Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BPHARM – SEMESTER II • EXAMINATION – WINTER - 2013

Subject code: 220001 Date: 11-12-2013

Subject Name: Applied Mathematics (Biostatistics)

Time: 10:30 am to 01:30 pm Total Marks: 80

Instructions:

1. **Attempt any five questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 (a) Suppose a population consists of four laboratories A, B, C and D producing a 3, 2, 6 and 4 kg of drug respectively. Draw all possible samples of size 2 and find the mean weight of drug for every sample. **06**

(b) Explain the following terms related to testing of hypothesis **05**

I. Null Hypothesis
II. Alternate Hypothesis
III. Level of Significance
IV. Type I and Type II error
V. Degree of freedom

(c) A company keeps accurate records of its monthly expenditure and its total monthly sales. For the first ten months of 2002, the record showed the following: **05**

Advertising Expenditure (in thousand)	43	44	36	38	47	40	41	54	37	46
Monthly sales (in lakhs)	74	76	60	68	79	70	71	94	65	78

Find Karl Pearson's correlation coefficient between the two variables under study.

Q.2 (a) Using the data given below, find the equation of the two lines of regression. **06**

Variable	Mean	S.D	Coefficient of correlation
X	40	5	r = 0.8
Y	30	4	

(b) What are the types of correlation and explain any one method for studying correlation. **05**

(c) The following data show the blood pressure reduction (in mm Hg) caused in 10 animals by a new antihypertensive compound. **05**

20	18	15	12	8	16	18	17	14	21

Test the Hypothesis that the blood pressure reduction for the population is 15 mm Hg. ($t_{9,0.05} = 2.262$)

Q.3 (a) In an experiment to study the dependence of hypertension on smoking habit, the following data were obtained on 180 individuals. **06**

Test the Hypothesis that the presence or absence of Hypertension is independent of smoking habit. ($\chi 2_{(2, 0.05)} = 5.991$)

	Non-smokers	Moderate Smokers	Heavy Smokers
Hypertension	21	36	30
No Hypertension	48	26	19

(b) Classify the types of Sampling Methods. What are the advantages of sampling? **05**

(c) The determination of maximum plasma concentration (C_{max}) of drugs in µg/ml at three different formulations A, B and C was the subject of a recent experiment. Four different subjects chosen at random from a group were used for this purpose. The data recorded are given in the following table. **05**

Subject	A	B	C
1	29	11	15
2	17	4	9
3	34	6	27
4	40	9	25

Carry out the analysis of variance and test at 5% level of significance that (i) there is no significant difference among the subjects and (ii) there is no significant difference among the maximum plasma concentrations of the three formulations A, B and C. ($F_{(3,6)} = 4.76$ and $F_{(2,6)} = 5.14$)

Q.4 (a) Write a note on Wilcoxon signed rank test. **06**

(b) Write difference between Regression and correlation. **05**

(c) Enumerate the various experimental designs for clinical trials and explain any one in detail. **05**

Q.5 (a) In an experiment of pea breeding, the following frequencies were obtained. **06**

Round and yellow	Wrinkled and yellow	Round and green	Wrinkled and green
315	101	108	32

Theory predicts that the frequencies are in proportions 9:3:3:1. Examine the correspondence between the theory and the experiment. ($\chi 2_{(3, 0.05)} = 7.82$)

(b) Diclofenac sodium sustained release tablets were analyzed in-vitro and in-vivo. The results are summarized in the following table: **05**

Time in minutes	Amount of drug released (%)	
	In - Vitro	In - Vivo
0	0	0
30	35.45	20.33
60	36.87	33.65
90	44.91	41.82
120	55.20	50.01
150	62.46	59.78

Find out whether both the methods of evaluation are correlated or not.

(c) Obtain the line of regression of monthly sales (Y) on advertisement expenditure (X) and estimate the monthly sales when the company will spend Rs. 50,000 on advertisement, if the data on Y and X are as follows. **05**

Y(in Lacks)	74	76	60	68	79	70	71	94
X (in Thousands)	43	44	36	38	47	40	41	54

Q. 6 (a) In order to compare the effectiveness of two sunburn lotions, a random sample of seven subjects is selected. Lotion A is applied to the left side of their faces and lotion B to the right side. After the subjects have sat in the sun watching a three hour tennis match, the degree of sunburn is measured on a scale. **06**

Subject	1	2	3	4	5	6	7
Lotion A	48	62	42	69	74	35	84
Lotion B	46	49	48	63	43	32	53

Applying Wilcoxon signed rank test, determine whether the data support the claim that the two lotions are equally effective.

The Table value for n=7 at 5% level of significance is 2.

(b) The following are the results of assays comparing three analytical methods: **05**

Method A	Method B	Method C
100	100	101
102	99	100
99	101	101
104	98	102
101	98	100

Test at 5% level of significance the null hypothesis that there are no significant differences among the three methods. ($F_{T\,(2,\,12\,=\,3.88)}$)

(c) A Beer's law plot is constructed by plotting absorbance versus concentration. The concentration in microgram per ml and absorbance are given herewith. Find the equation of line. **05**

Conc.	5	10	15	20	30	40
Absorbance	0.120	0.231	0.362	0.458	0.698	0.888

Q.7 (a) Write a note on F – Test with Applications. **06**

(b) Explain briefly Replicate Designs. **05**

(c) Five Tablets of Paracetamol and Omeprazole were analyzed for drug content. The following results were obtained: **05**

No.	Paracetamol	Omeprazole
1	99.47	100.86
2	99.88	110.53
3	101.42	99.57
4	100.99	99.59
5	100.54	100.66

Compare the two drugs using student's t-test. ($t_{\,8,\,0.05}$ = 2.306)

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