UNIVERSITY OF SWAZILAND
MAIN EXAMINATION PAPER 2012/2013

TITLE OF PAPER: BIOSTATISTICS

COURSE CODE: B305

TIME ALLOWED: THREE (3) HOURS

INSTRUCTIONS:

1. ANSWER ANY FOUR QUESTIONS.
2. EACH QUESTION 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.

SPECIAL REQUIREMENTS:

1. CALCULATORS (CANDIDATES MUST BRING THEIR OWN).
2. GRAPH PAPER.
3. STATISTICAL TABLES (TO BE SUPPLIED BY THE LECTURER).
4. USEFUL EQUATIONS (TO BE SUPPLIED BY THE LECTURER).

ANSWER ANY FOUR (4) OUT OF SIX (6) QUESTIONS

QUESTION 1

a) Show, by means of a sketch, what a normal distribution looks like. [2 marks]

b) A normally distributed population of molluscs has a mean shell width of 13.25 cm and a standard deviation of 1.913 cm.

I. What proportion of this population is 10.30 cm or larger? [4 marks]

II. If 1000 individuals were measured, how many are 10.30 cm or smaller? [1 mark]

III. What is the probability of selecting at random from this population a shell that is smaller than 14.05 cm? [3 marks]

IV. What is the probability of choosing at random from this population a sample of 10 shells with a mean shell width greater than 15.65 cm? [5 marks]

c) Present the following data in a graph that shows the mean, 95% confidence intervals, range and number of observations for each season. [10 marks]

Latitude	N	Mean time (min)	Standard error	Range
06°S	23	32.2	2.60	25.0-39.0
18°S	29	38.4	1.77	31.0-43.5
33°S	19	39.9	1.63	32.3-44.1

[TOTAL = 25 marks]

QUESTION 2

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

a) Using an appropriate statistical test, establish whether the three different species have significantly different incubation periods.

[15 marks]

b) If you rejected the H_0 in (a) above, then do a multiple comparison to show which species differ (or are similar) in incubation period compared with other species.

[10 marks]

[Total = 25 marks]

QUESTION 3

a) Define a normal distribution. [5 marks]

b) Present the following 48 data (masses of marula fruits in g) in a histogram: [8 marks]

22, 23, 24, 21, 22, 23, 24, 21, 23, 23, 24, 25, 21, 19, 23, 22, 23, 24, 23, 24, 27, 22, 23, 24, 23, 22, 23, 24, 23, 23, 23, 22, 23, 24, 21, 23, 24, 22, 21, 20, 25, 24, 23, 22, 23, 21, 23, 24

c) What is the difference between a histogram and a box plot? [3 marks]

d) Name and describe the different types of statistical data. [9 marks]

[TOTAL = 25 marks]

QUESTION 4

The following mortality data were collected for a particular species of grasshopper. A total of 218 grasshoppers were followed from eggs until their death. The number present under the "mortality" column refers to the number of grasshoppers dying in that particular age group (out of the total of 218 individual grasshoppers).

Mortality	Age group (months)
130	<1
30	1
10	2
10	3
8	4
7	5
6	6
7	7
5	8
5	>9
Total = 218	

a) Calculate the mortality rate associated with each age group and present it as a percentage

[5 marks]

b) Present these data graphically.

[10 marks]

c) What are the essential components of a research proposal?

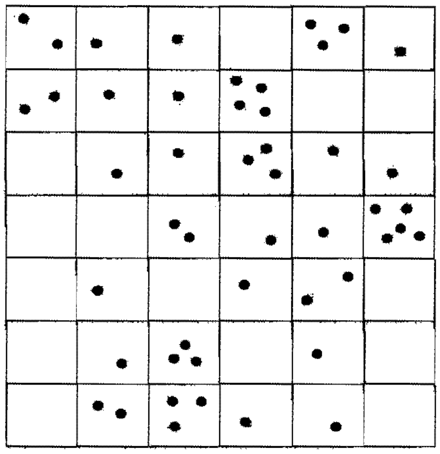
[10 marks]

[TOTAL = 25 marks]

QUESTION 5

Consider the distribution of weeds in a field (see map on next page). Each dot represents a single weed. Are the weeds distributed randomly in the field?

Distribution of weeds in an agricultural field.



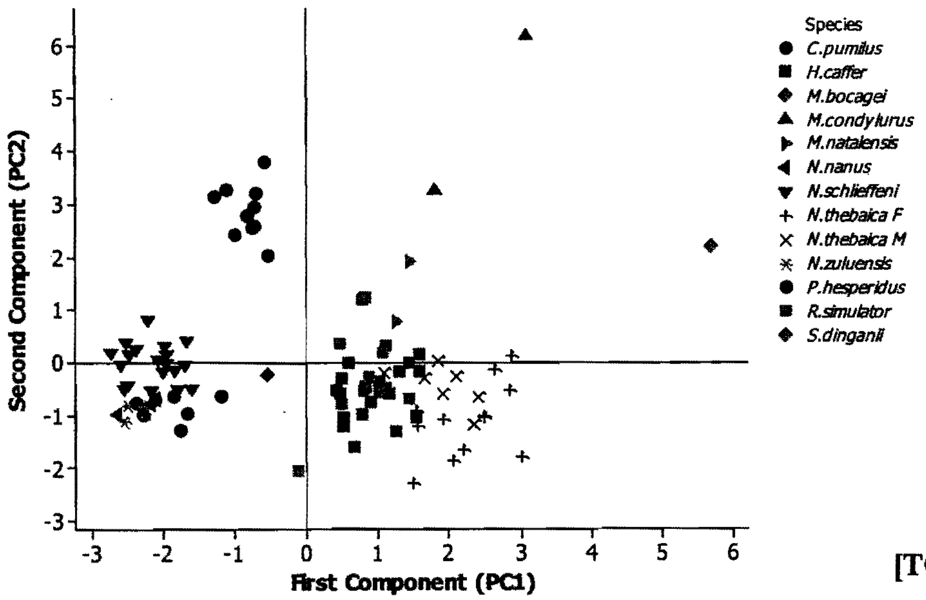
[TOTAL = 25 marks]

QUESTION 6

a) What differentiates multivariate statistics from multiple regression? [4 marks]

b) Give a detailed description of what cluster analysis does. Also include in your answer some examples of biological situations where cluster analysis has been and could be appropriately used. [12 marks]

c) The figure below was produced from a Principal Components Analysis (PCA). The analysis was based on the survey of 13 bat species with different wing morphologies and echolocation calls. What conclusions can you draw from this figure? [10 marks]



[TOTAL = 25 marks]