UNIVERSITY OF SWAZILAND
FINAL EXAMINATION PAPER 2005

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 table shows the wing lengths (cm) of 4 populations of a species of fruit fly.

Population "A"	Population "B"	Population "C"	Population "D"
1.2	0.8	1.2	0.9
1.5	0.9	1.8	0.8
1.3	1.4	1.9	0.7
1.8	1.4	2.1	1.0
0.9	1.1	2.0	1.1
1.2	1.0	1.9	1.2

a) Using the Kruskal-Wallis Rank test, establish whether the four different fruit fly populations had significantly different wing lengths. [20 marks]

b) When should you use the one-way ANOVA in preference to the Kruskal-Wallis test? [1 mark]

c) What are the assumptions of parametric tests? [4 marks]

[TOTAL = 25 marks]

QUESTION 2

a) 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 dogs under the age of 2 months who caught the disease, 20 died, 5 were permanently disabled and the rest recovered unharmed. Of the 50 dogs above the age of 2 months who caught the disease, 10 died, 5 were disabled and the rest recovered. Using an appropriate statistical technique, test whether the impact of the disease is affected by age. [20 marks]

b) What type of data are presented in this example (above)? [2 marks]

c) What is the purpose of subdividing a contingency table (when using the chi-square test)? [3 marks]

[TOTAL = 25 marks]

QUESTION 3

a) Consider a Poisson distribution with $\mu = 1.25$. Calculate P(X=0) up to P(X=6). [8 marks]

b) A population has $\mu = 3.4$ and follows a Poisson distribution. Calculate the upper and lower confidence limits associated with the mean. [7 marks]

c) In a sample of 9 male puppies infected with a contagious disease, 6 survive to adulthood and 3 die. Use the binomial test to determine whether the number of male puppies that survive and die in this population are equal. [10 marks]

[TOTAL = 25 marks]

QUESTION 4

The following data were collected by a physiologist.

Body temperature (°C)	Ambient temperature (°C)
38.1	15.3
39.3	24.6
39.5	32.2
40.1	41.1
39.1	23.3
39.0	19.1
38.9	18.5
39.5	23.4
39.4	27.6
39.2	30.1

a) Which is the independent and dependent variable? [2 marks]

b) Calculate *a* and *b* for the regression of body temperature on ambient temperature. [15 marks]

c) Is there a significant relationship between body temperature and ambient temperature? Use an **appropriate** statistical test to support your answer. [8 marks]

[TOTAL = 25 marks]

QUESTION 5

a) Name the conditions that have to be met for an unbiased chi-square test. [6 marks]

The following table shows the numbers of plants of different species in different seasons at Mantenga Nature Reserve.

	Number of plants recorded per hectare			
Plant species	Winter	Spring	Summer	Autumn
"A"	8	44	12	9
"B"	12	15	54	7
"C"	4	3	0	1
"D"	33	11	1	3

b) Are the number of plants recorded affected by the season? Test this hypothesis using the appropriate statistical procedure. [19 marks]

[TOTAL = 25 marks]

QUESTION 6

The following are wing length data of male and female Peregrine Falcon:

Males	Females
280	305
274	309
269	301
301	297
305	316
293	310
275	307

a) The data are normally distributed. Using an **appropriate** statistical test, test whether male and female Peregrine falcons have the same wing length. [18 marks]

b) What test would you have used had the data not been normally distributed? [1 mark]

c) Describe the various statistical transformations which may be used to alter non-normal data into normal data. [6 marks]

[TOTAL = 25 marks]