	-	+	-

Compute the 'Kappa' Statistic and interpret it.

(10 +10)

21. (a) Explain 'continuation-ratio logit' models.

(b) The responses of employees of a company on their feelings about the management of the company were categorized into four:

- 1 – Highly unhappy
- 2 – Dissatisfied
- 3 – Satisfied
- 4 – Very Happy

A continuation-ratio logit model was built and the logit equations obtained were:

$$\text{Log} \frac{P_1}{P_{234}} = -0.003 + 0.062 * \text{age} - 0.214 * \text{Salary} + 0.304 * D_M$$

$$\text{Log} \frac{P_2}{P_34} = 0.008 + 0.095 * \text{age} - 0.014 * \text{Salary} + 0.421 * D_M$$

$$\text{Log} \frac{P_3}{P_4} = 0.019 + 0.078 * \text{age} - 0.037 * \text{Salary} + 0.562 * D_M$$

where  $D_M$  indicates male employee and 'salary' is measured in thousand-rupee unit.

Estimate the probabilities for a 40 year old female employee drawing Rs. 15,000/- salary to belong to the four response categories. (8+12)

22. The following table summarizes the survival data on 25 dialysis patients. Carry out the Logrank test for comparing the survival curves of the group that continued dialysis and the group that stopped dialysis.

Patient	Days in study	Stopped dialysis	Outcome
1	632	No	Alive
2	619	No	Alive
3	1016	No	Alive
4	296	No	Alive
5	1059	No	Alive
6	828	No	Alive
7	357	No	Alive
8	1064	No	Alive
9	695	No	Alive
10	650	No	Alive
11	1022	No	Alive
12	166	No	Dead
13	643	No	Alive
14	1031	No	Dead
15	1097	No	Alive
16	228	No	Dead
17	497	No	Dead
18	346	No	Alive
19	969	Yes	Dead
20	576	Yes	Dead
21	860	Yes	Dead
22	158	Yes	Dead
23	174	Yes	Dead
24	76	Yes	Dead
25	63	Yes	Dead

\* \* \* \* \*