ISIT312 Big Data Management
Singapore 2023-2
Assignment 1

Scope

The objectives of Assignment 1 include the implementation of HDFS applications, the implementation of simple MapReduce applications, and describing an implementation of complex MapReduce applications.

This assignment is due on **Sunday, 30 April 2023, 8:00 pm** Singaporean Time (SGT).

This assignment is worth **10%** of the total evaluation in the subject.

The assignment consists of 3 tasks and the specification of each task starts from a new page.

Only electronic submission through Moodle at:
`https://moodle.uowplatform.edu.au/login/index.php`
will be accepted. A submission procedure is explained at the end of the Assignment 1 specification.

A policy regarding late submissions is included in the subject outline. Only one submission of Assignment 1 is allowed and only one submission per student is accepted.

A late submission penalty (25% of the total mark) will be applied for every 24 hours late.

A submission that contains an incorrect file attached is treated as a correct submission with all consequences coming from the evaluation of the file attached.

All files left on Moodle in a state `"Draft(not submitted)"` <u>will NOT be evaluated</u>.

An implementation that does not compile well due to one or more syntactical and/or run time errors scores no marks.

The first assignment is an **individual assignment** and it is expected that all its tasks will be solved **individually without any cooperation** with the other students. However, it is allowed to declare in the submission comments that a particular component or task of this assignment has been implemented in cooperation with another student. In such a case evaluation of a task or component may be shared with another student. In all other cases plagiarism will result in a **<u>FAIL</u>** grade being recorded for entire assignment. If you have any doubts, questions, etc. please consult your lecturer or tutor during laboratory/tutorial classes or over e-mail.

Task 1 (2 marks)
Implementation of HDFS application

Implement in Java HDFS application, that can be used to move a file from one location in HDFS into another location in HDSF.

The application must have the following two parameters.
(1) A path to and a name of a file to be moved from.
(2) A path to and a new name of the file to be moved to.

Perform the following steps.

(1) Implement the application and save its source code in `.java` file. The name of the file is up to you.

(2) Compile the Java source code and create a `jar` file.

(3) Upload to HDFS a small text file for the purpose of future testing. The name and location of the file in HDFS are up to you.

(4) Use Hadoop to process your application that moves a file on HDFS from one location to the other.

(5) Use Hadoop to provide evidence that the file earlier uploaded to HDSF has been successfully moved.

Deliverables
A file `solution1.java` with a source code of the application that moves a file in HDFS.
A file `solution1.pdf` that contains the contents of Terminal window with a report from compilation, creation of jar file, uploading to HDFS two small files for testing, processing of the application, and evidence that a file uploaded into HDFS has been successfully moved to another location in HDFS.

Task 2 (4 marks)
Implementation of MapReduce application

Assume, that The Bureau of Meteorology records total yearly rainfall in a number of cities located in different states. The measurements are recorded in a text file, that contains data from a period of the last year.

For example, a sample file with the recorded amounts of rainfall could be the following. The first column contains a name of a state, the second column contains a name of a city in a state and the third column contains the total rainfall depth per year measured in mm.

```
Queensland          Gold Coast 25
Victoria            Melbourne  125
Victoria            Geelong    90
Victoria            Wodonga    10
NSW                 Lismore    900
Queensland          Brisbane   50
South Australia     Adelaide   300
Western Australia Perth        200
Western Australia Albany       200
Western Australia Broome       10
```

Your task is to implement a MapReduce application, that finds the total rainfall in each state, the largest rainfall in one location in each state and the smallest rainfall in one location in each state.

For example, your application should generate the following outputs when processing the data listed above.

```
Queensland          75  50  25
Victoria            225 125 10
NSW                 900 900 900
South Australia     300 300 300
Western Australia 410 200 10
```

An input file with the speed measurement must include 10 lines listed above and it must contain at least 10 other measurements. All additional measurements are up to you.

Save your solution in a file `solution2.java`. When ready, compile, create `jar` file, and process your application. Display the results created by the application. Next, list your input file with the speed measurements. When finished, Copy and Paste the messages from a Terminal screen into a file `solution2.pdf`.

Deliverables
A file `solution2.java` with a source code of the application that implement the functionality of `SELECT` statement given above. A file `solution2.pdf` with a report from compilation, creating `jar` file, processing, displaying the results of processing `solution2.java`, and listing of your input file with the rainfall measurements.

Task 3 (4 marks)
Implementation of MapReduce application

Consider a classical MapReduce application that counts the total number of occurrences of words in a given text. For example, look at `WordCount` application `WordCount.java`.

Assume the following classification of words depending on the length of each word.

```
very short: 1 <= length <= 3
short:      4 <= length <= 5
medium:     6 <= length <= 8
long:       9 <= length <= 12
X long:    13 <= length <= 15
XX long:   16 <= length
```

Extend Java code of the application such that it counts in a given text the total number of words in each category. For example, the distribution of words in a text that consists of 90 words could be the following.

```
X short:    10 words
short:      15 words
medium:     35 words
long:       20 words
X long:     10 words
XX long:     0 words
```

Save your solution in a file `solution3.java`.

When ready, compile, create `jar` file, and process your application. To test your application, you can use a file `grep.txt` included. Display the results created by the application. When finished, Copy and Paste the messages from a Terminal screen into a file `solution3.pdf`.

Deliverables
A file `solution3.java` with a source code of the application counts in a given text file the total number of words in each category. A file `solution3.pdf` with a report from compilation, creating `jar` file, processing, and displaying the results of processing `solution3.java`.

<u>Submission of Assignment 1</u>

Note, that you have only one submission. So, make absolutely sure that you submit the correct files with the correct contents. Please submit an Academic Consideration in SOLS if an extension (1 week maximally) is required.

Please combine the files **solution1.pdf, solution2.pdf, and solution3.pdf** as a single pdf (**solutions.pdf**) first, then zip the files **solutions.pdf, solution1.java, solution2.java, and solution3.java** into a single zipped file (**A1-solutions.zip**). Please submit the zipped file through Moodle in the following way:

(1) Access Moodle at **http://moodle.uowplatform.edu.au/**
(2) To login use a **Login** link located in the right upper corner the Web page or in the middle of the bottom of the Web page
(3) When logged select a site **ISIT312 (SP223) Big Data Management**
(4) Scroll down to a section **SUBMISSIONS**
(5) Click at **Assignment 1** link.
(6) Click at a button **Add Submission**
(7) Move the zipped file **A1-solutions.zip** into an area **You can drag and drop files here to add them**. You can also use a link **Add**…
(9) Click at a button **Save changes**
(10) Click at a button **Submit assignment**
(11) Click at the checkbox with a text attached: **By checking this box, I confirm that this submission is my own work,** … in order to confirm authorship of your submission.
(12) Click at a button **Continue**

End of specification