

**UNIVERSITY OF SWAZILAND
MAIN EXAMINATION PAPER 2016/2017**

TITLE OF PAPER: BIostatISTICS

COURSE CODE: B305/BIO301

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)

Question 1

- (a) The following data are flash durations (in milliseconds) of a sample of 35 male fireflies of the species *Photinus ignites*:

79, 80, 82, 83, 86, 85, 86, 86, 88, 87, 89, 89, 90, 92, 94, 92, 94, 96, 95, 95, 95, 96, 98, 98, 98, 101, 103, 106, 108, 109, 112, 113, 118, 116, 119.

Calculate the following:

- (i) range (1 mark)
 - (ii) mean, (3 marks)
 - (iii) standard deviation, (3 marks)
 - (iv) 95% confidence interval for the population mean. (3 marks)
- (b) Layla is a nutritionist and she believes that 12 kg boxes of cereal should contain an average of 1.2 kg of bran. She suspects that a popular cereal has a different mean bran content. She carefully analyses the contents of a random sample of twenty 12 kg boxes of the cereal and finds that the mean bran content is 1.16 kg. It is known that the standard deviation of the bran content of all such boxes of cereal is 0.08 kg. Stating your assumptions, determine whether these data provide sufficient evidence to conclude that the mean bran content of all 12 kg boxes of this cereal differs from 1.2 kg at $\alpha = 0.05$ (10 marks)
- (c) 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)

- (c) 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 = 50]

SECTION B (Answer any two questions in this section)**Question 2**

- (a) The following table shows the nitrogen concentrations in the soil after harvesting of three crops. The data meet the assumptions of parametric tests.

Nitrogen conc (mol/l)		
Crop 1	Crop 2	Crop 3
46.5	47.0	39.1
44.3	46.3	43.2
47.1	44.9	46.1
46.8	47.4	40.7
45.6	45.8	42.7

- (i) Using an appropriate statistical test, establish whether the three different species have significantly different incubation periods. If you deem it appropriate, perform a multiple comparison to determine any species that may differ from other species in incubation period. (25 marks)

Question 3

- (a) Swaziland Defence Force has recently placed an upper limit on the height of its recruit soldiers on the assumption that people who are too tall stand out in the bush, making them a liability to others in the face of an enemy. To apply to be a soldier, one must not be taller than 180.3 cm (if you are a man) or 172.7 cm (if you are a woman). The mean height of Swazi women is 163.3 with standard deviation of 6.4 cm and the mean height of Swazi men is 177.0 cm with a standard deviation of 7.1 cm. Estimate the proportion of Swazi men that do not qualify to be soldiers. (5 marks)

- (b) The following data were collected by a psychologist:

Test score (%)	Time studied (min)
88	120
80	105
76	106
83	108
55	98
62	97
67	99

Determine if there is a significant correlation between the amount of time a student studied and his/her test score. Take α as 0.05. If appropriate, perform a regression analysis and test its significance using a t-test. (20 marks)

Question 4

The following table shows the number of items of litter (trash) washing up onto three different beaches. The data are not normally distributed.

Sampling occasion	Beach 1	Beach 2	Beach 3
1 st	68	67	61
2 nd	69	69	65
3 rd	71	72	67
4 th	71	70	65
5 th	68	69	63

- (a) Using an appropriate statistical test, establish whether the three different beaches have significantly different litter. Present these data in an appropriate graph showing the mean and standard deviation of litter on the three beaches. (25 marks)

Question 5

Bias and sampling error have been observed to reduce accuracy and precision when estimating and testing effects of one variable on another. Discuss experimental procedures that can be done to minimize bias and sampling error. (25 marks)

END OF EXAM PAPER