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UNIVERSITY OF RUHUNA – FACULTY OF ALLIED HEALTH SCIENCES
DEPARTMENT OF PHARMACY
SECOND BPHARM PART I EXAMINATION – NOVEMBER/DECEMBER 2023
PH 2143 BIOSTATISTICS II – SEQ PAPER

TIME: THREE HOURS

INSTRUCTIONS

- There are six questions in this SEQ paper.
- Answer all the questions.
- No paper should be removed from the examination hall.
- Do not use any correction fluid.
- Use illustrations where necessary.

1. Identify the most appropriate sampling method that you could employ to select samples for the following research investigations and explain briefly the procedure of selecting subjects. *(100 marks)*

1.1. A researcher wishes to identify the prevalence of antibiotic usage by employees in a garment factory in the last month. There are 2000 employees working in this factory. The researcher is planning to survey 200 employees.

1.2. A researcher wishes to select a sample of 3000 advanced level students from Galle district to investigate risk factors of obesity.

1.3. A pharmacist wishes to investigate drug adherence rates of his clients by gender and age using a sample of 1000 clients attending to his pharmacy.

1.4. A pharmacy student in FAHS is interested in investigating different types of pain killers used by cancer patients using a sample of 300 cancer patients attending the cancer clinic in Teaching Hospital, Karapitiya.

2.

2.1. Explain the differences between morbidity and mortality. *(10 marks)*

2.2. Explain the differences between single-blind and double-blind procedures in experimental studies. *(10 marks)*

2.3. Explain the differences between randomization and manipulation in clinical trials. *(20 marks)*

2.4. What is p chart in statistical quality control? *(10 marks)*

2.5. What is type I error and type II error in statistical quality control? *(10 marks)*

2.6. Give two examples for nominal and ordinal variables. *(10 marks)*

2.7. What is the difference between parameter and statistic? *(10 marks)*

2.8. List four potential sources of bias in clinical experiments. *(10 marks)*

2.9. What is the difference between prevalence and incidence? *(10 marks)*

2.10. What is the difference between probability and non-probability sampling methods? *(10 marks)*

3. A pharmacist is interested in identifying whether there is a significant difference of the mean platelet count (10^9/L, per microliter) between leptospirosis and dengue patients. A representative sample of 100 dengue and 100 leptospirosis patients were investigated. The mean (± *SD*) platelet count values were 500 ± 50 and 600 ± 60 for leptospirosis and dengue patients respectively.

3.1. Calculate 95% CI of the mean platelet count of dengue patients in this population. ***(20 marks)***

3.2. Calculate 99% CI of the mean platelet count of leptospirosis patients in this population. ***(20 marks)***

3.3. Write down null and alternative hypotheses for this investigation. ***(10 marks)***

3.4. Test the null hypothesis at 5% significant level. ***(40 marks)***

3.5. What is your conclusion? ***(10 marks)***

4. A pharmaceutical company launched a new product on the market, a dietary supplement that supposed to help people to reduce blood glucose by 10% in 8 weeks. You are required to see whether this new supplementary food is effective. A sample of 400 people, of which half of them were on that supplementary diet in addition to their normal diet, and the others were on their normal diet. Results after 8 weeks are shown in the following table.

Type of food	**Reduced blood glucose by 10%**	**Did not reduce blood glucose by 10%**
Supp. diet + Normal diet	120	80
Only normal diet	40	160

4.1. State null and alternative hypotheses for the above experiment. ***(20 marks)***

4.2. Calculate expected values for all observed values. ***(20 marks)***

4.3. Test the null hypothesis at 5% significant level. ***(40 marks)***

4.4. What is your conclusion? ***(20 marks)***

5. Age (in years) of 6 people and their cholesterol ratios are given in the following table.

x (Age)	y (Cholesterol Ratio) [Total Cholesterol/HDL)]
60	3.1
61	3.6
62	3.8
63	4
65	4.1
66	4.2

5.1 Complete the following table. *(15 marks)*

x Value	y Value	$x \times y$	$x \times x$	$y \times y$
60	3.1			
61	3.6			
62	3.8			
63	4			
65	4.1			
66	4.2			

5.2. Calculate $\sum_{i=1}^{6} y$, $\sum_{i=1}^{6} x$, $\sum_{i=1}^{6} xy$, $\sum_{i=1}^{6} x^2$, $\sum_{i=1}^{6} y^2$ **(25 marks)**

5.3. Calculate the correlation coefficient (r). **(20 marks)**

$$r = \frac{n\sum_{i=1}^{n} xy - [\sum_{i=1}^{n} x][\sum_{i=1}^{n} y]}{\sqrt{n(\sum_{i=1}^{n} x_i^2) - (\sum_{i=1}^{n} x_i)^2}\sqrt{n(\sum_{i=1}^{n} y_i^2) - (\sum_{i=1}^{n} y_i)^2}}$$

5.4. How would you interpret your result obtained for question 5.3? **(10 marks)**

5.5. Fit a least square linear regression equation to predict cholesterol ratio of the participants based on their age.

You may use $b = \frac{\sum xy - n\bar{x}\bar{y}}{\sum x^2 - n\bar{x}^2}$ *and* $a = \bar{y} - b\bar{x}$, to estimate the coefficients and write down the fitted regression equation. **(20 marks)**

5.6. Estimate the cholesterol ratio of a 67-year-old person using the fitted least square linear regression equation in 5.5. **(10 marks)**

6. An investigator is interested in identifying whether there is a difference of mean LDL level of two groups of patients; those who use treatment A and those who use treatment B. He investigated a total of 80 patients and results are given below.

Treatment	Sample Size	Mean	Standard Deviation
Treatment A	40	190	20
Treatment B	40	220	20

6.1. State null and alternative hypotheses. **(20 marks)**

6.2. What is the statistical test that you would use to check above hypothesis? **(20 marks)**

6.3. Is there statistical evidence of a low LDL cholesterol level in patients taking Treatment A as compared to participants taking Treatment B? You may use the following equation to calculate standard error between two sample means. ***(50 marks)***

$$\mathbf{SE\,(diff)} = \sqrt{\left(\frac{SD_1^2}{n_1} + \frac{SD_2^2}{n_2}\right)}$$

6.4. What is your conclusion? ***(10 marks)***

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