ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)
Department of Computer Science and Engineering (CSE)

CSE 4108: Structured Programming I Lab
Lab 8, Section 2A

Objectives

- 1-dimensional Arrays

- Iteration Statements

Guidelines

- All source codes (.c files) in the naming format `ID_Lab8_TaskN.c`, eg. `230041101_Lab8_Task1.c`.

- Ensure that your program produces the correct output for all sample cases.

- Source codes must be properly indented

- Screenshots are not required.

- Throughout the rest of the semester, try to regularly solve problems and participate in contests on online judges such as *Codeforces*, *Codechef*, *Atcoder*.

Task 1 — Second Fiddle

You are a lead developer for the video game company *Valve*, and are working on their critically acclaimed game *DotA 2*.

The developers think that the highest-level heroes are becoming too strong. To evaluate this claim, you you need to analyze the strength of the second-highest level hero.

Your task is to write a C program that takes an integer N representing the number of heroes and then takes N levels as input. The program should find and print the second largest level among these heroes.

Definitions

Second Largest Level: This is the level that is immediately smaller than the highest level in the list. If all heroes have the same level, there is no second largest level.

Sample Execution(s)

Input 1

```
Enter the number of heroes: 5
Enter the levels of heroes: 8 12 7 15 10
```

Output 1

```
Second Largest Level: 12
```

Input 2

```
Enter the number of heroes: 3
Enter the levels of heroes: 5 5 5
```

Output 2

```
Second Largest Level: None
```

Task 2 — Outlier

The developers now believe that the games have become unbalanced - some hero levels are deviating too far from the norm.

Your task is to write a C program that takes an integer N representing the number of heroes and then takes N levels as input. The program should calculate and print

- The **mean** of all levels.

- The **standard deviation** of all levels.

- Any **outliers** based on the 95% confidence interval.

Definitions

Mean (μ): The average level, calculated as the sum of all hero levels divided by the number of heroes, N.

Standard Deviation (σ): A quantity expressing by how much the members of a group differ from the mean value for the group. The formula for standard deviation is:

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

where N is the number of heroes, x_i represents each hero's level, and μ is the mean of the levels.

95% Confidence Interval: For data with mean μ and variance σ^2, the 95% confidence interval is defined as $\mu \pm 2 \times \sigma$.

A 95% confidence interval (CI) is a range of values that is calculated from a sample and contains the true population mean 95% of the time. It's a common term in experimentation and is used to indicate how precise a measurement is.

Outliers: Any level that falls outside the range of $\mu - 2 \times \sigma$ to $\mu + 2 \times \sigma$ is considered an outlier. These levels are significantly higher or lower than the typical levels, indicating unusual strengths or weaknesses among the heroes.

Sample Execution(s)

Input 1

```
Enter the number of heroes: 6
Enter the levels of heroes: 10 12 15 18 20 50
```

Output 1

```
Mean Level: 20.83
Standard Deviation: 13.47
Outliers: 50
```

Input 2

```
Enter the number of heroes: 10
Enter the levels of heroes: 1 50 51 52 53 54 55 56 57 100
```

Output 2

```
Mean Level: 52.90
Standard Deviation: 22.26
Outliers: 1 100
```