

UNIVERSITY OF SCIENCE AND TECHNOLOGY OF HANOI

MASTER ICT

## MI1.07 –SOFTWARE DEVELOPMENT PROJECT

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GROUP PROJECT – REPORT

Project REDUCE Manual

The aim of this documentation is to deliver instructions to the user of our Software Development Project – the REDUCE algorithm.

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# Chapter 1

## Software Overview

### 1.1 Goals

Reduce is a parallel design pattern that consists of compute a value from a set of values. One big problem here is linked to the floating point representation of real numbers. Indeed, it is well-known that the sum of several floats is rarely correct!

**For example:** Consider 2 arrays of float number

$A = \{1.000000000, 2.000000000, 3.000000000\},$

$B = \{3.000000000, 2.000000000, 1.000000000\}.$

Let's take sum of all elements inside each array. We may obtain  $res\_A = 6.000000001$  and  $res\_B = 5.999999999$ . These 2 results are not exactly the same!

In order to retrieve a “good” approximation of the result, many algorithms may be proposed.

The goal of this project is to compare some of those algorithms, in quality and complexity, respectively.

### 1.2 Constraints

- The project must be written in C++ and Qt.
- The user should be able to access saved-experiments-result files.

## Chapter 2

### Software Manual

#### 2.1 Graphical User Interface

The software GUI contains 3 main regions. They are corresponding to Progress tracking, Main input interface and Output box in succession.

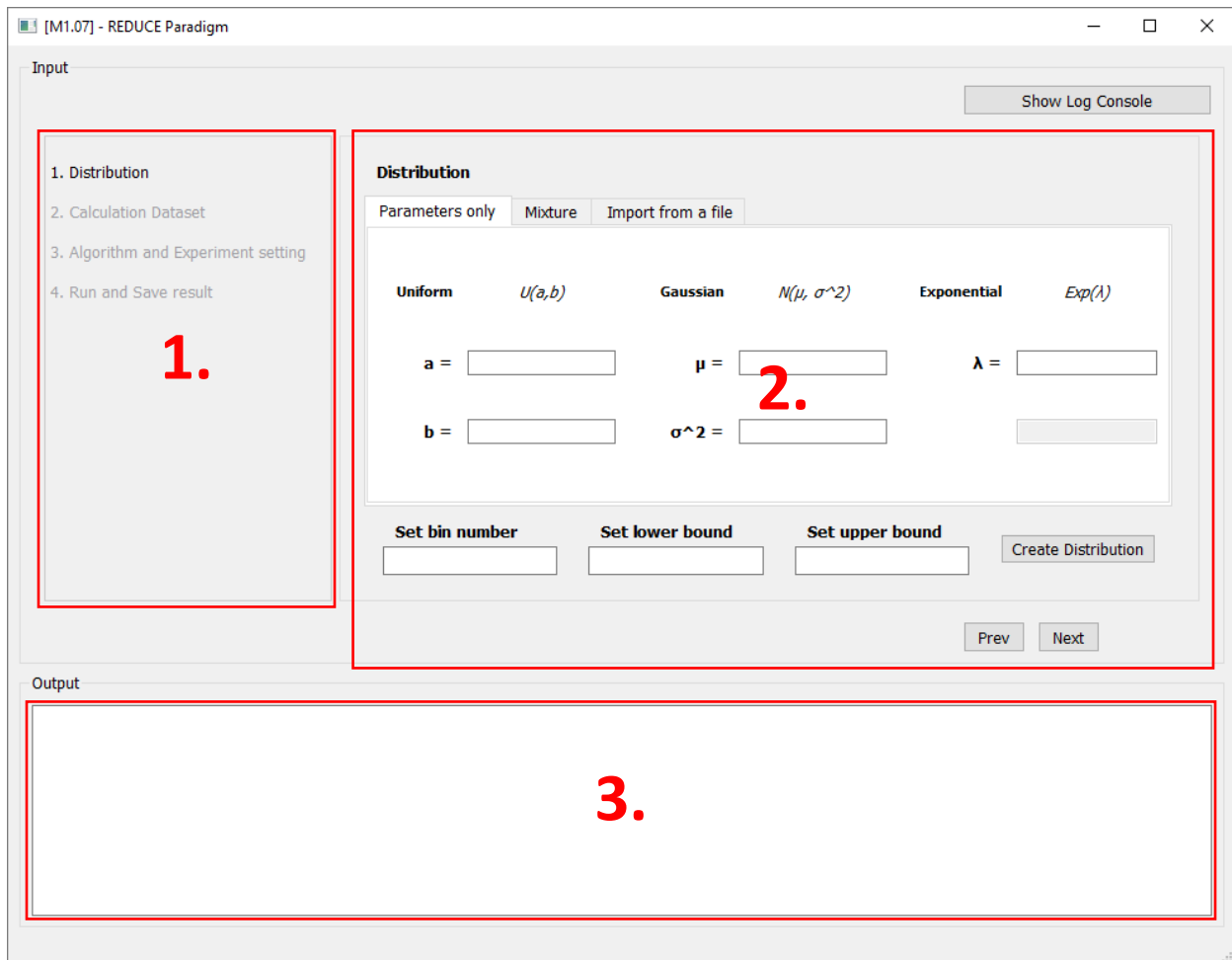


Figure 1: Project GUI – Overview

## 2.2 Detail features

### Region 1: Progress tracking

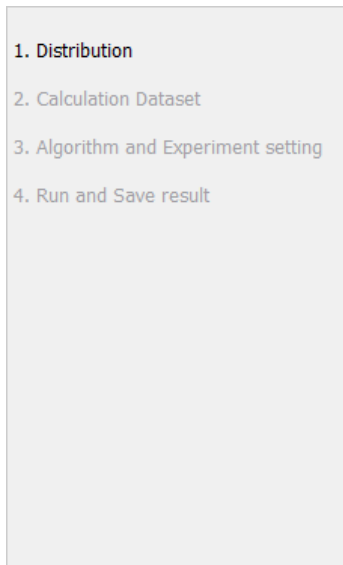


Figure 2: Project GUI – Progress tracking

This region will automatically highlight the current task in the workflow. It ensures that the user know what is going on.

## Region 2: Main input interface

### Region 2.1: Set Distribution

1. Input distribution options

**Distribution**

Parameters only   Mixture   Import from a file

**Uniform**    $U(a, b)$    **Gaussian**    $N(\mu, \sigma^2)$    **Exponential**    $E(\lambda)$

**a** =     **$\mu$**  =     **$\lambda$**  =

**b** =     **$\sigma^2$**  =   

2. Set Parameters

**Set bin number**   **Set lower bound**   **Set upper bound**   **Create Distribution**

3. General distribution settings

4. Create distribution

Figure 3: Project GUI – Set Distribution area

- The very first step is to select the most proper input options (see 1. Input distribution options above). There are 3 ways to setup distribution:

+ Parameters only: The user needs to type in the parameters. The system then parse those parameters to form a distribution.

Choose this option for a distribution such as  $U(a, b) + N(\mu, \sigma^2) + \text{Exp}(\lambda)$ .

+ Mixture: The user can type in an equation of distribution. The system then parse the string to form a distribution.

Choose this option for a complex mixture of distribution such as

$$(U(a, b) + N(\mu_1, \sigma_1^2)) * (N(\mu_2, \sigma_2^2) + E(\lambda))$$

+ Note: only parentheses "(" and ")" are supported

+ Import from a file: The user can select a text file which contains strings of distribution.

Choose this option to import complex mixture of distributions from a text file such as  
 $((U(a, b) + N(\mu_1, \sigma_1^2)) * N(\mu_2, \sigma_2^2)) + E(\lambda_1) + E(\lambda_2)$

- After setup distribution, it's time to establish bin number (the higher bin number, the higher precision), then Lower and Upper bound (measurement range).
- Click Next button to go to the next task.

**\* Note: If uniform distribution is used, then a, b must be inside lower bound → upper bound range.**



## Region 2.2: Set Calculation Dataset

1. Choose Data Type      2. Set Number of data

**Data Type**  
Array

**Number of data**

**Calculation dataset**  
Generated randomly    Import from a file    3. Get dataset options

**Save file setting**

Generate!    Save to    Browse    Save

4. Generate dataset      5. Browse Save Dir      6. Save dataset

Prev    Next

The image shows a software interface for setting calculation datasets. It has a light gray background. At the top, there are two main sections: 'Data Type' and 'Number of data'. 'Data Type' is a dropdown menu currently showing 'Array'. 'Number of data' is an empty text input field. Below these is the 'Calculation dataset' section, which contains two tabs: 'Generated randomly' (selected) and 'Import from a file'. To the right of the 'Import from a file' tab is a label '3. Get dataset options'. Below the tabs is a large white rectangular area titled 'Save file setting'. Inside this area, on the left, is a 'Generate!' button with a red arrow pointing to it from the label '4. Generate dataset'. In the center is a 'Save to' label followed by an empty text input field. To the right of this input field is a 'Browse' button with a red arrow pointing to it from the label '5. Browse Save Dir'. Further right is a 'Save' button with a red arrow pointing to it from the label '6. Save dataset'. At the bottom right of the main interface area are two buttons: 'Prev' and 'Next'. Red arrows from the numbered labels point to the corresponding UI elements.

Figure 4: Project GUI – Set Calculation Dataset area

- Click Next button to go to the next task.
- Click Prev button to go to the previous task.

### Region 2.3: Set Experiment setting and Choose Algorithm

1. Choose Operation

2. Set Number of test

3. Shuffle/Generate

3. Get dataset options

3. Shuffle/Generate

4. Set Precision type

5. Add a current algorithm in Algorithm List or Remove one in Selected Algorithm

**Experiment setting**

**Operation**

Sum

**Number of test**

**Shuffle/Generate**

☐ Generate new

**Precision**

PDOUBLE

**Algorithm**

**Algorithm List**

LINEAR

**Selected Algorithm**

Prev Next

Figure 5: Project GUI – Set Experiment setting and Choose Algorithm area

- Click Next button to go to the next task.
- Click Prev button to go to the previous task.

### Region 2.4: Run and Save Experiment

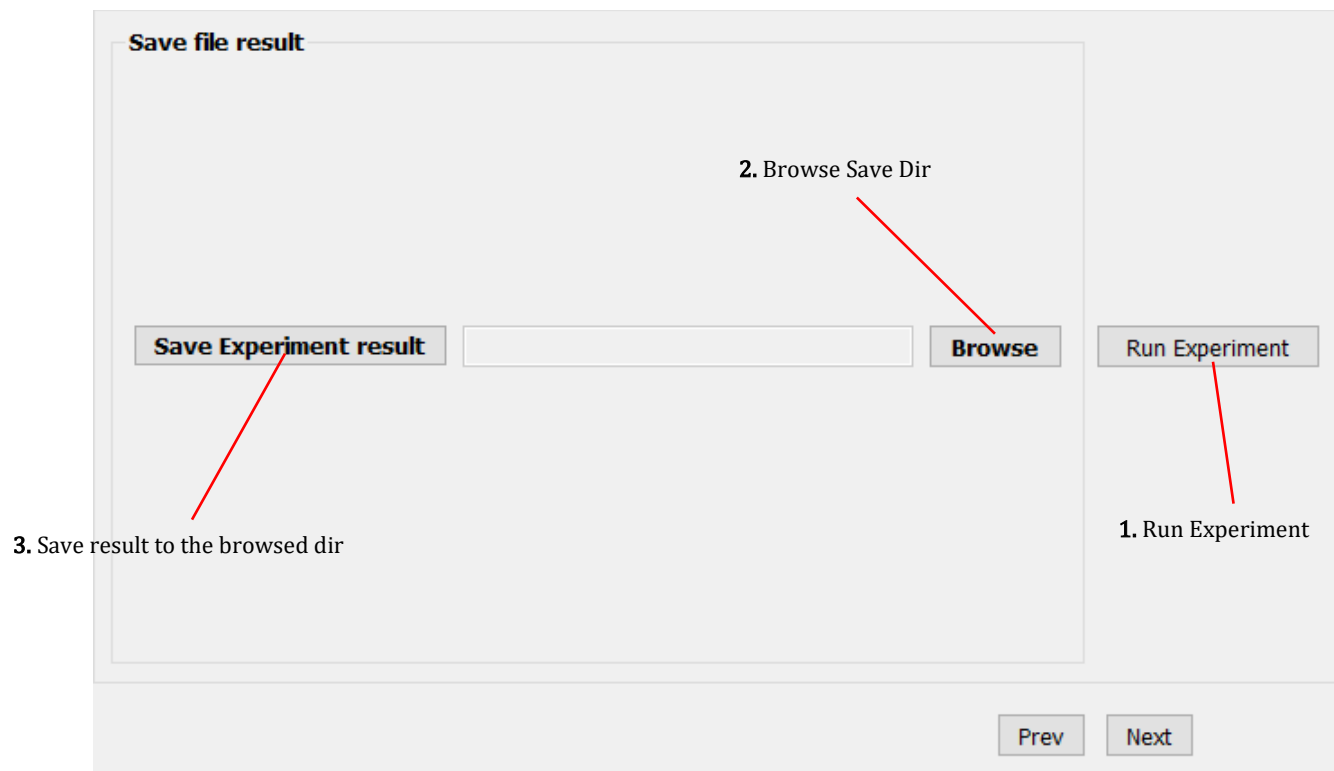


Figure 6: Project GUI – Run and Save Experiment area

- Click Prev button to go to the previous task.

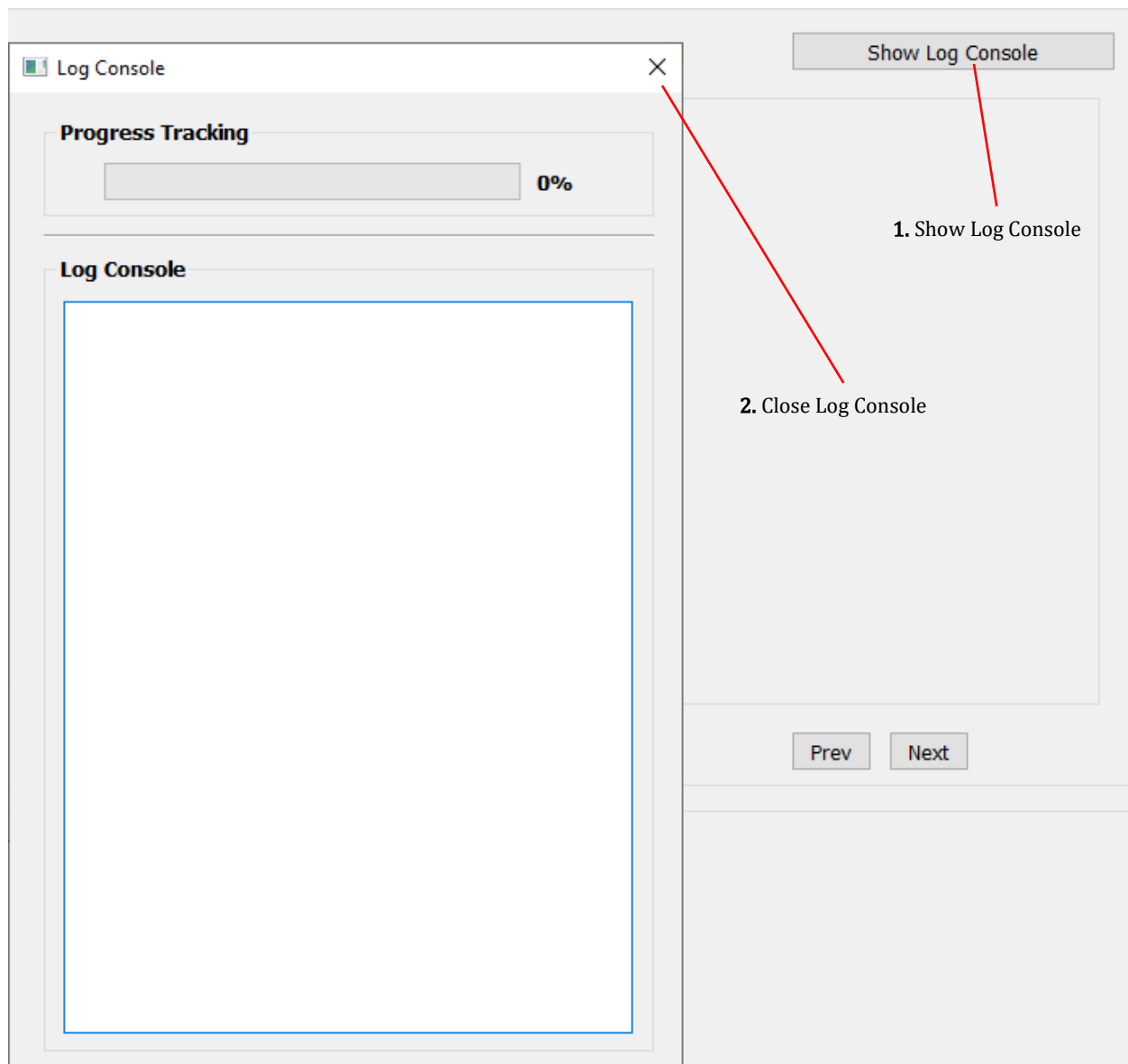


Figure 7: Project GUI – Show Log Console option

### Region 3: Output box



Figure 8: Project GUI – Output box

This region displays the result of the finished experiment(s).