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Index no:

UNIVERSITY OF RUHUNA – FACULTY OF ALLIED HEALTH SCIENCES

DEPARTMENT OF PHARMACY

SECOND BPHARM PART I EXAMINATION - NOVEMBER 2019

PH 2143 - BIOSTATISTICS II (SEQ)

THREE HOURS

INSTRUCTIONS

- There are **six** questions in A and B parts of the SEQ paper.
- Answer **each** part in a separate booklet.
- No paper should be removed from the examination hall.
- Do not use any correction fluid.
- Use illustrations where necessary

PART A

1.

(a) The following are the head circumferences (centimeters) at birth of 16 infants:

33.38 34.15 33.99 34.10 33.97 33.55 33.67 33.85 34.23 33.58
33.46 34.13 34.45 34.19 33.86 33.25

- (i) Construct the boxplot of the data. Based on the graph, how would you describe the shape of the distribution? (10 marks)
- (ii) Construct the normal Q-Q plot. Would you reject normality based on this plot? How would you describe the shape? Does it agree with your answer given in question 1.(a).(i)? (10 marks)
- (iii) Out of the mean and median, which one would best describe the center of the distribution? Explain your answer. (10 marks)
- (iv) Give your estimate of the center. (10 marks)
- (v) How would you measure the variability in the distribution? What is your estimate? (10 marks)

(b) A special diet mixed with a drug compound was designed to reduce low-density lipoproteins (LDL) cholesterol that was fed to a treatment group of rats. A placebo group of rats was fed the same special diet for the same period of time but without the drug compound.

Placebo	64	49	54	97	66	76	44	71	89	70
	62	46	77	86	71	72	71	55	60	64

Treatment	40	31	50	48	152	44	74	38	81	64
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- (i) Construct the side-by-side boxplots and normal Q-Q plots for the treatment group and the placebo group. Are there any outliers? *(10 marks)*
- (ii) If there are outliers remove those from the worksheet and re-construct the side-by-side boxplots and normal probability plots for the treatment group and the placebo group. *(10 marks)*
- (iii) What do the boxplots and normal probability plots of data and normality test tell about the underlying parent distributions? *(10 marks)*
- (iv) Based on your results in part (iii), complete a suitable test out of the pooled t-test, the two-sample t-test, and the two-sample Wilcoxon rank-sum test to evaluate the drug compound. Give p -value and state your conclusion. *(20 marks)*

2. A consumer agency wanted to find out if the mean time taken by each of three brands of medicines to provide relief from a headache is the same. The first drug was administered to six randomly selected patients, the second to five randomly selected patients, and the third to four randomly selected patients. The following table gives the time (in minutes) taken by each patient to get relief from a headache after taking the medicine.

- (e) Do you think that the three assumptions for the F test in one-way analysis of variance are satisfied? Explain. (10 marks)
- (f) Obtain the analysis of variance output for the above data. (10 marks)
- (g) Test the hypothesis that the mean time taken to provide relief from a headache is the same for each of the three drugs at 5% level of significance. Be sure to state your conclusions. (20 marks)
- (h) Determine whether a multiple comparison test is necessary. If it is, complete the test and indicate what differences exist among the three drugs. (20 marks)

3.

- (a) Patients in five different disease groups were classified according to whether they smoked or not, and if so how heavily (measured by number of cigarettes per day on average). The following data were obtained:

Disease group	Extent of smoking			
	Non-Smoker	Light	Medium	Heavy
Cancer (other than lung)	236	78	237	167
Respiratory (not cancer)	42	33	128	132
Heart	22	19	64	61
Gastric	39	31	143	115
Others	38	24	91	62

- (i) State the null and alternative hypotheses to test whether extent of smoking and disease classification are related. (10 marks)
- (ii) Is this a test of independence or a test of homogeneity? (10 marks)
- (iii) What is the value of test statistic? (15 marks)
- (iv) What is the p-value? Write your conclusion. (15 marks)
- (b) A placebo-controlled clinical trial is conducted to test the effectiveness of a sleeping drug and the results of the clinical trial is given in the table below. The table shows the number of hours of sleep, obtained by 10 patients when they took the sleeping drug and when they took the placebo.

Patient	1	2	3	4	5	6	7	8	9	10
Hours of sleep	6.1	6.0	8.2	7.6	6.5	5.4	6.9	6.7	7.4	5.8
	5.2	7.9	3.9	4.7	5.3	7.4	4.2	6.1	3.8	7.3

- Use an appropriate test to test the effectiveness of the sleeping drug. (50 marks)

4. In one stage of the development of a new drug for allergy, an experiment is conducted to study how different dosages of drug affect the duration of relief from the allergic symptoms. Ten patients are included in the experiment. The table below shows the dosage (x) in milligrams and the number of days for relief (y) from allergy for the 10 patients.

Dosage (x)	Duration for Relief (y)
3	9
3	5
4	12
5	9
6	14
6	16
7	22
8	18
8	24
9	22

- (a) Construct a scatter diagram. Does it appear a linear relationship between dosage and

- i. Why might a t-test not be very useful in this case? (10 marks)
- ii. Carry out a nonparametric procedure for testing the hypothesis that the length of stay are comparable in the two hospitals (state your hypotheses, give p-value and state your conclusion).

(30 marks)

- (b) Write down the mathematical model and the relevant null hypotheses for the fixed effects two-factor model. (15 marks)

- (c) An experiment was conducted to study the effects of temperature and type of oven on the life of a particular component. Four types of ovens and 3 temperature levels were used in the experiment. Twenty-four pieces were assigned randomly, two to each combination of treatments, and the following results were recorded.

Temperature ($^{\circ}$ F)	Oven			
	O1	O2	O3	O4
500	227	214	225	260
	221	259	236	229
550	187	181	232	246
	208	179	198	273
600	174	198	178	206
	202	194	213	219

Using a 0.05 level of significance, test the hypothesis that

- (i) the type of oven and temperature do not interact; (15 marks)
- (ii) different temperatures have no effect on the life of the component; (15 marks)
- (iii) different ovens have no effect on the life of the component. (15 marks)

PART B

6.

(a) Define the following terms.

(50 marks)

- (i) Neonatal mortality rate
- (ii) Post neonatal mortality rate
- (iii) Case specific mortality rate
- (iv) Infant mortality rate
- (v) Maternal mortality rate

(b) Compare advantages and disadvantages of case-control and cohort studies.

(50 marks)

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