Week 1

Weather Data Result

The following output results are found out based on the input file – 1912.csv

Multi-threaded Versions – 2 numbers of worker thread.

Code	Time(in ms)	MinTime(in ms)	MaxTime(in ms)	AverageTime(in ms)	SpeedUp
Seq	6999	5606	6999	5822.4	1
	5771				
	5700				
	5691				
	5734				
	5606				
	5781				
	5637				
	5651				
	5654				
NoLock	4824	2234	5245	4325.6	1.35
	4495				
	2457				
	4844				
	2234				
	4651				
	5012				
	5245				
	4698				
	4796				
CoarseLock	5447	5121	5528	5312	1.1
	5246				
	5528				
	5408				
	5353				
	5121				
	5262				
	5198				
	5386				
	5171				
FineLock	2559	2559	5101	4641.7	1.25
	5101				
	4998				
	4948				

	5007				
	4918				
	4898				
	4620				
	4626				
	4742				
NoSharing	4987	4674	5148	4842.8	1.21
	4942				
	4800				
	4735				
	4799				
	4742				
	4674				
	5148				
	4789				
	4812				
SeqV2(Fib)	6499	5751	6499	5986.6	1
	5884				
	5913				
	5862				
	6100				
	5892				
	5751				
	5934				
	6096				
	5935				
NoLockV2(Fib)	2318	2318	5167	4675.4	1.28
	4864				
	4880				
	4812				
	4754				
	4963				
	4849				
	5116				
	5167				
	5031				
CoarseLockV2(Fib)	6308	5123	6695	5603.2	1.07
	5663				
	5123				
	5995				
	5286				
	5263				

	6695				
	5253				
	5241				
	5205				
FineLockV2(Fib)	4869	4322	5249	4796.3	1.25
	4752				
	5122				
	4654				
	5249				
	4698				
	4322				
	4712				
	4597				
	4988				
NoSharingV2(Fib)	5277	4543	5510	5004.8	1.2
	5141				
	5062				
	5064				
	4993				
	4875				
	5510				
	4707				
	4543				
	4876				

1. **Which program version (SEQ, NO-LOCK, COARSE-LOCK, FINE-LOCK, NO-SHARING) would you normally expect to finish fastest and why? Do the experiments confirm your expectation? If not, try to explain the reasons.**

   I would expect NO-LOCK version to run the fastest since it's a multithreaded version and it doesn't use any kind of lock which wouldn't cause any delay time.
   Yes, the experiment did confirm my expectations.

2. **Which program version (SEQ, NO-LOCK, COARSE-LOCK, FINE-LOCK, NO-SHARING) would you normally expect to finish slowest and why? Do the experiments confirm your expectation? If not, try to explain the reasons.**

   I would expect SEQ version to be the slowest. However, there might be a case where COARSE-LOCK might be the slowest. It would depend on the input data. More the data with same key, would result in locking of the HashMap would cause delay.
   Yes, the experiment did confirm my expectation.

3. **Compare the temperature averages returned by each program version. Report if any of them is incorrect or if any of the programs crashed because of concurrent accesses.**

   The temperature averages are same in SEQ, COARSE-LOCK, FINE-LOCK and NO-SHARING versions. I found incorrect results in the NO-LOCK version because of two threads accessing data with no-lock, hence causing DIRTY-READ and incorrect update of value in the HashMap.

4. **Compare the running times of SEQ and COARSE-LOCK. Try to explain why one is slower than the other. (Make sure to consider the results of both B and C—this might support or refute a possible hypothesis.)**

   The running time of SEQ and COARSE-LOCK are pretty much similar in my experiment with COARSE-LOCK just edging above SEQ with SPEED UP of 1.10(Case B) and 1.07(Case C).
   The reason SEQ might be slower than COARSE-LOCK are –
   SEQ version runs sequentially while COARSE-LOCK version tries to run parallelly. Since, the lock is on HashMap, there is a delay in time execution. Also, the time delay would be more if there is a lot of data per key since the lock is in place during the update.

5. **How does the higher computation cost in part C (additional Fibonacci computation) affect the difference between COARSE-LOCK and FINE-LOCK? Try to explain the reason.**

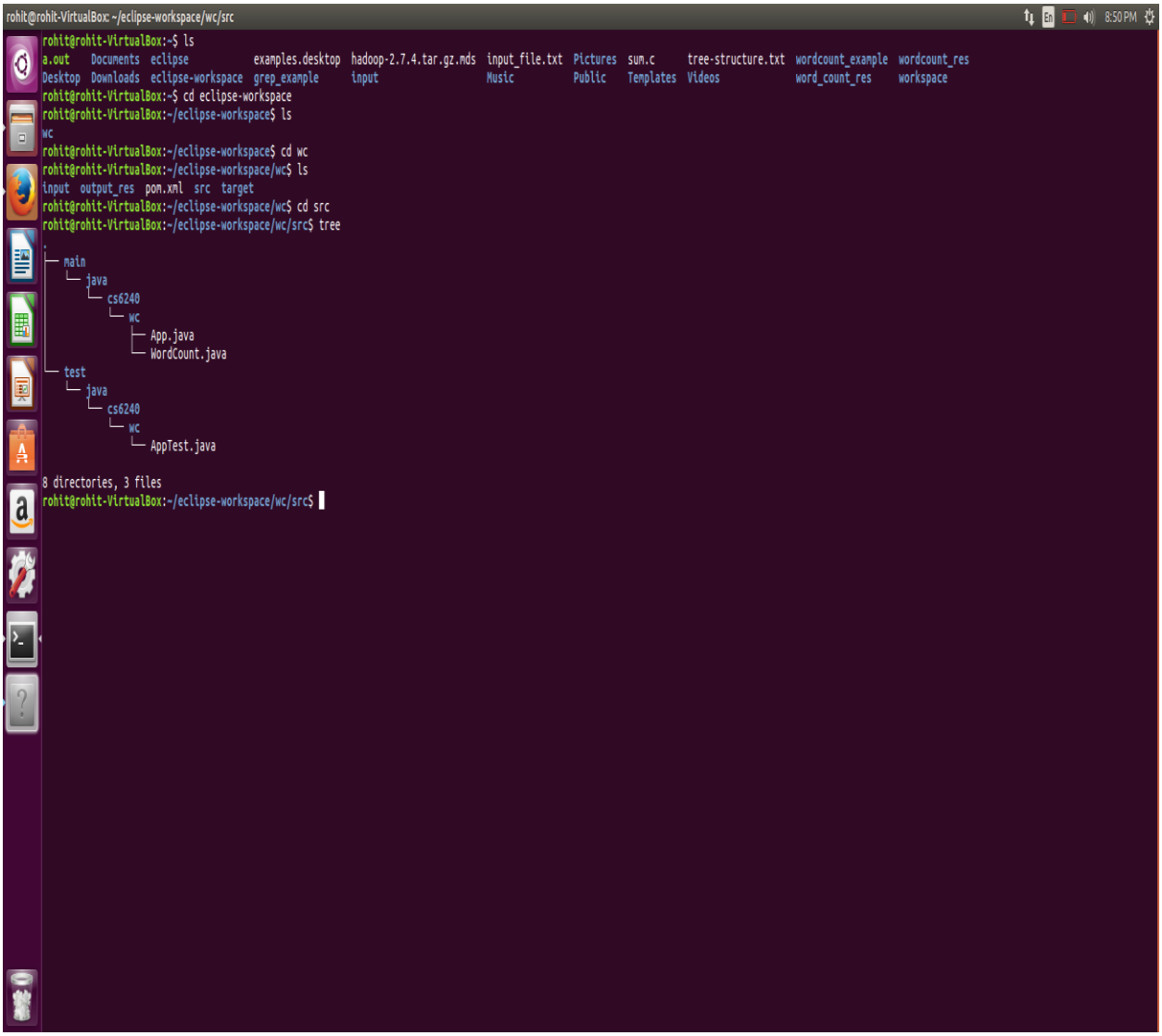
   The additional Fibonacci computation affect both COARSE-LOCK and FINE-LOCK by increasing the running time due to an extra functionality being executed.

   In my experiment, the difference between COARSE-LOCK and FINE-LOCK increases as compared to CASE B (Can be verified seeing the difference in SPEED UP in the above table) which tells us, since COARSE LOCK is held for longer time, the time of execution also increases.

WEEK 2

Word Count Local Execution

Project Directory Structure:

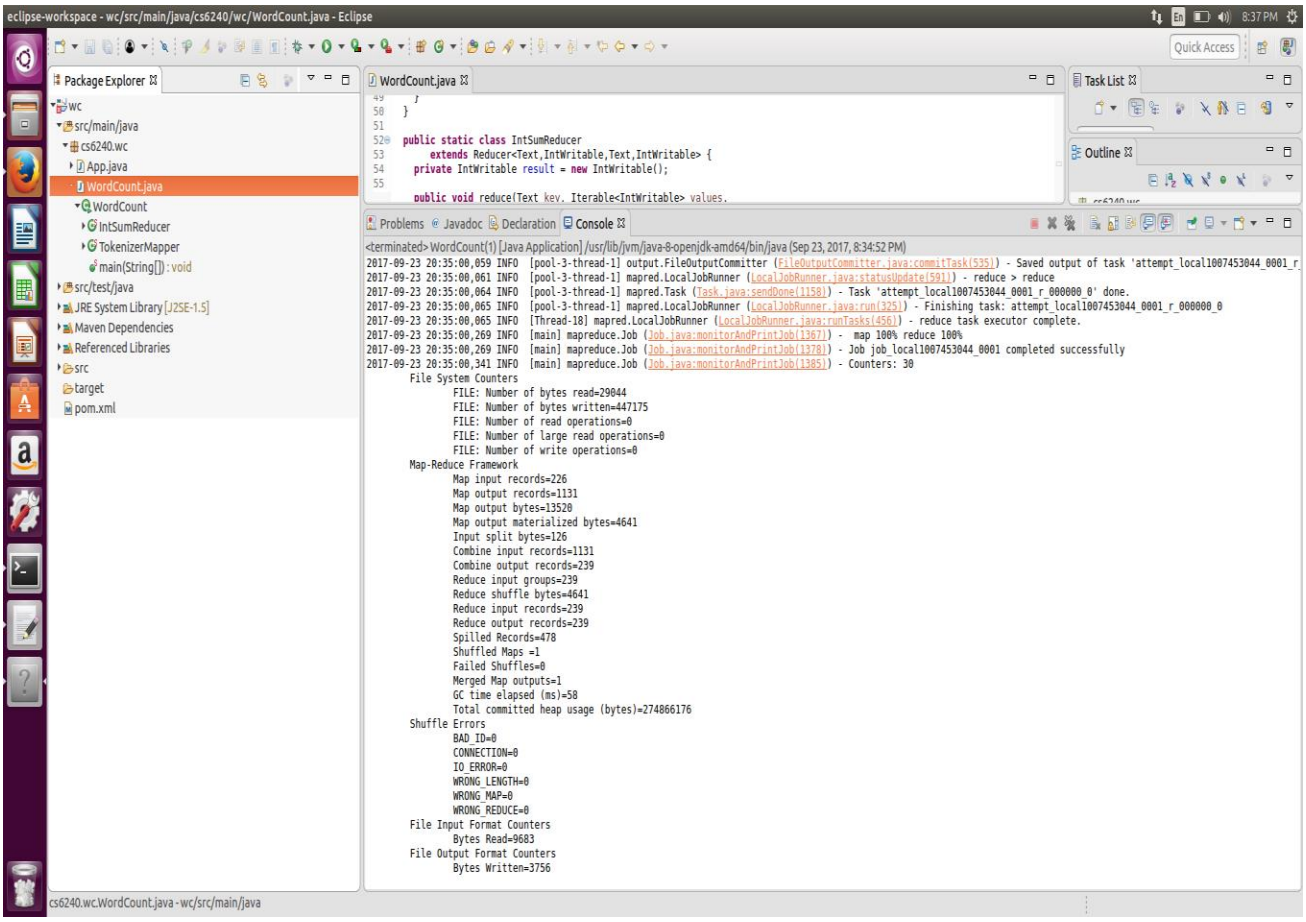


Output:

Please note, I couldn't run locally on the given data file in HW1, i.e., hw1.txt due to disk space issue on my Linux VM.

I executed it locally on a randomly large file.

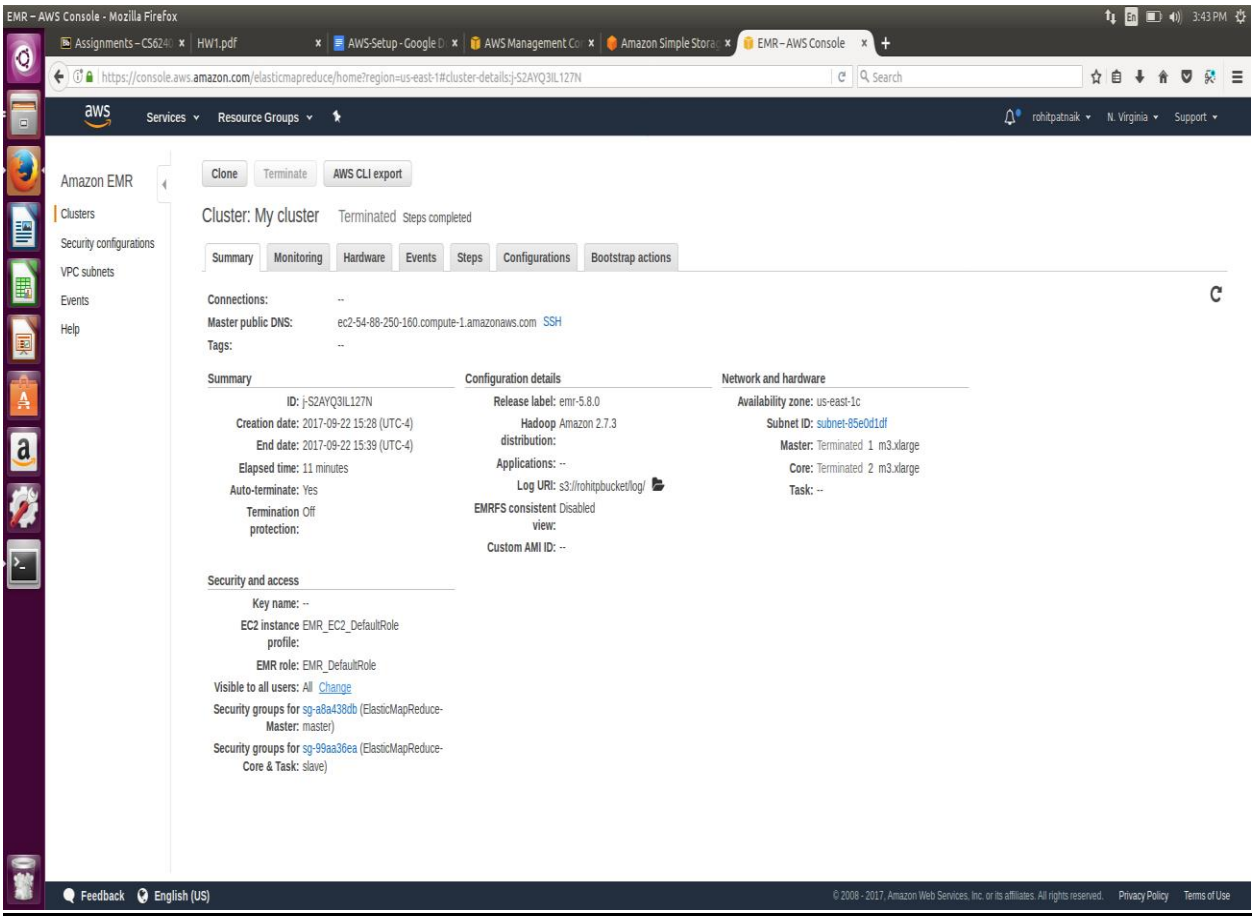
From Eclipse Editor:



From Terminal:

```
rohit@rohit-VirtualBox: ~
17/09/23 15:20:41 INFO reduce.MergeManagerImpl: Merged 8 segments, 20012 bytes to disk to satisfy reduce memory limit
17/09/23 15:20:41 INFO reduce.MergeManagerImpl: Merging 1 files, 20002 bytes from disk
17/09/23 15:20:41 INFO reduce.MergeManagerImpl: Merging 0 segments, 0 bytes from memory into reduce
17/09/23 15:20:41 INFO mapred.Merger: Merging 1 sorted segments
17/09/23 15:20:41 INFO mapred.Merger: Down to the last merge-pass, with 1 segments left of total size: 19992 bytes
17/09/23 15:20:41 INFO mapred.LocalJobRunner: 8 / 8 copied.
17/09/23 15:20:41 INFO Configuration.deprecation: mapred.skip.on is deprecated. Instead, use mapreduce.job.skiprecords
17/09/23 15:20:42 INFO mapred.Task: Task:attempt_local982432570_0001_r_000000_0 is done. And is in the process of committing
17/09/23 15:20:42 INFO mapred.LocalJobRunner: 8 / 8 copied.
17/09/23 15:20:42 INFO mapred.Task: Task attempt_local982432570_0001_r_000000_0 is allowed to commit now
17/09/23 15:20:42 INFO output.FileOutputCommitter: Saved output of task 'attempt_local982432570_0001_r_000000_0' to file:/home/rohit/word_count_res/_temporary/0/task_local982432570_0001_r_000000
17/09/23 15:20:42 INFO mapred.LocalJobRunner: reduce > reduce
17/09/23 15:20:42 INFO mapred.Task: Task 'attempt_local982432570_0001_r_000000_0' done.
17/09/23 15:20:42 INFO mapred.LocalJobRunner: Finishing task: attempt_local982432570_0001_r_000000_0
17/09/23 15:20:42 INFO mapred.LocalJobRunner: reduce task executor complete.
17/09/23 15:20:42 INFO mapreduce.Job:  map 100% reduce 100%
17/09/23 15:20:42 INFO mapreduce.Job: Job job_local982432570_0001 completed successfully
17/09/23 15:20:42 INFO mapreduce.Job: Counters: 30
        File System Counters
                FILE: Number of bytes read=2946821
                FILE: Number of bytes written=5454025
                FILE: Number of read operations=0
                FILE: Number of large read operations=0
                FILE: Number of write operations=0
        Map-Reduce Framework
                Map input records=745
                Map output records=2754
                Map output bytes=34804
                Map output materialized bytes=20044
                Input split bytes=821
                Combine input records=2754
                Combine output records=1160
                Reduce input groups=588
                Reduce shuffle bytes=20044
                Reduce input records=1160
                Reduce output records=588
                Spilled Records=2320
                Shuffled Maps =8
                Failed Shuffles=0
                Merged Map outputs=8
                GC time elapsed (ms)=412
                Total committed heap usage (bytes)=1398206464
        Shuffle Errors
                BAD_ID=0
                CONNECTION=0
                IO_ERROR=0
                WRONG_LENGTH=0
                WRONG_MAP=0
                WRONG_REDUCE=0
        File Input Format Counters
                Bytes Read=26036
        File Output Format Counters
                Bytes Written=10097
rohit@rohit-VirtualBox:~$
```

Word Count AWS Execution



HOMEWORK 1

CS6240 Parallel Data Processing – Map Reduce Rohit Patnaik