LABORATORY PROGRAM – 7

Create a Map Reduce program to sort the content in an alphabetic order listing only top 10 maximum occurrences of words

Driver Code (TopNDriver.java)

```
package samples.topn;
import org.apache.hadoop.conf.Configuration;
import org.apache.hadoop.fs.Path;
import org.apache.hadoop.io.IntWritable;
import org.apache.hadoop.io.Text;
import org.apache.hadoop.mapreduce.Job;
import org.apache.hadoop.mapreduce.lib.input.FileInputFormat;
import org.apache.hadoop.mapreduce.lib.output.FileOutputFormat;
public class TopNDriver {
 public static void main(String[] args) throws Exception {
 if (args.length != 3) {
 System.err.println("Usage: TopNDriver <in> <temp-out> <final-out>");
 System.exit(2);
 }
 Configuration conf = new Configuration();
 // === Job 1: Word Count ===
 Job wcJob = Job.getInstance(conf, "word count");
 wcJob.setJarByClass(TopNDriver.class);
 wcJob.setMapperClass(WordCountMapper.class);
 wcJob.setCombinerClass(WordCountReducer.class);
 wcJob.setReducerClass(WordCountReducer.class);
 wcJob.setOutputKeyClass(Text.class);
 wcJob.setOutputValueClass(IntWritable.class);
 FileInputFormat.addInputPath(wcJob, new Path(args[0]));
 Path tempDir = new Path(args[1]);
 FileOutputFormat.setOutputPath(wcJob, tempDir);
 if (!wcJob.waitForCompletion(true)) {
 System.exit(1);
 }
 // === Job 2: Top N ===
 Job topJob = Job.getInstance(conf, "top 10 words");
 topJob.setJarByClass(TopNDriver.class);
 topJob.setMapperClass(TopNMapper.class);
 topJob.setReducerClass(TopNReducer.class);
 topJob.setMapOutputKeyClass(IntWritable.class);
 topJob.setMapOutputValueClass(Text.class);
 topJob.setOutputKeyClass(Text.class);
 topJob.setOutputValueClass(IntWritable.class);
 FileInputFormat.addInputPath(topJob, tempDir);
 FileOutputFormat.setOutputPath(topJob, new Path(args[2]));
  System.exit(topJob.waitForCompletion(true) ? 0 : 1);
 }
}
```

Mapper Code (WordCountMapper.java)

```
package samples.topn;
import java.io.IOException;
import java.util.StringTokenizer;
import org.apache.hadoop.io.IntWritable;
import org.apache.hadoop.io.Text;
import org.apache.hadoop.mapreduce.Mapper;
public class WordCountMapper
 extends Mapper<Object, Text, Text, IntWritable> {
 private final static IntWritable ONE = new IntWritable(1);
 private Text word = new Text();
 // characters to normalize into spaces
 private String tokens = "[_|$#<>\\^=\\[\\]\\*/\\\\,;,.\\-:()?!\"']";
 @Override
 protected void map(Object key, Text value, Context context)
 throws IOException, InterruptedException {
 // clean & tokenize
 String clean = value.toString()
 .toLowerCase()
 .replaceAll(tokens, " ");
 StringTokenizer itr = new StringTokenizer(clean);
 while (itr.hasMoreTokens()) {
 word.set(itr.nextToken().trim());
 context.write(word, ONE);
 }
 }
}
```

Mapper Code (TopNMapper.java)

```
package samples.topn;
import java.io.IOException;
import org.apache.hadoop.io.IntWritable;
import org.apache.hadoop.io.Text;
import org.apache.hadoop.mapreduce.Mapper;
public class TopNMapper
 extends Mapper<Object, Text, IntWritable, Text> {
 private IntWritable count = new IntWritable();
 private Text word = new Text();
 @Override
 protected void map(Object key, Text value, Context context)
 throws IOException, InterruptedException {
 // input line: word \t count
 String[] parts = value.toString().split("\\t");
 if (parts.length == 2) {
 word.set(parts[0]);
 count.set(Integer.parseInt(parts[1]));
 // emit count → word, so Hadoop sorts by count
 context.write(count, word);
 }
 }
}
```

Reducer Code (WordCountReducer.java)

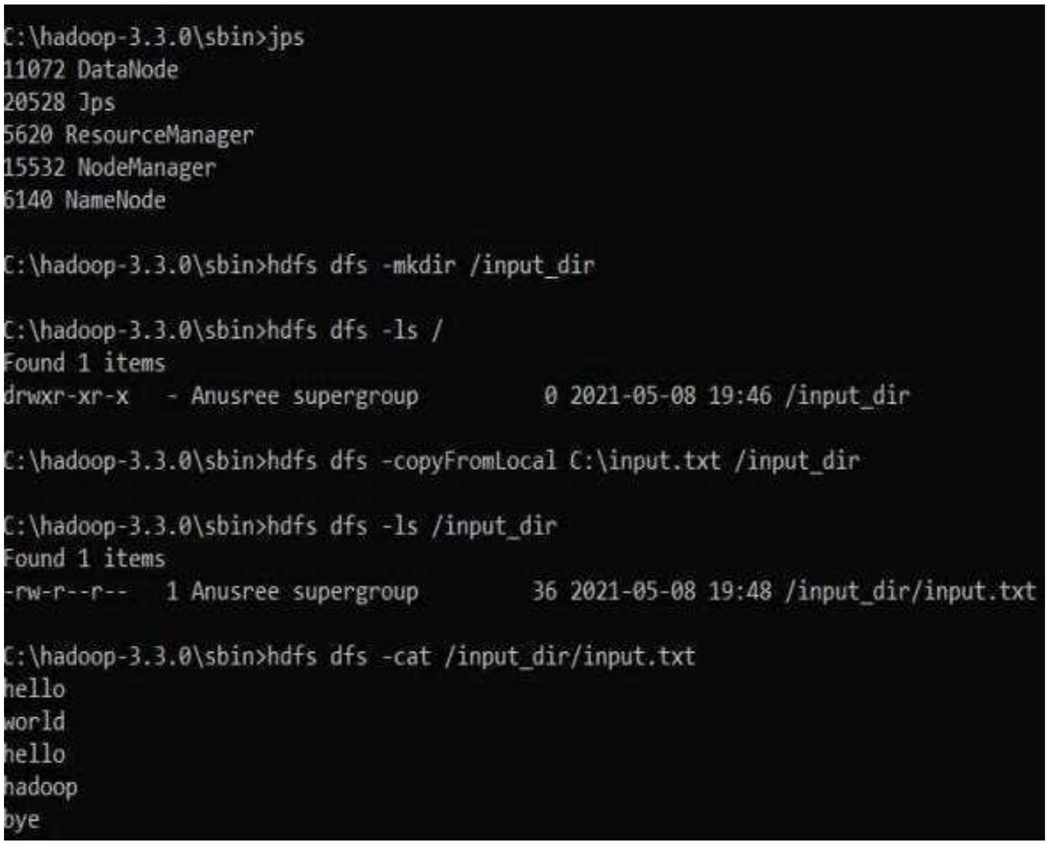
```
package samples.topn;
import java.io.IOException;
import org.apache.hadoop.io.IntWritable;
import org.apache.hadoop.io.Text;
import org.apache.hadoop.mapreduce.Reducer;
public class WordCountReducer
 extends Reducer<Text, IntWritable, Text, IntWritable> {
 @Override
 protected void reduce(Text key, Iterable<IntWritable> values, Context context)
 throws IOException, InterruptedException {
 int sum = 0;
 for (IntWritable val : values) {
 sum += val.get();
 }
 context.write(key, new IntWritable(sum));
 }
}
```

Reducer Code (TopNReducer.java)

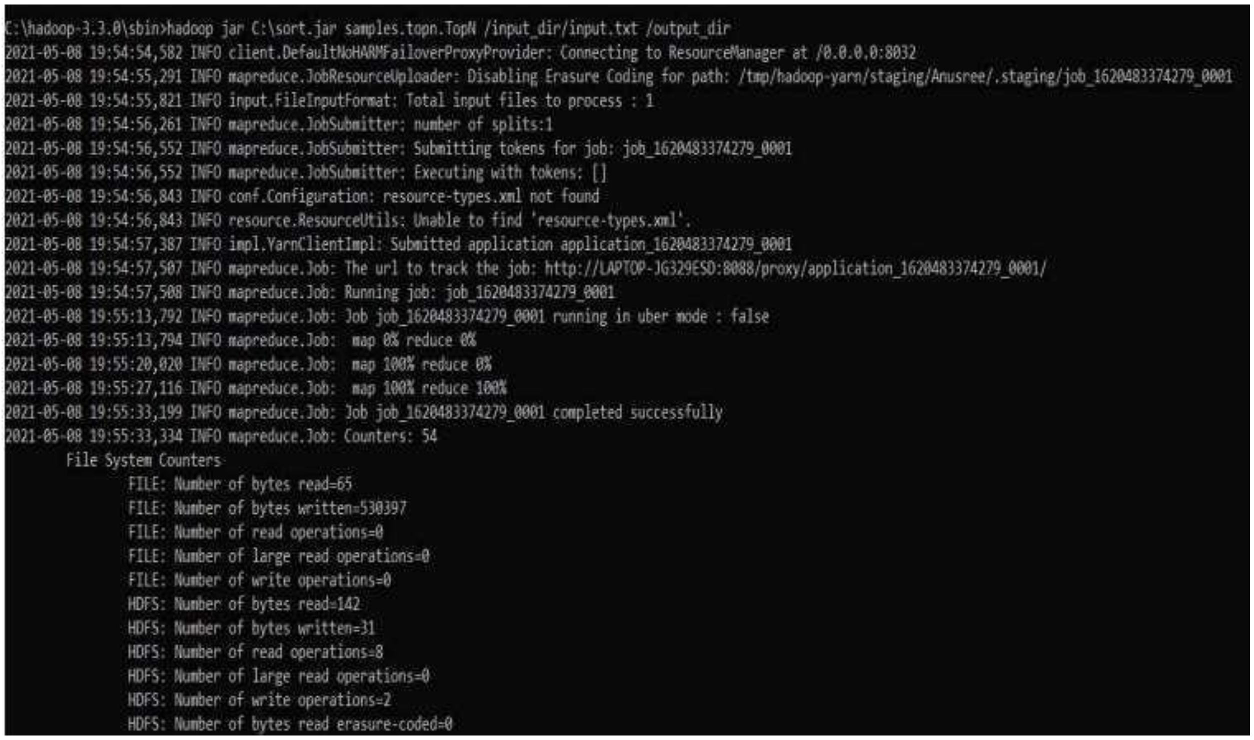
```
package samples.topn;
import java.io.IOException;
import java.util.ArrayList;
import java.util.Collections;
import java.util.List;
import java.util.Map;
import java.util.TreeMap;
import org.apache.hadoop.io.IntWritable;
import org.apache.hadoop.io.Text;
import org.apache.hadoop.mapreduce.Reducer;
public class TopNReducer
 extends Reducer<IntWritable, Text, Text, IntWritable> {
 // TreeMap with descending order of keys (counts)
 private TreeMap<Integer, List<String>> countMap =
 new TreeMap<>(Collections.reverseOrder());
 @Override
 protected void reduce(IntWritable key, Iterable<Text> values, Context context)
 throws IOException, InterruptedException {
 int cnt = key.get();
 List<String> words = countMap.getOrDefault(cnt, new ArrayList<>());
 for (Text w : values) {
 words.add(w.toString());
 }
 countMap.put(cnt, words);
 }
 @Override
 protected void cleanup(Context context)
 throws IOException, InterruptedException {
 // collect top 10 word→count pairs
 List<WordCount> topList = new ArrayList<>();
 int seen = 0;
 for (Map.Entry<Integer, List<String>> entry : countMap.entrySet()) {
```

```
 int cnt = entry.getKey();
 for (String w : entry.getValue()) {
 topList.add(new WordCount(w, cnt));
 seen++;
 if (seen == 10) break;
 }
 if (seen == 10) break;
 }
 // sort these 10 entries alphabetically by word
 Collections.sort(topList, (a, b) -> a.word.compareTo(b.word));
 // emit final top 10 in alphabetical order
 for (WordCount wc : topList) {
 context.write(new Text(wc.word), new IntWritable(wc.count));
 }
 }
 // helper class
 private static class WordCount {
 String word;
 int count;
 WordCount(String w, int c) { word = w; count = c; }
 }
}
```

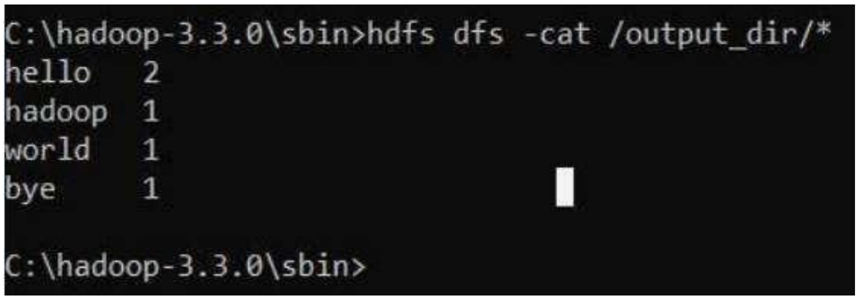
OBSERVATION



```
C:\hadoop-3.3.0\sbin>jps
11072 DataNode
20528 Jps
5620 ResourceManager
15532 NodeManager
6140 NameNode

C:\hadoop-3.3.0\sbin>hdfs dfs -mkdir /input_dir

C:\hadoop-3.3.0\sbin>hdfs dfs -ls /
Found 1 items
drwxr-xr-x   - Anusree supergroup          0 2021-05-08 19:46 /input_dir

C:\hadoop-3.3.0\sbin>hdfs dfs -copyFromLocal C:\input.txt /input_dir

C:\hadoop-3.3.0\sbin>hdfs dfs -ls /input_dir
Found 1 items
-rw-r--r--   1 Anusree supergroup         36 2021-05-08 19:48 /input_dir/input.txt

C:\hadoop-3.3.0\sbin>hdfs dfs -cat /input_dir/input.txt
hello
world
hello
hadoop
bye
```



```
C:\hadoop-3.3.0\sbin>hadoop jar C:\sort.jar samples.topn.TopN /input_dir/input.txt /output_dir
2021-05-08 19:54:54,582 INFO client.DefaultNoHARMFailoverProxyProvider: Connecting to ResourceManager at /0.0.0.0:8032
2021-05-08 19:54:55,291 INFO mapreduce.JobResourceUploader: Disabling Erasure Coding for path: /tmp/hadoop-yarn/staging/Anusree/.staging/job_1620483374279_0001
2021-05-08 19:54:55,821 INFO input.FileInputFormat: Total input files to process : 1
2021-05-08 19:54:56,261 INFO mapreduce.JobSubmitter: number of splits:1
2021-05-08 19:54:56,552 INFO mapreduce.JobSubmitter: Submitting tokens for job: job_1620483374279_0001
2021-05-08 19:54:56,552 INFO mapreduce.JobSubmitter: Executing with tokens: []
2021-05-08 19:54:56,843 INFO conf.Configuration: resource-types.xml not found
2021-05-08 19:54:56,843 INFO resource.ResourceUtils: Unable to find 'resource-types.xml'.
2021-05-08 19:54:57,387 INFO impl.YarnClientImpl: Submitted application application_1620483374279_0001
2021-05-08 19:54:57,507 INFO mapreduce.Job: The url to track the job: http://LAPTOP-JG329ESD:8088/proxy/application_1620483374279_0001/
2021-05-08 19:54:57,508 INFO mapreduce.Job: Running job: job_1620483374279_0001
2021-05-08 19:55:13,792 INFO mapreduce.Job: Job job_1620483374279_0001 running in uber mode : false
2021-05-08 19:55:13,794 INFO mapreduce.Job:  map 0% reduce 0%
2021-05-08 19:55:20,020 INFO mapreduce.Job:  map 100% reduce 0%
2021-05-08 19:55:27,116 INFO mapreduce.Job:  map 100% reduce 100%
2021-05-08 19:55:33,199 INFO mapreduce.Job: Job job_1620483374279_0001 completed successfully
2021-05-08 19:55:33,334 INFO mapreduce.Job: Counters: 54
        File System Counters
                FILE: Number of bytes read=65
                FILE: Number of bytes written=530397
                FILE: Number of read operations=0
                FILE: Number of large read operations=0
                FILE: Number of write operations=0
                HDFS: Number of bytes read=142
                HDFS: Number of bytes written=31
                HDFS: Number of read operations=8
                HDFS: Number of large read operations=0
                HDFS: Number of write operations=2
                HDFS: Number of bytes read erasure-coded=0
```



```
C:\hadoop-3.3.0\sbin>hdfs dfs -cat /output_dir/*
hello   2
hadoop  1
world   1
bye     1

C:\hadoop-3.3.0\sbin>
```