[2 14]   SEAT No.

SARDAR PATEL UNIVERSITY
M.Sc(Statistics) Semester IV
Certificate Course in Biostatistics
Tuesday, March 26,2019
Time 2:00 p.m. to 5:00 p.m.
Subject:PS04ESTA03/ PS04ESTA23: Bioassays

Note: (i) Figures to the right of questions indicate maximum marks.   Total Marks 70

1.   Choose the correct answer(s) and write in your answer book.   **08**

(i) Direct Assay is practicable only if
(a) One can measure just a dose needed for required response.
(b) The response need not be observed completely
(c) Response can be predicted
(d) None of (a) to (c)

(ii) In a dilution assay
(a) Standard preparation behaves like dilution of test preparation
(b) Test preparation behaves like dilution of Standard preparation
(c) Test preparation behave like concentration of standard preparation
(d) Both (b) and (c)

(iii) In Bioassays, Probit or Logit analysis is used when
(a) we require dose response relation.
(b) usual analysis fails.
(c) we have quantal dose response relation.
(d) None of (a) to (c)

(iv) In parallel line assays
(a) Slopes of lines are same and intercepts may be different
(b) Intercepts are same and slopes are also same
(c)Slopes and Intercepts are different.
(d) None of (a) to (c)

(v) Let u=f(α+βx) were x is dose of a preparation. Then the relation gives
(a) response metameter
(b) dose metameter
(c) dose response relation
(d) none of (a) to (c)

(vi) If responses to more than one preparation are non-homoscedastic then what will you use to make them homoscedastic?
(a) We use dose metameter.
(b)We use variance stabilizing transformation
(c) We use response metameter.
(d) None of (a) to (c)

(vii) The variance of the estimate of slope in a simple regression is
(a) $\dfrac{\sigma^2}{S_{xx}}$
(b) $\sigma^2 S_{xx}$

(P.T.O)

(c) $\dfrac{\sigma^2}{S_{yy}}$ (d) None of (a) to (c)

(viii) If the difference in dose-response linear relation for test preparation and standard preparation are only in their slope then such a assay is called

(a) Indirect Assay (b) Direct Assay .

(c)Dilution Assay (d) slope ratio assay.

2 Answer any **7** of the following. **14**

(i) Define Potency of a Test Preparation with respect Standard Preparation. Give interpretation of potency equal 1.8.

(ii) Explain fiducial intervals

(iii) Explain the notations ED 90 and LD50 discussing in detail type of assay used to estimate these.

(iv) Explain with the help of examples the role of dose metameter and response metameter.

(v) Describe symmetric and non symmetric designs in parallel line assays.

(vi) Write down the table of coefficients of orthogonal contrast in (3,3) point design corresponding to parallel line assay.

(vii) Explain why Fieller's theorem is important in bioassays.

(viii) What are Box-Cox Transformations? How they are useful bioassays?

(ix) Give the advantages of equal replications of doses in any bioassays with proportional doses?

3 (a) Describe in detail, with the help of examples, Barlett's test homoscedasticity **6**

(b) The following are data on a industrial product, produced by five identical machines. Carryout Bartlett's test for homoscedasticity and write the report. **6**

	Line A	Line B	Line C	Line D	Line E
	250	310	250	340	250
	260	330	230	270	240
	230	280	220	300	270
	270	360	260	320	290
Count	4	4	4	4	4
Average	252.5	320.0	240	307.5	262.5
s_i^2	291.667	1133.333	333.333	891.667	491.667
Log(s_i^2)	2.4649	3.0544	2.5229	2.9502	2.6917

OR

(b) The following table gives the doses (cc per 100g of body weight) obtained from two groups of mice for two preparations of insulin, labeled as A and B. Estimate the relative potency (treating A as standard) and interpret the result. Further obtain variance of **6**

potency using approximate formula derived using CV (a/b).

	Standard(A)	Test(B)
	2.4	6.3
	1.9	6.5
	2	5.6
	2.3	6.5
	1.7	5.8
		6.2
Sample size	5	6
Sum	10.3	36.9
Mean	2.06	6.15
Sample Variance	0.083	0.139

4 (a) State and prove Fieller's Theorem. **6**

(b) For the data given in question "OR" part of question 3(b) obtain fiducial limits for estimated relative potency. The tabulated value of t, at 5% level of significance and 9 degrees of freedom is 2.26. **6**

<center>OR</center>

(b) Write a detailed note on principles of planning of an assay.

5 (a) **An assay of corticotrophin by subcutaneous injection in rats:** The standard preparation is administered at 0.25 and 1.0 unit per 100 g of body mass. The test preparation is administered in the same quantities as the standard. The individual responses, sums, means, total sum of squares and sample variances are given in table below.

	Standard S		Preparation T	
Dose((D)	S_1=0.25	S_2=1	T_1=0.25	T_2=1
x=Log_2(D)- Log_2(0.5)	-1	1	-1	1
	300	289	310	230
	310	221	290	210
	330	267	360	280
	290	236	341	261
	364	250	321	241
	328	231	370	290
	390	229	303	223
	360	269	334	254
	342	233	295	216
	306	259	315	235
Sum ($y_{i.}$)	3320	2484	3239	2440
Sum of Squares($\sum_{j=1}^{n_i} y_{ij}^2$)	1111480	621380	1055637	601828
s_i^2	1026.67	483.82	724.99	718.67
Adjusted Sum of Products.	S_{xy}^S= - 836		S_{xy}^T= -799	

C P T·O

For above data fit the two parallel lines and calculate the Relative Potency.

(b) Using the coefficients of orthogonal contrasts for (2,2) design obtain sum squares for   **6**
'preparation', 'regression', 'parallelism' and 'quadratic' components of ANOVA for the
data given in 4(a) above.

<div align="center">OR</div>

(b) Discuss in detail symmetric (k,k) point parallel line assay when k is odd.   **6**

6 (a) Discuss slope ratio assay by writing model and obtain expressions for least square
estimates of intercept and slopes.

(b) Consider the following asymmetric slope ratio assay

	Response in an assay of nicotinic acid in a meat extract(ml/14 NaOH)								
	Dose for Standard Preparation(μg per tube) x_S					Dose of test preparation (ml per tube) x_T			Blanks x_o
Dose	0.05	0.10	0.15	0.20	0.25	1.0	1.5	2.0	
Response	3.5	5.0	6.2	8.0	9.4	4.9	6.3	7.7	1.5
	3.2	4.7	6.1	7.7	9.5	4.8	6.5	7.7	1.4

Further we have following calculations available. S_{x_S}=1.5, S_{x_T}=9.0, S_y=104.1, $S_{x_S x_S}$ =
0.15, $S_{x_S x_T}$ =-0.75, $S_{x_T x_T}$ =10.0, $S_{x,y}$=2.34, $S_{x_T,y}$=7.65. Here S_{x_S}, S_{x_T}, and S_y denote
the sums of respective variables in the suffix.

Using above intermediate calculations calculate relative potency. Also find two
regression lines with common intercept and different slopes.

<div align="center">OR</div>

(b) Describe the study of quantal response through logit analysis.