

UNIVERSITY OF SWAZILAND  
SUPPLEMENTARY EXAMINATION PAPER 2006

**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 a plant ecologist:

Rainfall (mm)	Mean leaf area (cm <sup>2</sup> )
150	12
670	23
1020	50
313	19
518	24
401	22
826	31
752	33
209	15
365	18

- a) Which are the dependent and independent variables? [2 marks]
- b) Calculate  $a$  and  $b$  for the regression of mean leaf area on rainfall. [15 marks]
- c) Is there a significant relationship between mean leaf area and rainfall? 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 marine snails has a mean mass of 163.5g and a standard deviation of 12.2g.
- I. What proportion of this population is 178.0g or larger? [4 marks]
- II. If 1000 individuals were measured, how many of them are 178.0g or smaller? [1 mark]
- III. What is the probability of selecting at random from this population a weight smaller than 141.0g? [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 165.0g? [5 marks]

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

Month	n	Mean mass (kg)	Standard error	Range
Species A	23	32.2	2.60	25.0-39.0
Species B	29	38.4	1.77	31.0-43.5
Species C	19	39.9	1.63	32.3-44.1

[TOTAL = 25 marks]

**QUESTION 3**

a) Consider a binomial distribution with  $P = 0.6$ . 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	34
2	56
3	48
4	3

[8 marks]

a) In an ecotoxicology experiment, 5 out of 7 fishes 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 **NOT** 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

- a) Using an appropriate statistical test, establish whether the four different varieties have significantly different concentrations of element. [22 marks]
- b) What are the assumptions of parametric tests? [3 marks]
- [TOTAL = 25 marks]**

**QUESTION 5**

- a) Define a normal distribution. [5 marks]
- b) Present the following data in a histogram: [8 marks]

canine length (mm)	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]

Length of petals (cm)		
	Variety A	Variety B
	12.2	6.6
	13.5	6.9
	11.8	6.1
	12.7	6.7
	13.4	6.8
Mean	12.72	6.62
Std Deviation	0.7396	0.3114

- 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 varieties are the same. [9 marks]

**[TOTAL = 25 marks]**