University of Fort Hare

Together in Excellence

DEPARTMENT OF COMPUTATIONAL SCIENCES

STATISTICS DESCIPLINE

STA 111

DESCRIPTIVE STATISTICS AND DIFFERENTIATION

SUPPLEMENTARY EXAMINATION

MAY/JUNE 2025

TIME: 3 HOURS **MARKS : 100**

Internal Examiners

Mr L.Dlembula

Moderator

Ms. S Zungu

This paper consists of 8 pages including the cover pages

Instructions

Write neatly and legibly

Non-programmable Calculators may be used

Clearly show all your calculations

Question 1 [25 Marks]

1.1 Explain the difference between the following pairs of words used in statistics.

a) Permutation and Combination counting techniques
b) Census and Survey
c) Binomial distribution and Poisson distribution
d) Inferential statistics and Descriptive statistics
e) Random sample and Representative sample

[2 Marks x 5 = 10 Marks]

1.2 Select the most appropriate answer for each of the following questions

1.2.1. Which of the following represents descriptive statistics:

A. Evaluation of casual relationships.
B. Summarization of population data.
C. Prediction of future trends based on current data.
D. Testing a hypothesis for generalization.
E. None of the above

1.2.2. An arrangement of objects without regard to order is called a:

A. Permutation
B. Combination
C. Random experiment
D. Sample point.

1.2.3. Which of the following is **not** a requirement of a binomial distribution?

A. A constant probability of success
B. Only two possible outcomes
C. A fixed number of trials
D. Equally likely outcomes

[2 Marks x 3 = 6 Marks]

1.3 Let A = {x: x is a prime integer and $x \leq 30$}

a) Find n(A)

[3 Marks]

1.4 Roll a die $S = \{1,2,3,4,5,6\}$. Let $A = \{2,3,4,6\}$, $B = \{1,3,5\}$, $and\ C\{2,6\}$.

Determine:

a) $A \cap C$
b) $A \cap B$
c) $B \cap C$
d) $A \cup B$
e) $A \cup C$
f) $B \cup C$

[1 Mark x 6 = 6 Marks]

Question 2 [25 Marks]

The following data represents the ages for a sample of 100 industrial workers

Age (years)	Number of workers
18-22	10
23-27	30
28-32	35
33-37	20
38-42	05

2.1 Construct a fully labelled histogram for the above distribution

[8 Marks]

2.2 Compute the following for industrial workers:

a) Median age
b) First Quartile (Q_1) age
c) Modal age

[4 + 4 + 4 = 12 Marks]

2.3Consider the dataset provided below and answer the following questions

2 3 7 8 8 5 5 3 7 3

a) Find the harmonic mean and Geometric mean.

[5 Marks]

Question 3 [25 Marks]

3.1 How many different words can you build by re-arranging the words

a) Graph?

b) Book?

[1+2 = 3 Marks]

3.2 Ten boys are running a race. In how many ways can the first three places be filled if there are no dead heats?

[3 Marks]

3.3 The computer department of a large company assigns a personal code number to each employee in the form of a three-digit number, using digits 0 to 9 inclusive. Code numbers starting with zero are reserved for members of management only.

a) How many code numbers are available for non-management employees?

[3 Marks]

b) How many code numbers are available for all the employees?

[3 Marks]

3.4 A mixed Hockey team of 5 men and 6 women is to be chosen from 7 men and 9 women. In how many ways can this be done?

[3 Marks]

3.5 There are 5 mathematicians and 7 statisticians. A committee consisting of 2 mathematics and 3 statisticians is to be formed. In how many ways can this be done if:

a) Any mathematician and any statistician can be included.

[3 Marks]

3.6 Determine the number of 5 card combinations out of a deck of 52 cards, if there is exactly one ace in each combination.

[2 Marks]

3.7 A group consists of 4 girls and 7 boys. In how many ways can a team of 5 members be selected if a team has;

a) no girls

b) at least three girls.

[2+3 =5 Marks]

Question 4 [25 Marks]

4.1 The random variable X has the probability distribution given in the table below:

x	a	b	c
$P(X = x)$	$log_{32}\, a$	$log_{32}\, b$	$log_{32}\, c$

Where:

- $a, b, and\ c$ are distinct integers $a < b < c$
- all the probabilities are greater than zero

a) Find the values of $a, b, and\ c$ [6 Marks]

4.2 The 2010 United states Census found the chance of a household being a certain size. Size of Household are 1 2 3 4 5 6 7 and their Probabilities are 26.7% 33.6% 15.8% 13.7% 6.3% 2.4% 1.5%.

a) Construct a probability distribution table using the above information.

b) Compute the probability that a household has exactly 3 people.

[3+2 = 5]

4.3 A manufacturer produces a light-bulbs that are packed into boxes of 100. If quality control studies indicate that 0.5% of the light-bulbs produced are defective, what percentage of the boxes will contain.

a) no defective?

[3 Marks]

b) 2 or more defectives?

[3 Marks]

c) Find variance and standard deviation.

[2 Marks]

4.5 80% people who purchase pet insurance are women. If 9 pet insurance owners are randomly selected, find the probability that exactly 6 are women.

[3 Marks]

4.6 60% of people who purchase sports cars are men. If 10 sports car owners are randomly selected, find the probability that exactly 7 are men.

[3 Marks]

FORMULA SHEET

$$\bar{x} = \frac{\sum x}{n}$$

$$\bar{x} = \frac{\sum mf}{n}$$

$$\mu = \frac{\sum x}{N}$$

$$\mu = \frac{\sum mf}{N}$$

$$s^2 = \frac{\sum (x - x)^2}{n-1} = \frac{\sum x^2 - \frac{(\sum x)^2}{n}}{n-1}$$

$$s^2 = \frac{\sum m^2 f - \frac{(\sum mf)^2}{n}}{n-1}$$

$$\sigma^2 = \frac{\sum (x-\mu)^2}{N} = \frac{\sum x^2 - \frac{(\sum x)^2}{N}}{N}$$

$$\sigma^2 = \frac{\sum m^2 f - \frac{(\sum mf)^2}{N}}{N}$$

$$L + \left[\frac{\frac{n}{2} - pcf}{f}\right] \times i$$

$$L + \left[\frac{\frac{jn}{4} - pcf}{f}\right] \times i \qquad j = 1, 2, 3$$

$$L + \left[\frac{\frac{kn}{100} - pcf}{f}\right] \times i \qquad j = 1, 2, 3, \ldots\ldots, 99$$

$$L + \left[\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right] \times i$$

$$Z = \frac{X - \mu}{\sigma}$$

$$SS_{xy} = \sum XY - \frac{(\sum X)(\sum Y)}{n}$$

$$SS_{xx} = \sum X^2 - \frac{(\sum X)^2}{n}$$

$$SS_{yy} = \sum Y^2 - \frac{(\sum Y)^2}{n}$$

$$10^{\left(\frac{\sum \log x}{n}\right)}$$

$$10^{\left(\frac{\sum f \log x}{n}\right)}$$

$$\left(\prod_{i=1}^{n} x_i\right)^{1/n} = \sqrt[n]{x_1, x_2, x_3, \ldots, x_n}$$

$$\frac{n}{\sum_{i=1}^{n} \frac{1}{x_i}}$$

$$\frac{n}{\sum_{i=1}^{n} \left(f_i \times \frac{1}{x_i}\right)}$$

$${}^{n}P_r = \frac{n!}{(n-r)!}$$

$${}^{n}C_r = \frac{n!}{(n-r)!r!}$$

$P(X) = \frac{n!}{(n-x)!x!} p^x q^{n-x}$

$0,1,2,\dots,n \quad \lambda > 0$

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

$\mu = E(X) = np$

$Var(X) = npq$

$\mu = E(X) = \lambda$

$Var(X) = \lambda$

$\mu = E(X) = \sum xp(x)$

$Var(X) = \sum x^2 P(x) - \mu^2$