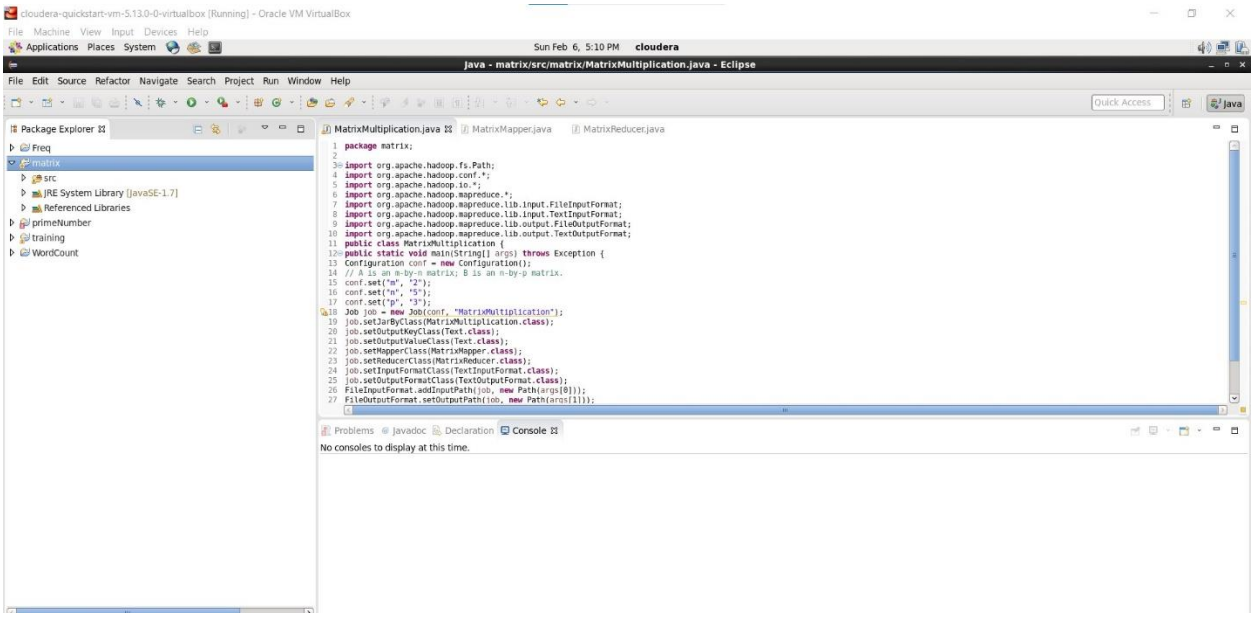
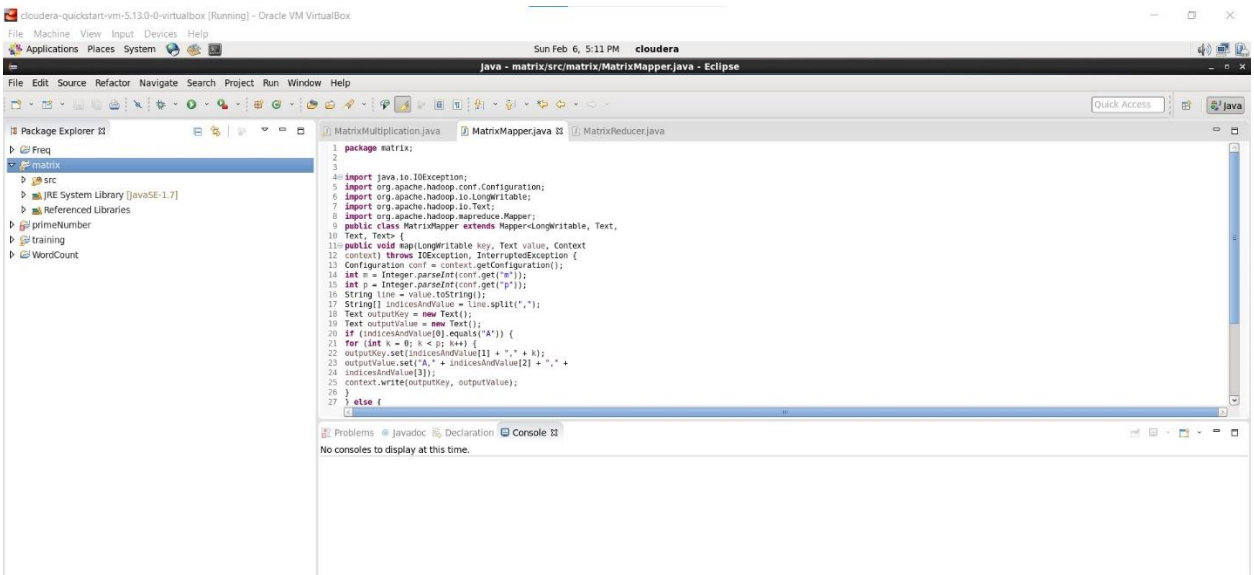
ICE-3

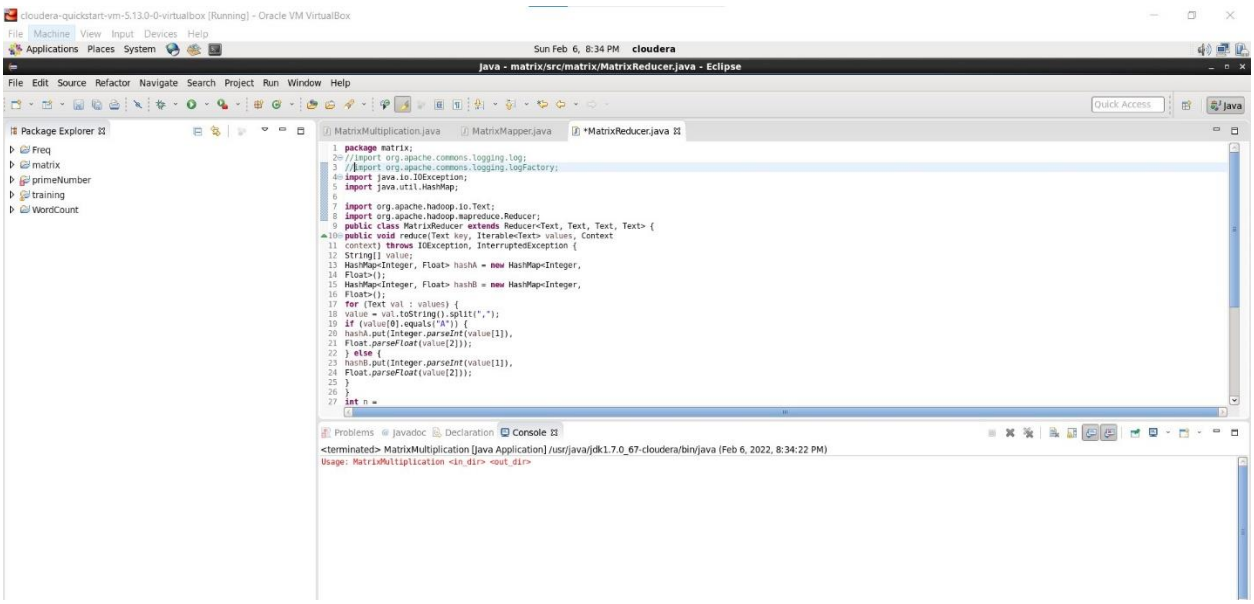
Matrix Multiplication using Mapreduce



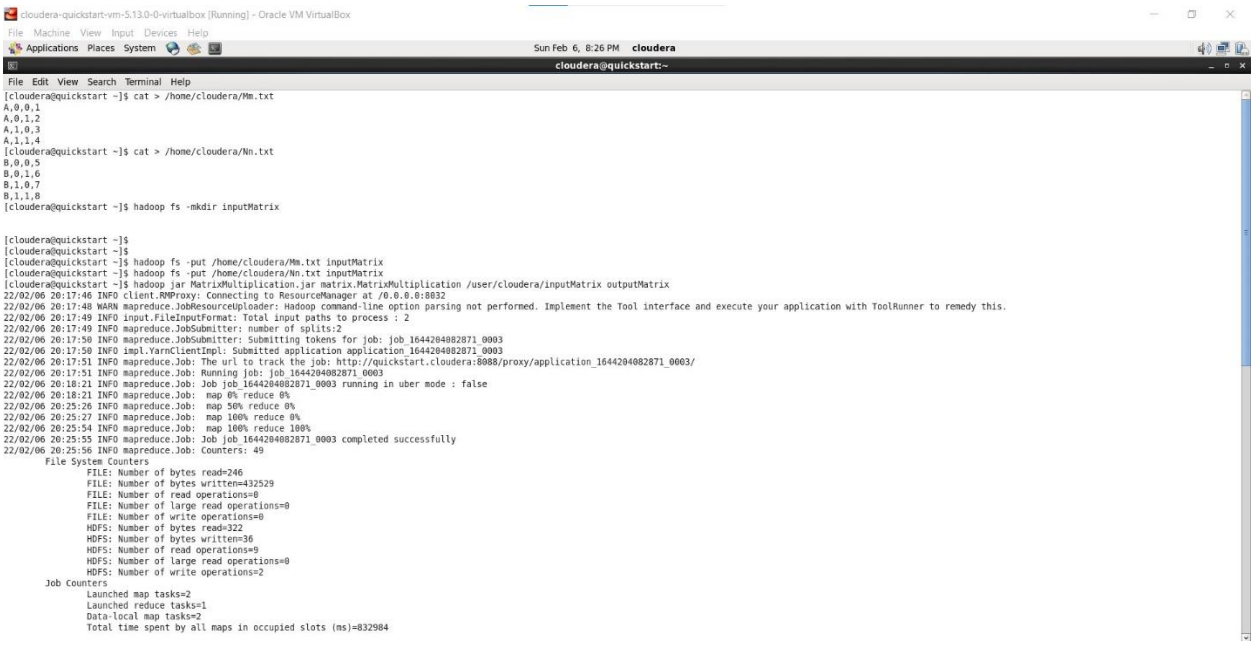
- Firstly I have created a project named matrix and imported all the required external libraries.
- Then I have created a class named MatrixMultiplication and defined the configuration for the matrices.
- Then I have set the jobs for all classes like Mapper, Reducer, TextInput, TextOutput and also set the paths for input and output.



- Next I created mapper class named MatrixMapper which will extend the mapper class.
- We defined A as a m by n matrix and B as a n by p matrix.
- Then we defined map function which produces key value pairs for each element a_{ij} of A matrix. The key value pairs are produced in form of (i,k),(A,j, a_{ij})) where k depends on the columns of B matrix. i and j are referred as rows and columns and (A,j, a_{ij}) is the value.
- Then we defined map function which produces key value pairs for each element b_{ij} of B matrix. The key value pairs are produced in form of (i,k),(B,j, b_{ij})) where k depends on the rows of A matrix. i and j are referred as rows and columns and (B,j, b_{ij}) is the value.
- The map function finally returns all key values that each key (i,k) has a combination of values of A and B matrices. This output is fed as input to the reducer class which performs multiplication operation,



- Then we define reducer class as MatrixReducer and then we define hashmap for storing key-value pairs.
- The reducer function takes key (i,k) and sorts the values that start with A by j in list$_A$ and sorts values of B matrix in list$_B$.
- Then we define for loop which iterates and multiplies a(i,j) rows and b(j,k) columns with jth value of both lists and sums up the value and stores in result.
- Finally the reducer function returns result in the form of key value pair where key is (i,k) and value is the sum of product. This gives the final result matrix.



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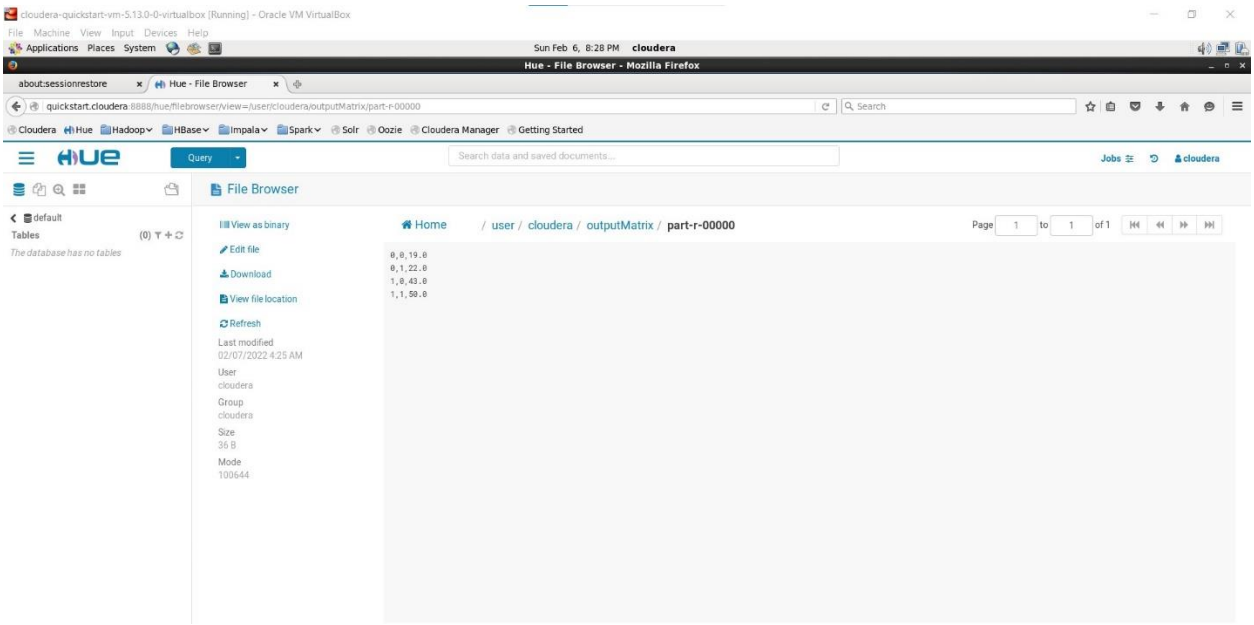
[cloudera@quickstart ~]$ cat > /home/cloudera/Mm.txt
A,0,0,1
A,0,1,2
A,1,0,3
A,1,1,4
[cloudera@quickstart ~]$ cat > /home/cloudera/Nn.txt
B,0,0,5
B,0,1,6
B,1,0,7
B,1,1,8
[cloudera@quickstart ~]$ hadoop fs -mkdir inputMatrix


[cloudera@quickstart ~]$
[cloudera@quickstart ~]$
[cloudera@quickstart ~]$ hadoop fs -put /home/cloudera/Mm.txt inputMatrix
[cloudera@quickstart ~]$ hadoop fs -put /home/cloudera/Nn.txt inputMatrix
[cloudera@quickstart ~]$ hadoop jar MatrixMultiplication.jar matrix.MatrixMultiplication /user/cloudera/inputMatrix outputMatrix
22/02/06 20:17:46 INFO client.RMProxy: Connecting to ResourceManager at /0.0.0.0:8032
22/02/06 20:17:48 WARN mapreduce.JobResourceUploader: Hadoop command-line option parsing not performed. Implement the Tool interface and execute your application with ToolRunner to remedy this.
22/02/06 20:17:49 INFO input.FileInputFormat: Total input paths to process : 2
22/02/06 20:17:49 INFO mapreduce.JobSubmitter: number of splits:2
22/02/06 20:17:50 INFO mapreduce.JobSubmitter: Submitting tokens for job: job_1644204082871_0003
22/02/06 20:17:50 INFO impl.YarnClientImpl: Submitted application application_1644204082871_0003
22/02/06 20:17:51 INFO mapreduce.Job: The url to track the job: http://quickstart.cloudera:8088/proxy/application_1644204082871_0003/
22/02/06 20:17:51 INFO mapreduce.Job: Running job: job_1644204082871_0003
22/02/06 20:18:21 INFO mapreduce.Job: Job job_1644204082871_0003 running in uber mode : false
22/02/06 20:18:21 INFO mapreduce.Job:  map 0% reduce 0%
22/02/06 20:25:26 INFO mapreduce.Job:  map 50% reduce 0%
22/02/06 20:25:27 INFO mapreduce.Job:  map 100% reduce 0%
22/02/06 20:25:54 INFO mapreduce.Job:  map 100% reduce 100%
22/02/06 20:25:55 INFO mapreduce.Job: Job job_1644204082871_0003 completed successfully
22/02/06 20:25:56 INFO mapreduce.Job: Counters: 49
        File System Counters
                FILE: Number of bytes read=246
                FILE: Number of bytes written=432529
                FILE: Number of read operations=0
                FILE: Number of large read operations=0
                FILE: Number of write operations=0
                HDFS: Number of bytes read=322
                HDFS: Number of bytes written=36
                HDFS: Number of read operations=9
                HDFS: Number of large read operations=0
                HDFS: Number of write operations=2
        Job Counters
                Launched map tasks=2
                Launched reduce tasks=1
                Data-local map tasks=2
                Total time spent by all maps in occupied slots (ms)=832984
```

- Then I created a folder Mm.txt to store the input for the A matrix and gave the input as follows,
  A,0,0,1
  A,0,1,2
  A,1,0,3
  A,1,1,4
- Then I created a folder Nn.txt to store the input for the B matrix and gave the input as follows,
  B,0,0,5
  B,0,1,6
  B,1,0,7
  B,1,1,8
- Then I have copied files from Mm.txt and Nn.txt into inputMatrix using **put** command.
- Then I executed the command for mapreduce job and it has executed as follows,

- Then I have listed the files in the outputMatrix using ls command
- Finally I have used cat command to display the output of matrix multiplication and the result is correct as follows,
  0,0,19.0
  0,1,22.0
  1,0,43.0
  1,1,50.0



- Then I have visualized the output file using Hue.