

UNIVERSITY OF SWAZILAND
MAIN EXAMINATION PAPER 2016/2017

82

TITLE OF PAPER: BIOSTATISTICS

COURSE CODE: B305

TIME ALLOWED: THREE (3) HOURS

- INSTRUCTIONS:**
1. QUESTION 1 IN SECTION A IS COMPULSORY AND IT CARRIES 50 MARKS.
 2. ANSWER **ANY TWO** QUESTIONS IN SECTION B
 2. EACH QUESTION IN SECTION B CARRIES TWENTY FIVE (25) MARKS.
 3. ILLUSTRATE YOUR ANSWERS WITH LARGE AND CLEARLY LABELED DIAGRAMS WHERE APPROPRIATE.
 4. CLEARLY STATE YOUR NULL AND ALTERNATIVE HYPOTHESES AND YOUR CONCLUSIONS WHERE APPROPRIATE.
 5. SHOW ALL WORKING WHERE APPLICABLE.

SPECIAL REQUIREMENTS:

1. CALCULATORS (CANDIDATES MUST BRING OWN).
2. GRAPH PAPER.
3. STATISTICAL TABLES (TO BE SUPPLIED BY THE INSTRUCTOR).

THIS PAPER IS NOT TO BE OPENED UNTIL PERMISSION HAS BEEN GRANTED BY THE INVIGILATORS

SECTION A (Compulsory)

83

Question 1

- (a) State any one assumption (without repeating) of the following:
- (i) parametric tests, (1 mark)
 - (ii) chi square test, (1 mark)
 - (ii) one-sample t- test. (1 mark)
- (b) Briefly explain the difference between the following:
- (i) p-value and α -value, (1 mark)
 - (ii) type I error and a type II error, (1 mark)
 - (iii) poisson and binomial distribution, (1 mark)
 - (iv) clustered random sampling and stratified random sampling. (1 mark)
- (c) State the conditions under which a z-test is preferred over a t-test. (2 marks)
- (d) The table below gives frequency distribution data for weight (kg) of 100 randomly chosen UNISWA students

Weight (kg)	60–62	63–65	66-68	69-71	72-74
Frequency	5	18	42	27	8

Determine the following measures of central tendency and spread.

- (i) mean (1 mark)
 - (ii) variance, (2 marks)
 - (iii) 99 % confidence limits of the mean. (4 marks)
- (e) Scores for a Mature Age Entry Exam at UNISWA are normally distributed, with a mean of 75 and a standard deviation of 5.6. To be eligible for acceptance, applicant must score in the top 10%. Determine the minimum score that will guarantee acceptance. (3 marks)
- (f) The population mean and variance of the number of contaminants in a bacterial vaccine preserved with phenol are 60 and 25 respectively. A random sample of 20 bacterial vaccines in a different preservative gave the following contamination counts:
- 67, 62, 52, 55, 54, 61, 51, 59, 54, 57, 57, 60, 50, 66, 68, 54, 53, 52, 58, 56.**
- Assuming that the counts are normally distributed, examine whether the preservative has significantly changed the contamination counts at 95% confidence level. (8 marks)
- (g) Suppose you want to make a survey of Swazis who use WhatsApp® on a daily basis. If the acceptable standard deviation of the population mean is 53 people, how many people must be interviewed in the survey if you want to be 95% confident that the sample mean is within an error margin of 10 users of the population mean? (3 marks)

- (h) The mean time for mice to die when injected with 1000 leukemia cells is known to be 12.5 days. When the injection was doubled in a random sample of 10 mice, the survival times were:

10.5, 11.2, 12.9, 12.7, 10.3, 10.4, 10.9, 11.3, 10.6 and 11.7.

If the survival times are normally distributed, use a suitable statistical test to determine whether these results suggest that the increased dosage caused a significant decreased survivorship at 5% significance level. (10 marks)

- (i) The activities of an enzyme (U/g protein) in 12 liver tissues, (A), infected with hepatitis and 18 normal liver tissues, (B), were as follows:

A	4.15, 4.48, 4.22, 3.94, 4.52, 3.70, 4.77, 4.03, 3.90, 4.86, 3.16, 3.33.
B	3.15, 4.23, 3.12, 2.70, 3.99, 4.40, 3.86, 3.86, 3.16, 4.27, 4.34, 3.79, 4.28, 4.63, 4.98, 3.52, 2.77, 3.18

Using a suitable statistical test, determine whether or not hepatitis infection has a significant effect on enzyme activity. Hence construct a 95% confidence interval for the difference between population means of the enzyme activities in the two liver cell types. (10 marks)

[TOTAL MARKS = 50]

SECTION B (Answer any two questions in this section)

85

Question 2

- (a) In a survey, 48% of UNISWA students agreed to voluntarily pay extra E200 towards SRC subscriptions. Then, 65 students in the sampling frame who had previously agreed to pay extra subscription were randomly picked and asked if they eventually paid the extra E200. What is the probability that fewer than 40 of them responded "Yes I paid extra E200"? (5 marks)
- (b) The table below shows data on breathing patterns in an experimental and control groups of people. The variable of interest is the total ventilation measurements (litres of air per minute per square meter of body area). The data are drawn from a non-normal distribution.

Experimental	5.32	5.60	5.74	6.06	6.32	6.34	6.79	7.18
Control	4.5	4.78	4.79	4.86	5.41	5.70	6.08	6.21

Use a suitable statistical test to check if the data indicate that a significant difference in the ventilation measurements of the two groups. (20 marks)

[TOTAL MARKS = 25]

Question 3

A survey on the impacts of a potentially deadly disease on domestic dogs of two different age groups showed that out of a total of 40 sick puppies aged one month or younger, 20 died, 5 were permanently disabled and the rest recovered. Of the 50 sick puppies aged of 3 months and/or above, 10 died, 5 were permanently disabled and the rest recovered. Using an appropriate statistical test, deduce whether the severity of disease impact is dependent on the age of puppies. (25 marks)

[TOTAL MARKS = 25]

Question 4

At RFM hospital, a total of 25 patients with blisters were divided into 3 groups based on how their blisters were treated. The table below gives the number of days it took until blisters were healed.

Treatment A	5, 6, 6, 7, 7, 8, 9, 10
Treatment B	7, 7, 8, 9, 9, 10, 10, 11
Placebo	7, 9, 9, 10, 10, 10, 11, 12, 13

Use a suitable statistical test to determine if there are significant differences in treatment. If applicable, diagnose the source of any differences using any method of your choice. (25 marks)

[TOTAL MARKS = 25]

Question 5

The following data were collected by a botanist examining the size of fruits in relation to rainfall:

Fruit mass (g)	53	57	64	71	80	84
Rainfall (mm)	50	200	800	1500	2800	4200

- (a) Examine if there is a significant relationship between fruit mass and rainfall. (7 marks)
- (b) Perform a regression analysis for these data. Hence plot these data on an appropriate graph and give 95% confidence limits for the slope. (12 marks)
- (c) Use ANOVA to test for significance of the slope at $\alpha = 0.05$. (6 marks)

[TOTAL MARKS = 25]

END OF EXAM PAPER