UNIVERSITY OF SWAZILAND
MAIN EXAMINATION PAPER 2007/2008

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).

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

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

QUESTION 1

The following data were collected by an ecologist:

Altitude (m)	Body length (mm)
150	120
670	230
1020	502
313	192
518	243
401	221
826	315
752	336
209	154
365	188

a) Which are the dependent and independent variables? [2 marks]

b) Calculate a and b for the regression of body length on altitude.

[15 marks]

c) Is there a significant relationship between body length and altitude? Use an **appropriate** statistical test to support your answer.

[8 marks]

[TOTAL = 25 marks]

QUESTION 2

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

b) A normally distributed population of humans has a mean mass of 73.5 kg and a standard deviation of 3.2 kg.

I. What proportion of this population is 78.0 kg or larger? [4 marks]

II. If 1000 individuals were measured, how many of them are 78.0 kg or smaller? [1 mark]

III. What is the probability of selecting at random from this population a weight smaller than 69.0 kg? [3 marks]

QUESTION 2 (continued)

IV. What is the probability of choosing at random from this population a sample of 10 weights that has a mean greater than 76.0 kg? [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]

Month	N	Mean mass (kg)	Standard error	Range
Spring	23	32.2	2.60	25.0-39.0
Summer	29	38.4	1.77	31.0-43.5
Winter	19	39.9	1.63	32.3-44.1

[TOTAL = 25 marks]

QUESTION 3

a) Consider a binomial distribution with $P = 0.55$. Calculate $P(X=0)$ up to $P(X=6)$. [6 marks]

b) Could the following data have come from the above distribution? Show your working.

X	Observed numbers
0	8
1	33
2	52
3	41
4	3

[8 marks]

a) In an ecotoxicology experiment, 6 out of 8 frogs died after being exposed to water from a polluted river. Use the binomial test to test the null hypothesis that equal numbers of fishes died and survived exposure to the polluted water.

[9 marks]

[TOTAL = 25 marks]

QUESTION 4

The following table shows the content of an essential element (in mg of element/ g of crop) of four different varieties of crops. The data are normally distributed.

Element concentrations			
Variety 1	**Variety 2**	**Variety 3**	**Variety 4**
44	47	44	46
46	46	47	44
44	45	45	47
45	47	47	44
44	47	46	45

Using an appropriate statistical test, establish whether the four different varieties have significantly different concentrations of element.

[25 marks]

QUESTION 5

a)   Define a normal distribution.   [5 marks]

b)   Present the following data in a histogram: [8 marks]

Feeding time (s)	Number of records
<110	3
110	2
120	31
130	42
140	69
150	36
160	9
>160	3

QUESTION 5 (continued)

c)   What is the difference between a histogram and an X-Y graph?   [3 marks]

d)   Name and describe the different types of statistical data.   [9 marks]
                                                                        [TOTAL = 25 marks]

QUESTION 6

a)   What are the assumptions of parametric tests?   [6 marks]
b)   The data given in the table below are not parametric. Why not?   [2 marks]

	Mass (g)	
	Pop. A	**Pop. B**
	122	66
	125	69
	118	61
	127	67
	130	68
Mean	124.4	66.2
Variance	21.30	9.70

c)   Using the log-transformation, transform these data.

                                                                                       [6 marks]
d)   Are the transformed data now parametric? If so, why?

                                                                                       [2 marks]
e)   Using an appropriate test, test whether the masses of the two populations are the
        same.

                                                                                       [9 marks]
                                                                        [TOTAL = 25 marks]