

**POST GRADUATE DIPLOMA IN
APPLIED STATISTICS (PGDAST)**

Term-End Examination

June, 2025

MSTE-004 : BIOSTATISTICS—II

Time : 3 Hours

Maximum Marks : 50

Note : (i) *Question No. 1 is compulsory.*

(ii) *Attempt any **four** questions from the remaining Question Nos. 2 to 7.*

(iii) *Use of scientific calculator (non-programmable) is allowed.*

(iv) *Use of Formulae and Statistical Tables Booklet for PGDAST is allowed.*

(v) *Symbols have their usual meanings.*

1. State whether the following statements are True or False. Give reasons in support of your answers : 5×2=10

(a) Both samples should be independent and random to apply McNemar's test.

- (b) For a regression model $Y = 2.5 + 0.15X$, 95% confidence interval for the slope is (0.0386, 0.2614) when $n = 12$ and $SE(\hat{\beta}_1) = 0.05$.
- (c) If full and null log-likelihood functions of a logistic model are -60 and -62.5 , the McFadden pseudo R^2 will be 0.04.
- (d) The log-rank test is applied to compare the hazard functions.
- (e) If relative risk for a clinical trial is 35%, the relative risk reduction will be 65%.
2. (a) The following data show the observations of two doctors who examined 350 patients :

Doctor I	Doctor II	Frequency
Y	Y	94
Y	Y	22
Y	N	7
Y	N	88
N	Y	37
N	Y	24
N	N	4
N	N	74

where Y represents presence and N represents absence of a disease. Calculate the value of Kappa statistics and its 95% confidence interval. 8

(b) Differentiate between the sensitivity and specificity of a diagnostic test. 2

3. The Systolic Blood Pressure (SBP), age (in years) and weight (in kgs) of 12 persons are given in the following table : 10

S. No.	SBP	Age	Weight
1	120	34	70
2	115	34	50
3	100	29	70
4	145	38	90
5	135	36	63
6	160	42	84
7	170	40	60
8	140	37	80
9	160	38	81
10	185	41	78
11	200	42	66
12	170	40	72

- (i) Fit the multiple regression model of SBP on age and weight.
- (ii) Compute the predicted values of SBP and residuals (r_i) for all the given observations.
- (iii) Verify that $\sum_{i=1}^{12} r_i = 0$.
4. For the following case-control study of lung cancer and smoking status, fit a logistic model :

	Lung Cancer (Case)	No. Lung Cancer (Control)
Smoker	452	215
Non-smoker	548	785
Total	1000	1000

Also obtain the log-odds and odds ratio with the fitted logistic model.

10

5. The survival data of a randomized controlled trial corresponding to two treatment groups are given as follows :

	Survival time (in months)
Treatment 1	3, 4, 4 ⁺ , 6, 7, 9, 9 ⁺ , 11, 12, 14, 16, 18, 18, 20 ⁺ , 20 ⁺
Treatment 2	5, 7, 8, 10 ⁺ , 12, 14, 14 ⁺ , 17, 19, 20, 20 ⁺ , 21, 22 ⁺

Test whether there is a significant difference between the survival times of both treatments at 5% level of significance. 10

6. (a) Describe survival function with example. 5
- (b) Differentiate between Chi-square test and McNemar's test. 5
7. (a) Differentiate between coefficient of determination and adjusted coefficient of determination. 5
- (b) Explain the following in brief : 5
- (i) Probit model
- (ii) Complementary log-log model

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