SOEN 6011 (Software Engineering Processes)

Eternity - σ (Standard Deviation function)

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1 Introduction

This document presents a detailed Software Requirements Specification (SRS) for the standard deviation function, following the ISO/IEC/IEEE 29148 Standard as per the course guidelines. The standard deviation function is denoted as :

$$\sigma = \sqrt{(\frac{1}{N}\sum_{i=1}^{N}(x_i - \mu)^2)}$$

2 Scope

The software to be designed will compute the standard deviation of a set of real numbers (possibly array of ints/floats) in Java Programming Language. The software will be used in scientific computing applications.

3 Definitions, Acronyms, and Abbreviations

- **SRS:** Software Requirements Specification

- σ**:** Standard deviation function

4 Functional Requirements

4.1 Input Requirements

- **FR1:** The function must accept a list of real numbers as input.

- **FR2:** The function must validate the input to ensure it is a list of real numbers.

4.2 Processing Requirements

- **FR3:** The function must calculate the mean of the input numbers.

- **FR4:** The function must calculate the variance of the input numbers using the formula:

$$\sigma^2 = \frac{1}{N}\sum_{i=1}^{N}(x_i - \mu)^2$$

where N is the number of input numbers, x_i is an input number, and μ is the mean of the input numbers.

4.3   Output Requirements

- **FR5:** The function must calculate the standard deviation by taking the square root of the variance.

- **FR6:** The function must return the standard deviation as a real number.

5   Non-Functional Requirements

- **NFR1:** The function must handle large lists of numbers efficiently.

- **NFR2:** The function must return accurate results up to a reasonable precision.

- **NFR3:** The function must provide error messages for invalid inputs.

6   Assumptions and Dependencies

- **A1:** It is assumed that the input list is not empty.

- **A2:** It is assumed that the input numbers are real numbers.

7   Algorithm for Standard Deviation Calculation

1. Initialize a variable 'sum' to 0.

2. For each number 'x' in the list of numbers:

   - Add 'x' to 'sum'.

3. Calculate the mean 'mu' (μ) by dividing 'sum' by the number of elements 'N' in the list (N is assumed to be greater than 0).

4. Initialize a variable 'varianceSum' to 0.

5. For each number 'x' in the list of numbers:

   - Subtract 'mu' from 'x' to get 'diff'.
   - Square 'diff' to get 'squaredDiff'.
   - Add 'squaredDiff' to 'varianceSum'.

6. Calculate the variance by dividing 'varianceSum' by 'N'.

7. Calculate the standard deviation 'sigma' by taking the square root of the variance.

8 References

- ISO/IEC/IEEE 29148:2018 - Systems and software engineering – Life cycle processes – Requirements engineering.

- Standard deviation (2024) Wikipedia. Available at: `https://en.wikipedia.org/wiki/Standard_deviation` (Accessed: 04 July 2024).