BOTSWANA OPEN UNIVERSITY

DIPLOMA IN BUSINESS MANAGEMENT

BUSINESS STATISTICS
BS121

SESSIONAL EXAMINATION

Time: 3 Hours   **Marks: 100**

Instructions:

1. The examination consists of THREE sections: A, B and C.

2. Answer questions according to instructions given in each section.

3. Write answers in the answer book provided.

4. Only non-programmable calculators may be used.

5. Write in grammatical English.

SECTION A.   Multiple Choice Questions.   [10 MARKS]

Answer ALL questions in this section. Each question carries 1 mark.

1. The variable "*Gender*" can be regarded as being, in general_____

   (a) qualitative and ratio level
   (b) quantitative
   (c) qualitative and nominal level
   (d) qualitative and ordinal level

2. Which of the following statements is always true?

   (a) $P(A) + P(\text{Not } A) = 1$
   (b) $P(A) - P(\text{Not } A) = 0$
   (c) $P(A) = 1 + P(\text{Not } A)$
   (d) $P(A) + P(A) = 0$

3. Which of the following is **not** a statistic?
   (a) the sample mean
   (b) the sample median
   (c) the population proportion
   (d) the sample IQR (interquartile range)
   (e) all of the above are statistics

4. A simple random sample of 10 students is selected from College A. For the 10 students, the number of days each was absent during the last semester was to be:
   $$3, 7, 2, 1, 0, 2, 4, 2, 6 \text{ and } 2 \qquad 0\,1\,2\,2\,2\,2\,3\,4\,6\,7$$

   Which of the following statements is false?

   (a) the range is 7
   (b) the mean is 4 y
   (c) the median is 2
   (d) the mode is 2

5. The collection of all possible sample points in an experiment is _____
   (a) the sample space
   (b) a sample point
   (c) an experiment
   (d) the population

Questions 6-7 refer to the following information:

A researcher has collected the following sample data: 3   5   12   3   2

6. The standard deviation is _____
    1. 8.944
    2. 4.062
    3. 13.2
    4. 16.5

7. The interquartile range is _____
    (a) 11
    (b) 5.5
    (c) 6
    (d) 12

8. The symbol ∪ shows the _____
    (a) union of events
    (b) intersection of events
    (c) sum of the probabilities of events
    (d) sample space

9. If P(A) = 0.38, P(B) = 0.83, and P(A ∩ B) = 0.57; then P(A ∪ B) = _____
    (a) 1.21
    (b) 0.64
    (c) 0.78
    (d) 1.78

10. Two events are mutually exclusive if _____
    (a) the probability of their intersection is 1
    (b) they have no sample points in common
    (c) the probability of their intersection is 0.5
    (d) the probability of their intersection is 1 and they have no sample points in common

SECTION B – SHORT ANSWER QUESTIONS   [30 MARKS]

Answer ALL questions in this section.

1. Explain any five (5) reasons why we study samples when we want to know about populations.
                                                                             (10 marks)

2.

a. Define the following terms:

    i.   Population.   **(2 marks)**

    ii.   Sample.   **(2 marks)**

    iii.   Discrete data.   **(2 marks)**

    iv.   Continuous data.   **(2 marks)**

b. What is the main difference between a bar chart and a histogram?   **(2 marks)**

3. Indicate whether the following are discrete or continuous data

    i)   Number of buses in a bus terminus   **(1 mark)**

    ii)   Weight of babies born on a particular day at a hospital   **(1 mark)**

    iii)   Heights of people in a bank   **(1 mark)**

    iv)   Number of cattle in a village   **(1 mark)**

    v)   Number of birds in a nearby bush   **(1 mark)**

4. Show whether the following is quantitative or qualitative data

    i)   Colour of sweets in a box   **(1 mark)**

    ii)   Number of students in a class   **(1 mark)**

    iii)   Gender of students at a college   **(1 mark)**

    iv)   Weight of babies at a hospital   **(1 mark)**

    v)   Number computers in the lab.   **(1 mark)**

SECTION C   **[60 MARKS]**

Answer any THREE (3) questions in this Section.

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Question 1   (20 marks)

Consider the amount of money (in Pula) that each of the twenty boys has on a certain day. The amounts are recorded in the table below.

20	5	36	6	38	35	25	16	7	10
30	15	43	34	36	9	11	3	23	40

     a. Represent the above data using an ordered stem-and-leaf diagram.   (5 marks)

     b. Calculate the range of the data.   (1 mark)

     c. Determine the median and the mode.   (4 marks)

     d. Group the data in classes of $1-10; 11-20; 21-30; \ldots\ldots$ (5 marks)

     e. Represent the grouped data in (d) using a histogram.   (5 marks)

Question 2   (20 marks)

Students are known to have either blue or brown eyes. From experience, 4 out of every 5 students have blue eyes. The others have brown eyes. A sample of 20 students is selected. Calculate the following probabilities:

     a. That no one has brown eyes.   (3 marks)

     b. That exactly 3 students have brown eyes.   (4 marks)

     c. That at least 18 students have brown eyes.   (4 marks)

     d. That at most 3 students have brown eyes.   (4 marks)

     e. That between 4 and 6 inclusive have blue eyes.   (5 marks)

Question 3   (20 marks)

Consider the following data for a sample of twenty students. The numbers represent the number of hours worked per week by students who were employed.

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6	6	6	6	8	9	9	10	10	10
13	16	20	20	20	20	24	27	30	33

Using two (2) decimal places where applicable:

a. Determine the mean, median, and mode. **(6 marks)**

b. Determine the range, mean absolute deviation, variance, standard deviation, and coefficient of variation. **(10 marks)**

c. What would the variance and standard deviation be if these data represented the whole population instead of just a sample? **(4 marks)**

Question 4 **(20 marks)**

Consider the following joint distribution of students with tattoos and body piercings.

		tattoos		
piercings	yes	no	
yes	0.1250	0.4375	0.5625
no	0.0625	0.3750	0.4375
	0.1875	0.8125	1.0000

Giving your answers to 4 decimal places:

a. What is the probability that a randomly selected student has both piercings and tattoos? **(3 marks)**
b. What is the probability that a randomly selected student has piercings or has no tattoos? **(4 marks)**
c. If a randomly selected student has tattoos, what is the probability the student has piercings?
   (4 marks)
d. If a randomly selected student has no piercings, what is the probability the student has no tattoos?
   (3 marks)
e. Are piercings and tattoos mutually exclusive events? Explain. **(3 marks)**
f. Suppose that for the probability that a randomly selected student has tattoos, you got an answer of -0.2. How do you know that this answer cannot be correct? **(3 marks)**

END OF EXAMINATION

LIST OF FO LIST OF FORMULAE

$$\bar{x} = \frac{\sum x_i}{n} \qquad s^2 = \frac{\sum\left(x_i - \bar{x}\right)^2}{n-1}$$

Grouped Data

$$\bar{x} = \frac{\sum f_i x_i}{n} \qquad Median = O_{me} + \frac{c(\frac{n}{2} - f(<))}{f_{me}} \qquad Mode = O_{mo} + \frac{c(f_m - f_{m-1})}{2f_m - f_{m-1} - f_{m+1}}$$

$$Q_1 = O_{q1} + \frac{c(\frac{n}{4} - f(<))}{f_{q1}} \qquad Q_3 = O_{q3} + \frac{c(\frac{3n}{4} - f(<))}{f_{q3}}$$

$$Variance = s^2 = \frac{\sum f_i x_i^2 - n\bar{x}^2}{n-1}$$

Index Numbers

$$LPI = \frac{\sum P_n Q_0}{\sum P_0 Q_0} * 100 \quad LQI = \frac{\sum P_0 Q_n}{\sum P_0 Q_0} * 100 \quad PPI = \frac{\sum P_n Q_n}{\sum P_0 Q_n} * 100 \quad PQI = \frac{\sum P_n Q_n}{\sum P_n Q_0} * 100$$

$$FPI = \sqrt{LPI \times PPI} \qquad FQI = \sqrt{LQI \times PQI}$$

Regression Analysis

$$b = \frac{n\sum xy - \sum x \sum y}{n\sum x^2 - (\sum x)^2} \qquad a = \frac{\sum y - b\sum x}{n} \quad r = \frac{n\sum xy - \sum x \sum y}{\sqrt{n\sum x^2 - (\sum x)^2} \times \sqrt{n\sum y^2 - (\sum y)^2}}$$

$$R_S = 1 - \frac{6 * \sum d^2}{n(n^2 - 1)}$$

Probability

$P(A \cap B) = P(A) + P(B) - P(A \cup B)$

$P(A \cap B) = P(A) * P(B)$

$$P(A/B) = \frac{P(A \cap B)}{P(B)}$$

$$P(x) = \frac{e^{-a} a^x}{x!}$$

$P(r) =\ _nC_r\, p^r q^{n-r}$

Other

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \qquad x_m = -\frac{b}{2a} \qquad a^m \times a^n = a^{m+n}$$

$$Log\,(M \times N) = Log\,M + Log\,N \qquad a^m \div a^n = a^{m-n} \qquad a^0 = 1$$

$$Log\left(\frac{M}{N}\right) = Log\,M - Log\,N \qquad (a^m)^n = a^{mn} \qquad a^{-m} = \frac{1}{a^m}$$

$$Log\,A^x = x\,Log\,A$$