

GUJARAT TECHNOLOGICAL UNIVERSITY
B. Pharmacy Sem-II Remedial Examination September 2009

Subject code: 220001

Subject: Applied Mathematics (Biostatistics)

Date: 07/09/2009

Time: 10:30am-1:30pm

Total Marks: 80

Instructions:

1. Write seat no. and enrolment no. at given location on question paper.
2. Attempt any five questions.
3. Make suitable assumptions wherever necessary.
4. Figures to the right indicate full marks.

Q.1 (a) Classify the types of Sampling Methods. What are the advantages of sampling? **05**

(b) A population consists of 5 units with values 2, 1, 4, 6, 5. Write down all possible samples of size 2 with replacement and find sample mean for each sample. **05**

(c) During a laboratory experiment muscular Contractions of frog muscle were measured against different doses of given drug. The height of the curve was considered as the response to the drug. Calculate the correlation coefficient of the following data : **06**

Serial No.	1	2	3	4	5
Dose of the drug	57	58	60	62	63
Response to the drug	54	59	60	65	70

Q.2

(a) What is a crossover design? Discuss merits and demerits of crossover design. **05**

(b) The data regarding advertisement expenditure and sales of Biotech Products limited are as follows : **06**

	Advertise Expenditure X (Crores Rs.)	Sales Y (Crores Rs)
Mean	20	120
Standard Deviation	5	25

Coefficient of correlation is 0.8.

- (i) Find the equation of two lines of regression.
 - (ii) If the advertisement expenditure is Rs. 25 Crores, find the estimated sales.
 - (iii) If the company fixes a target for sales of Rs. 150 Crores, how much it should spend after advertisement?
- (c)** The following data show the blood pressure reduction (in mmHg) caused in 10 animals by new antihypertensive compound **05**
 20, 18, 15, 12, 08, 16, 18, 17, 14, 21
 Test the hypothesis that the Blood pressure reduction for the population is 15mmHg. ($t_{9,0.05} = 2.262$)

- Q.3 (a)** The following are the weights in pounds, before and after, of 16 persons who stayed on certain reducing diet for four weeks **06**

Before	After	Before	After
147.0	137.9	147.7	149.0
183.5	176.2	208.1	195.4
232.1	219.0	166.8	158.5
161.6	163.8	131.9	134.4
197.5	193.5	150.3	149.3
206.3	201.4	197.2	189.1
177.0	180.6	159.8	159.1
215.4	203.2	171.7	173.2

Use the Wilcoxon signed rank test to test at the 0.05 level of significance whether the weight reducing diet is effective.

($Z = 1.645$)

- (b)** Three groups of six guinea pigs each were injected, respectively with 0.5 milligram, 1.0 milligram, and 1.5 milligrams of a new tranquilizer and the following are the numbers of minutes it took them to fall asleep. **06**

0.5 mg	21, 23, 19, 24, 25, 23
1.0 mg	19, 21, 20, 18, 22, 20
1.5 mg	15, 10, 13, 14, 11, 15

Test at the 0.05 level of significance whether the null hypothesis that differences in dosage have no effect can be rejected F at 5% level at (d.f. = (2,15), $F_T = 3.68$)

- (c)** Explain the following : **04**
- (1) Level of Significance and Types of errors.
 - (2) State the advantages of non parametric test.

Q.4

- (a)** Nine students secured the following percentage of marks in mathematics and chemistry. **04**

Roll No.	1	2	3	4	5	6	7	8	9
Marks in Maths	78	36	98	25	75	82	90	62	65
Marks in Chem.	84	51	91	60	68	62	86	58	53

Find the rank correlation coefficient and comment on its value.

- (b)** To find out whether the inhabitants of two south pacific islands may be regarded as having the same racial ancestry, an anthropologist determines at the cephalic indices of six adult males from each island, getting $\bar{x}_1 = 77.4$ and $\bar{x}_2 = 72.2$, and the corresponding standard deviation $s_1 = 3.3$ and $s_2 = 2.1$. Use 0.01 level of significance to see whether the difference between the two sample means can reasonably be attributed to chance. ($t_{0.01,10} = 3.17$) **06**

- (c)** The following are the weights gains of two random samples of young turkeys fed two different diets but otherwise kept under identical conditions. **06**

Diet 1 :	16.3, 10.1, 10.7, 13.5, 14.9, 11.8, 14.3, 10.2, 12.0, 14.7, 23.6, 15.1, 14.5, 18.4, 13.2, 14.0
Diet 2 :	21.3, 23.8, 15.4, 19.6, 12.0, 13.9, 18.8, 19.2, 15.3, 20.1, 14.8, 18.9, 20.7, 21.1, 15.8, 16.2

Use the U test at the 0.01 level of significance to test the null hypothesis that the two populations sampled are identical against the alternative hypothesis that on the average the second diet produces a greater gain in weight. ($Z_{0.02} = -2.33$)

Q.5

- (a) In cross breeding experiment with plants of certain species 20 off springs were classified in to 4 classes with respect to the structure of their leaves as follows : **05**

Class	I	II	III	IV	Total
Frequency	21	127	40	52	240

According to theory, the probabilities of off springs in the four classes should be in the ratio 1:9:3:3. Are these data consistent with theory? ($\chi^2_{3,0.05} = 7.815$)

- (b) Discuss type of distributions with examples. **06**

- (c) A population is divided into 4 strata consisting of 30, 40, 50 and 70 items. From each stratum a random sample is drawn. Sample values are given in the following table. Estimate the population mean and total of the population : **05**

Stratum No.	Stratum Size	Sample Size	Sample Values
1	30	3	2, 7, 9
2	40	4	3, 4, 8, 5
3	50	5	8, 6, 3, 7, 1
4	70	7	4, 9, 5, 10, 3, 6, 12

Q. 6

- (a) Thirty microgram of vitamin B₁₂ were given intramuscularly every four week to six patients of pernicious anemia during period of remission. The results are given below. Do the data indicate improvement in hemoglobin level? ($t_{5,0.05} = 2.57$) **05**

Individual No.	Hemoglobin g%	
	Before Therapy	After 3 months therapy
1	12.2	13.0
2	11.3	13.4
3	14.7	16.0
4	11.4	13.6
5	11.5	14.0
6	12.7	13.8

- (b) (1) A random sample of 18 pairs of observations form a bivariate normal population gave a correlations coefficient of 0.63. Is it likely that the variables in the population are uncorrelated? ($t_{16,0.05} = 2.12$) **03**

(2) Distinguish between Cluster sampling and Stratified sampling. **03**

- (c) The following are the miles per gallon which a test driver got for 10 tank-fuels of each of three kinds of gasoline **05**

Gasoline A	20, 31, 24, 33, 23, 24, 28, 16, 19, 26
Gasoline B	29, 18, 29, 19, 20, 21, 34, 33, 30, 23
Gasoline C	19, 31, 16, 26, 31, 33, 28, 28, 25, 30

Use the Kruskal-Wallis test at the 0.05 level of significance to test whether or not there is difference in the actual average mileage yield of the three kinds of gasoline. ($\chi^2_{2,0.05} = 5.991$)

Q.7

- (a) Two researchers adopted different sampling techniques while investigating the same group of students to find the number of students falling in different intelligence levels the results are as follows :

Researchers	Number of students in each level				Total
	Below Avg.	Avg.	Above Avg.	Genius	
X	86	60	44	10	200
Y	40	33	25	02	100
Total	126	93	69	12	300

Would you say that sampling techniques adopted by the two researches are significantly different? ($\chi^2_{3,0.05} = 7.815$)

- (b) To study the performance of three detergents and three different water temperatures, the following “whiteness’ readings were obtained with specially designed equipment

Water Temp.	Detergents		
	A	B	C
Cold Water	57	55	67
Warm Water	49	52	68
Hot Water	54	46	58

Prefer two way ANOVA using 5% level of significance. ($F_{T1} = F_{T2} = 6.94$).

- (c) Explain briefly Replicate Design.
