UNIVERSITY OF SWAZILAND

EXAMINATION PAPER 2007

TITLE OF PAPER   : DISCREPTIVE STATISTICS

COURSE CODE   : ST 132

TIME ALLOWED   : TWO (2) HOURS

REQUIREMENTS   : CALCULATOR AND GRAPH PAPER

INSTRUCTIONS   : ANSWER QUESTION ONE AND ANY OTHER
                                    TWO QUESTIONS

Question 1

a) The data given below are the numbers (in thousands) of farms in each of 50 states, given in order of increasing numbers of farms.

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1    1    2    3    3    4    4    6    7    8    8    9    9
14   14   17   21   24   24   27   28   33   36   36   37   38
39   42   46   49   50   50   52   57   57   61   70   71   73
78   79   82   87   88   93   96   99   109  115  160
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Compute the median, mean, standard deviation and Comment on the skewness (spread) of this distribution.   (10 marks)

b) Two human resource managers in different citrus companies want to compare the lengths of time that employees stay in their organisations before leaving. They consulted their records on 31 March and looked at all the employees who left the organisations in the previous three months. The data are shown in the table.

Number of employees

Length of service (months)	Company A	Company B
Less than 1	2	40
1 but less than 2	3	20
2 but less than 3	7	18
3 but less than 6	20	22
6 but less than 12	33	20
12 but less than 24	20	20
24 but less than 36	10	20
36 or more	5	40

From the above table, estimate;
i)   the median length of service in Company A,
ii) the median length of service in Company B,
iii) the inter-quartile range of length of service in Company A,
iv) the inter-quartile range of length of service in Company B.
v)   compare the lengths of service at the two companies.

(15 Marks)

Question 2

A sample of 10 sea bass was caught by a fisheries scientist who then measured their length x (in millimetres) and their weight y (in grams). The data are given in the table below.

Length (x)	387	366	329	293	273	268	294	198	185	169
Weight (y)	720	680	480	330	270	220	380	108	89	68

a) Calculate a measure of the magnitude of the relationship between x and y variables.
b) Calculate the least-squares estimates of the parameters of the regression line.
c) Comment on the appropriateness of the regression line estimated in part (a) as a model for the relationship between the weights and lengths of sea bass.
d) Calculate the standard error of the regression line.

$(5 + 6 + 4 + 5 \text{ Marks})$

Question 3

A small business was started in 1995 and, as part of a five-year review, the managing director investigated the changes in the price of stationery purchased by the company over the period from 1995 to 1999. The prices charged and quantities purchased for a range of stationery items are shown in the table.

Prices of Stationery and Quantities Used in 1995 and 1999

Item	Unit price (£) in 1995	Unit price (£) in 1999	Quantity purchased in 1995	Quantity purchased in 1999
Box of envelopes	22.49	42.00	5	20
Ream of copier paper	8.69	13.99	10	30
Pack of folders	3.99	4.29	10	10
Box of paper clips	0.57	0.72	15	10

a) Calculate Laspeyre's , Paasche's and Fisher's indices of prices for 1999 (1995 = 100).

(15 Marks)

b) Interpret the values of these indices and advise the Managing Director as to which of the two methods of calculation is more appropriate, in this instance, for measuring the change in stationery prices over the period 1995-99.

(5 Marks)

Question 4

a) Write down a formula for $P(A|B)$, the conditional probability of an event A given an event B. (You may assume that the probability of B is non-zero.)

(2 Marks)

b) State what is meant by saying that two events A and B are independent
   i)   in terms of $P(A \text{ and } B)$;
   ii) in terms of $P(A|B)$.

(4 Marks)

c) A farm machine has two components X and Y and have respective probabilities 3/4 and 7/8 of functioning correctly. They function independently of one another. Two devices are constructed using such components. Device 1 works only if both X and Y function correctly, Device 2 works whenever at least one of X and Y functions correctly.
   i)   Find the probability that Device 1 works.
   ii) Find the probability that Device 2 works.

(6 marks)

d) Suppose Device 1 works. Find the three probabilities
   i)   that X is functioning correctly,
   ii) that only X is functioning correctly,
   iii) that both X and Y are functioning correctly.

Find the same probabilities, supposing instead that Device 2 works.   (8 Marks)