UNIVERSITY OF RUHUNA – FACULTY OF MEDICINE

ALLIED HEALTH SCIENCES DEGREE PROGRAMME

SECOND BPHARM PART I EXAMINATION - June 2016

PH 2143 - BIOSTATISTICS II

DATE: 08/06 /2016   INDEX NO: ....

Three (03) HOURS

INSTRUCTIONS

- No paper should be removed from the examination hall.

- Create a folder on the desktop with your index number as the name of the folder and save all your work in that folder

- Answer all Questions.

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 to part (i)?

(10 marks)

(iii) Out of the mean and median, which one would best describe the center of the distribution? Justify 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 rat. A placebo group of rat was fed the same special diet for the same period of time but without the drug compound. Following are the plasma LDL levels for the two groups:

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	52	44	74	38	81	64

(i) Construct the side-by-side boxplots and normal Q-Q plots for the treatment group and the placebo group.

(10 marks)

(ii) What do the boxplots and normal Q-Q plots of data tell about the underlying parent distributions?

(10 marks)

(iii) Based on your results in part (ii), use an appropriate test to evaluate the drug compound. Give the value of test statistic and p-value. State your conclusion.

(30 marks)

2. Rats were given one of four different diets at random, and the response measure was liver weight as a percentage of body weight. The responses were

Treatment			
1	2	3	4
3.52	3.47	3.54	3.74
3.36	3.73	3.52	3.83
3.57	3.38	3.61	3.87
4.19	3.87	3.76	4.08
3.88	3.69	3.65	4.31
3.76	3.51	3.96	3.98
3.94	3.35		3.86
	3.64		3.71

(a) State the null and alternative hypotheses for a one-way analysis of variance test.

(10 marks)

(b) Construct side by side boxplots. Does it appear that there is a difference among the four diets?

(10 marks)

(c) Construct normal Q-Q plots for each diet. Does the normality assumption seem to be satisfied?

(10 marks)

(d) Obtain descriptive statistics of the data for each diet. Do you think the population standard deviations are homogeneous? Explain.

(10 marks)

Do you think that the assumptions for the F test are satisfied? Explain.

(10 marks)

(f) Complete an analysis of variance output.

(10 marks)

(g) Test the hypothesis that there is no difference among the four diets. 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 four diets.

(20 marks)

3.

(a) 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	Drug	6.1	6.0	8.2	7.6	6.5	5.4	6.9	6.7	7.4	5.8
of sleep	Placebo	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)

(b) Use the data in the table below to test whether there is an association between Vitamin C and incidence of colds.

		Regularly take vitamin C		
		Yes	No	Total
Colds per year	Few	32	16	48
	Some	13	27	40
	Many	5	7	12
	Total	50	50	100

Answer the following questions:

(i) State the null and alternative hypotheses of the test.

(10 marks)

(ii) Construct a table with the expected and observed cell counts.

(10 marks)

(iii) Write down the value of the Pearson chi-squared test statistic and the value of the degrees of freedom.

(10 marks)

(iv) Write down the p-value.

(05 marks)

(v) Write down your conclusion.

(15 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. Dose it appear a linear relationship between dosage and duration of relief ?

(10 marks)

(b) Obtain the least square estimates of β_0 and β_1 for the model $y = \beta_0 + \beta_1 x + \varepsilon$.

(10 marks)

(c) Interpret the meaning of β_1 in this problem.

(20 marks)

(d) Test the hypothesis that $\beta_1 = 0$. Write down the value of test statistic and p-value. Do the results of this test indicate that a linear trend is significant?

(20 marks)

(e) How much of the variability in y is explained by the linear regression model?

(20 marks)

(f) A new trial is to be made on a single patient with the dosage 6.5 milligrams. Predict the duration of relief.

(20 marks)

5.

(a) Briefly explain the following designs:

  (i) Completely randomized design,

(15 marks)

  (ii) Matched pairs design,

(15 marks)

  (iii) Randomized block design,

(15 marks)

  (iv) Latin Squares Design.

(15 marks)

(b) Four diets were compared on premature babies with three types of respiratory disease. The table below gives the increase in mass, in kilograms, for these babies.

		Diets			
		1	2	3	4
Respiratory disease	A	3.2	3.9	2.7	2.0
	B	2.3	3.0	3.9	4.5
	C	2.7	3.4	5.7	6.3

Carry out an analysis of variance and test for differences between diets and between diseases.

(40 marks)

6.

(a) What is incidence rate?

(20marks)

(b) What is person-time of observation?

(20 marks)

(c) What is cumulative incidence?

(20 marks)

(d) What are the biases that can occur in case-control studies?

(20 marks)

(e) How you can overcome such biases that can occur in case-control studies?

(20 marks)