

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.DefaultHadoopFailoverProxyProvider: 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.VarnClientImpl: 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>
```