PROJECT REPORT

METRICSTICS (DELIVERABLE - 1)

Prepared By

Sharanyu Pillai(40227794)
Wei Qi(40198872)
Anitha Ramakrishnan(40231724)
Arshiya Sahni(xxx)
Vinay Sahrawat(40220936)

Under the Guidance of
Prof. Pankaj Kamthan

Submitted at
CONCORDIA UNIVERSITY

Github:
`https://github.com/WeiQi5588/SOEN-6611`
By Team M

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Introduction

There has been a growing recognition of the pivotal role that descriptive statistics play in data analysis. Descriptive statistics provide a quantitative framework for characterizing the features of a dataset. By employing measures of central tendency, frequency distributions, and variability, descriptive statistics offer valuable insights into the underlying structure and patterns within the data, laying the groundwork for further analysis and interpretation. In this context, we consider a random variable denoted as x, which draws values from a finite dataset x1, x2, x3, ..., xn, where each value carries an equal probability. Within this framework, we introduce the concepts of minimum (m) and maximum (M), representing the smallest and largest values in the dataset, respectively. Additionally, we identify the mode (o) as the value with the highest frequency. For measures of central location, we introduce the median (d), which represents the middle value when the dataset size is odd, and the arithmetic mean when it is even.

1.1 System Information

A key system is being developed as part of the development of the Logistics and Supply Chain Analytics Solution, known as "METRICSTICS," to conduct a thorough study of logistics and supply chain performance. This system will examine statistical analyses of logistical data with the goal of giving the logistics management team the tools they need to efficiently track trends in logistics operations over time. It will enable thorough examinations of historical records in the logistics and supply chain area, enabling well-informed decision-making based on the priceless insights gained. Professionals in logistics, such as Warehouse Manager, Logistics Managers, Inventory managers and Procurement Managers, make up the majority of "METRICSTICS"'s stakeholders and will gain the most from the insights and features this analytics solution provides.

1.2 Assumptions

The project has the following assumptions:

1. **Random Variables and Data Set**

   - The system operates on random variables that can take values from a finite data set $x_1, x_2, x_3, \ldots, x_n$ with each value having the same probability.

2. **Probability Distribution:**

   - The probability distribution of the random variable is assumed to be uniform, as each value in the data set has the same probability.

3. **Uniqueness of Minimum and Maximum:**

   - The probability distribution of the random variable is assumed to be uniform, as each value in the data set has the same probability.

4. **Uniqueness of Mode:**

   - The mode o may not be unique. There can be multiple modes if multiple values occur with the highest frequency.

5. **Calculation of Median for Even n:**

   - When the number of observations (n) is even, the median d is calculated as the arithmetic mean of the two middle values.

6. **Calculation of Standard Deviation:**

   - The standard deviation (σ) is calculated based on the squared differences between each observation and the arithmetic mean.

7. **Accuracy of Data:**

   - It is assumed that the data provided to the system is accurate and free from errors.

8. **Input Data Source:**

   - The system can accept data from different sources, including real-world data from authoritative sources or artificially generated data from a random data generator.

1.3 Constraints

The project has some potential constraints:

1. **Computational Resources:**
    - The system's performance may be limited by the available computational resources, such as processing power, memory, and storage.
2. **Input Data Quality:**
    - The accuracy and reliability of the descriptive statistics may be affected by the quality and integrity of the input data. Inaccurate or incomplete data may lead to unreliable results.
3. **Data Size:**
    - The system may face limitations in processing very large datasets, potentially leading to longer processing times or resource constraints.
4. **Statistical Assumptions:**
    - The accuracy of the descriptive statistics relies on the validity of certain statistical assumptions, such as the assumption of a uniform probability distribution for the data.
5. **Output Interpretation:**
    - Users must be able to interpret the descriptive statistics correctly to derive meaningful insights from the results. Inadequate understanding may lead to misinterpretation.

Problem 1: Goal-Question-Metric

2.1 Goal

Purpose
To conduct a comprehensive analysis of historical logistics and supply chain data to gain a deep understanding of the trends and patterns that have evolved over time.

Perspective
Assess the historical logistics and supply chain data from the viewpoint of logistics and supply chain management.

Environment
Within the context of developing the Logistics and Supply Chain Analytics Solution (METRICSTICS).

2.2 SMART Principles

The goal is considered SMART (Specific, Measurable, Attainable, Realistic, and Timely) for the following reasons:

- **Specific:** The METRICSTICS program is particularly specific in that it specifically defines the goal of examining historical logistics and supply chain data to get a thorough understanding of trends and patterns within the area. This focus enables us to give specific and meaningful information to logistics and supply chain managers, allowing informed decision-making.
- **Measurable:** The project's success is measurable through the formulation of key performance indicators and questions. These indicators could include measures of annual logistics cost reduction, inventory turnover rates, on-time delivery performance, and supply chain cycle time reduction. We can assess the influence of METRICSTICS by quantifying these aspects.

- **Attainable:** The aim is Attainable, as the application of METRICSTICS allows for the examination of past logistics and supply chain data. METRICSTICS equips logistics professionals with the necessary tools and infrastructure to collect, process, and analyze pertinent data, ultimately providing them with important insights.

- **Realistic:** The goal of METRICSTICS is realistic in relation to the jobs and responsibilities of logistics and supply chain management. It allows them to obtain a thorough understanding of previous performance, optimize logistics and supply chain strategies, and set realistic goals for future improvements. As a result, METRICSTICS skills are perfectly aligned with the requirements of logistics experts.

- **Timely:** The project is Timely since it focuses on the study of historical logistics and supply chain data spanning certain time periods, ensuring a well-defined timeframe for completing analyses. This approach ensures that we stay on track to achieve our goal within the designated timeframe and budget.

In brief, METRICSTICS follows the SMART principles of being Specific, Measurable, Attainable, Realistic, and Timely. These criteria lead our efforts to provide an analytics solution that is well-defined, quantifiable, realistic, applicable, and time-bound for logistics and supply chain professionals.

2.3 Question And Metric

- **Question 1:** What is the average lead time for procurement of raw materials on a monthly and quarterly basis?

  Metric:

  M1. Average monthly lead time

  M2. Average quarterly lead time

  Mechanism:

  i.Owner = Procurement Managers

  ii.Frequency Collected = Following procurement data entry

  iii.Frequency Reported = Monthly and Quarterly

- **Question 2:** What is the percentage change in shipping costs for each shipping method, both monthly and quarterly?

  Metric:

M3. Maximum monthly shipping cost increase percentage

M4. Minimum monthly shipping cost decrease percentage

M5. Maximum quarterly shipping cost increase percentage

M6. Minimum quarterly shipping cost decrease percentage

Mechanism:

i.Owner = Logistics Managers

ii.Frequency Collected = Following shipping cost data update

iii.Frequency Reported = Monthly and Quarterly

- **Question 3:** How do we identify fluctuations in warehouse storage space utilization on a monthly and quarterly basis?

Metric:

M7. Calculate the Monthly Average Storage Utilization Rate

M8. Calculate the Quarterly Average Storage Utilization Rate

Mechanism:

i.Owner = Warehouse Managers

ii.Frequency Collected = Following warehouse storage data analysis

iii.Frequency Reported = Monthly and Quarterly

- **Question 4:** Which month and quarter experienced the most significant inventory turnover rate change over the year?

Metric:

M9. Standard deviation of monthly inventory turnover rates

Mechanism:

i.Owner = Inventory Managers

ii.Frequency Collected = Following inventory turnover rate analysis

iii.Frequency Reported = Monthly and Quarterly

- **Question 5:** Which month and quarter experienced the most significant supplier delivery time changes over the year?

Metric:

M10. Standard deviation of monthly supplier delivery times

Mechanism:

i.Owner = Procurement Managers

ii.Frequency Collected = Following supplier delivery time analysis

iii.Frequency Reported = Monthly and Quarterly

- **Question 6:** How can we identify the top 10 suppliers with the most consistent on-time deliveries on a monthly and quarterly basis?

  Metric:

  M11. Count the number of times each supplier has on-time deliveries in a month and quarter

  M12. Sort suppliers by their on-time delivery frequency

  Mechanism:

  i.Owner = Procurement Managers

  ii.Frequency Collected = Following supplier performance data collection

  iii.Frequency Reported = Monthly and Quarterly

- **Question 7:** What is the most commonly used transportation route for shipments on a monthly basis?

  Metric:

  M13. Count the number of shipments on each route in a month and find the route with the highest count.

  Mechanism:

  i.Owner = Logistics Managers

  ii.Frequency Collected = Following shipment data analysis

  iii.Frequency Reported = Monthly

- **Question 8:** In which region do we experience the highest number of shipping delays on a yearly basis?

  Metric:

  M14. Count the number of shipping delays by region for the entire year and find the region with the highest count.

  Mechanism:

  i.Owner = Logistics Managers

  ii.Frequency Collected = Following yearly shipping delay analysis

  iii.Frequency Reported = Yearly

- **Question 9:** How can we determine the day of the year with the highest order fulfillment activity?

Metric:

M15. Count the number of order fulfillments each day in a year and find the day with the highest count.

Mechanism:

i.Owner = Warehouse Managers

ii.Frequency Collected = Following yearly order fulfillment analysis

iii.Frequency Reported = Yearly

- **Question 10:** What is the average transit time for shipped products for each carrier on a monthly and quarterly basis?

Metric:

M16. Average monthly transit time by carrier

M17. Average quarterly transit time by carrier

Mechanism:

i.Owner = Logistics Managers

ii.Frequency Collected = Following shipping data entry

iii.Frequency Reported = Monthly and Quarterly

Problem 2: Use Case Model

3.1 Use Case Diagram

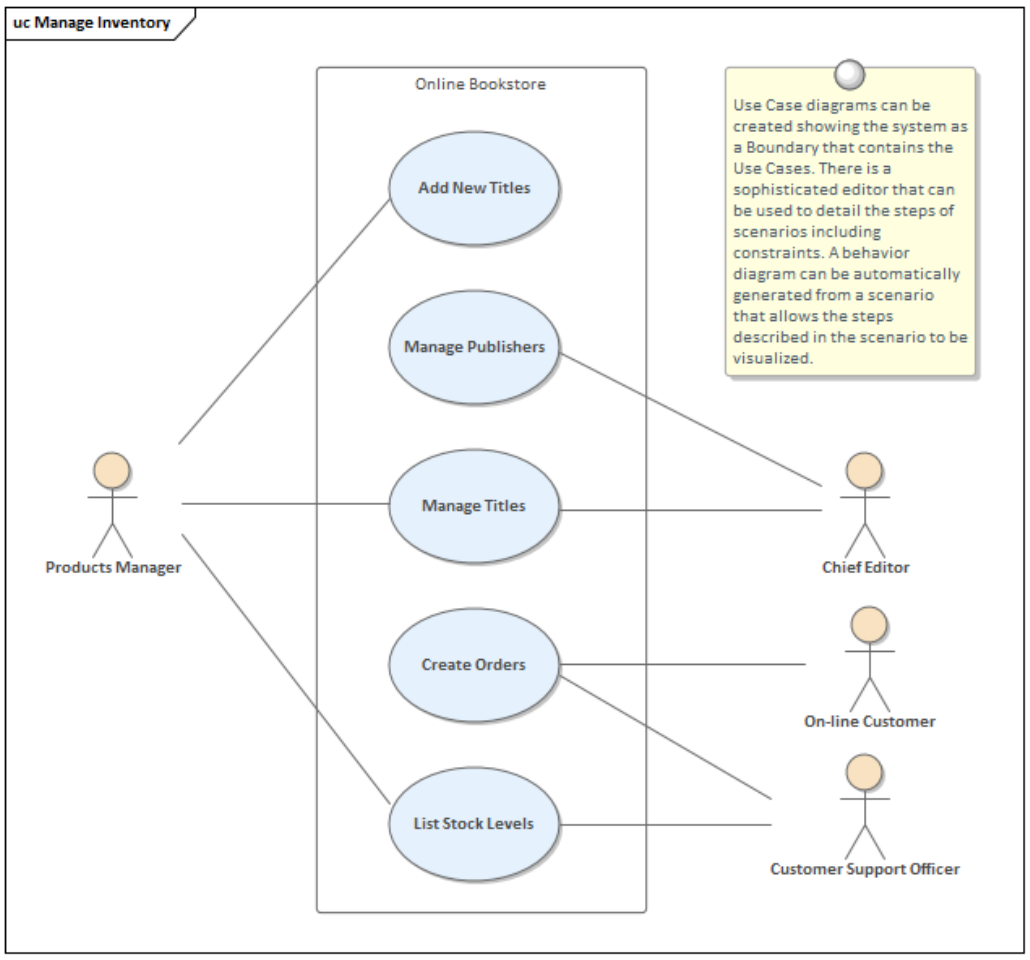

Figure 3.1: Use Case Model

3.2 Use Cases

Use Case ID	UC-1
Use Case Name	Log in to the System
Primary Actors	• Sales Representative • Sales Manager
Priority	High
Description	User can login into the System.
Pre-conditions	• User has a valid account on the system • Sales Manager
Post-conditions	• User logged in successfully • Sales Manager
Normal Flow	1. User open the login page of the system 2. User open the login page of the system 3. User open the login page of the system 4. User open the login page of the system 5. User open the login page of the system