



**UNIVERSITY OF RUHUNA – FACULTY OF ALLIED HEALTH SCIENCES**

**DEPARTMENT OF PHARMACY**

**FIRST BPHARM PART II EXAMINATION – AUGUST 2022**

**PH 1262 BIOSTATISTICS I– SEQ PAPER**

**TIME: TWO HOURS**

**INSTRUCTIONS**

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

1.

1.1. Briefly describe the following distribution shapes:

1.1.1. Uni-, bi- and multimodal distributions

**(10 marks)**

1.1.2. Symmetric and skewed distributions

**(10 marks)**

1.2. Write the most appropriate measurement for the center of the distribution when the distributions are Symmetric and Skewed.

**(20 marks)**

1.3. In a study using identical twins, one twin was given a drug and then given an intelligence test while under the influence of the drug. The other twin was given the same intelligence test under normal drug-free conditions. Here are their test scores:

Twin A (no drug)	83	74	67	64	70	67	81	64	72
Twin B (drug)	78	74	63	66	68	63	77	65	70

1.3.1. Find the mean value and the standard deviation for the difference of scores (Twin A- Twin B).

**(10 marks)**

1.3.2. Find the five number summary values and IQR for the difference of scores.

**(25 marks)**

1.3.3. Sketch a boxplot of the difference of scores.

**(15 marks)**

1.3.4. Discuss the shape of the distribution of the difference of scores.

**(10 marks)**

2.

2.1. Define the sensitivity, specificity and predictive value positive (PV+) of a screening test.

**(30 marks)**

2.2. A drug company is developing a new pregnancy-test kit for use on an outpatient basis. The company uses the pregnancy test on 100 women who are known to be pregnant, for whom 95 test results are positive. The company uses the pregnancy test on 100 other women who are known to not or not to be pregnant, of whom 99 test negative.

2.2.1. What is the sensitivity of the test?

**(20 marks)**

2.2.2. What is the specificity of the test?

**(20 marks)**

2.2.3. The company expects that of the women who will use the pregnancy-test kit, 10% will actually be pregnant. What is the PV+ of the test?

**(30 marks)**



- 3.
- 3.1. Eighty-seven percent (87%) of heart failures are due to natural occurrences and the others are due to outside factors. Outside factors are related to induced substances or foreign objects. Natural occurrences are caused by arterial blockage, disease, and infection. Suppose that 20 patients will visit an emergency room with heart failures. Assume that causes of heart failure between individuals are independent.
- 3.1.1. What is the probability that three individuals have conditions caused by outside factors? (15 marks)
- 3.1.2. What is the probability that three or more individuals have conditions caused by outside factors? (20 marks)
- 3.1.3. What are the mean and standard deviation of the number of individuals with conditions caused by outside factors? (10 marks)
- 3.2. Briefly discuss the Poisson process. (20 marks)
- 3.3. The number of people arriving for treatment at an emergency room can be modeled by a Poisson distribution with a rate parameter of five per hour.
- 3.3.1. What is the probability that exactly four arrivals occur during a particular hour? (15 marks)
- 3.3.2. What is the probability that at least two people arrive during a particular hour? (20 marks)
- 4.
- 4.1. What are the parameters of the normal distribution? (20 marks)
- 4.2. How do the width and height of a normal distribution change when its mean remains the same but its standard deviation decreases? (20 marks)
- 4.3. Serum cholesterol is an important risk factor for coronary disease. We can show that serum cholesterol is approximately normally distributed, with mean  $\mu = 219$  mg/dL and standard deviation  $\sigma = 50$  mg/dL.
- 4.3.1. If the clinically desirable range for cholesterol is  $< 200$  mg/dL, what proportion of people have clinically desirable levels of cholesterol? (20 marks)
- 4.3.2. Some investigators believe that only cholesterol levels over 250 mg/dL indicate a high-enough risk for heart disease to warrant treatment. What proportion of the population does this group represent? (20 marks)
- 4.3.3. What proportion of the general population has borderline high-cholesterol levels (cholesterol level is  $> 200$  but  $< 250$  mg/dL)? (20 marks)

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