Assignment 4(Parallel Sorting)

Tasks:

1. A cutoff (defaults to, say, 1000) which you will update according to the first argument in the command line when running. It's your job to experiment and come up with a good value for this cutoff. If there are fewer elements to sort than the cutoff, then you should use the system sort instead.
2. Recursion depth or the number of available threads. Using this determination, you might decide on an ideal number (*t*) of separate threads (stick to powers of 2) and arrange for that number of partitions to be parallelized (by preventing recursion after the depth of *lg t* is reached).
3. An appropriate combination of these.

Relationship:

From the graphs below it could be observed that increasing the number of threads after 4 does not have a huge effect on time.

The cutoff value can be observed to not affecting the time after 25% of the array size.

So, it can be concluded that the optimal solution for the combination of thread and cutoff value is 4 threads and 25% of array size.

And, for recursion depth d and threads t:

$$t=2^d$$

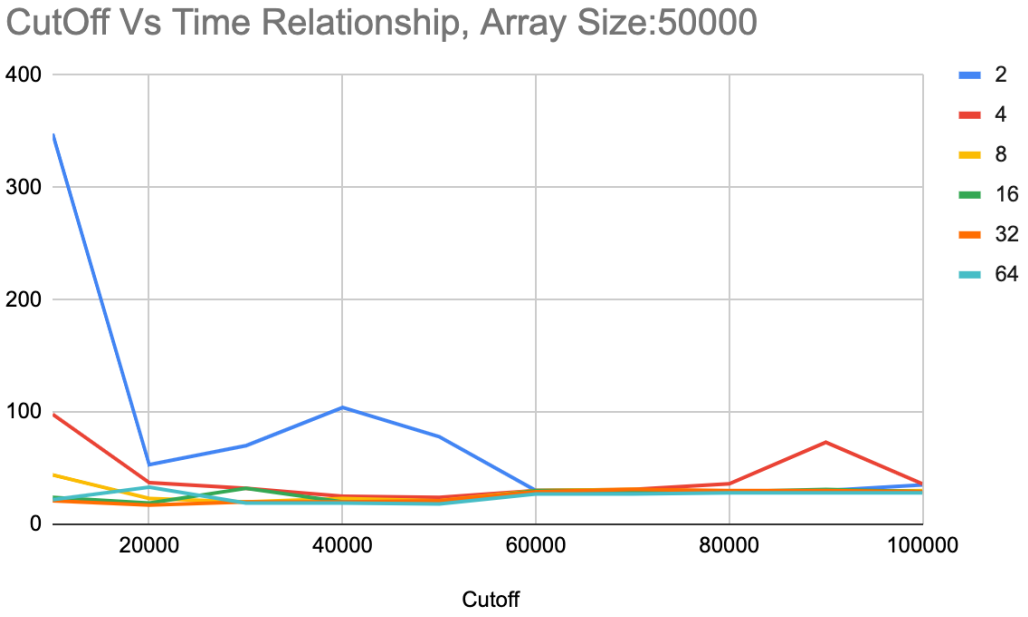
Maximum depth possible: lg (array size/cutoff)

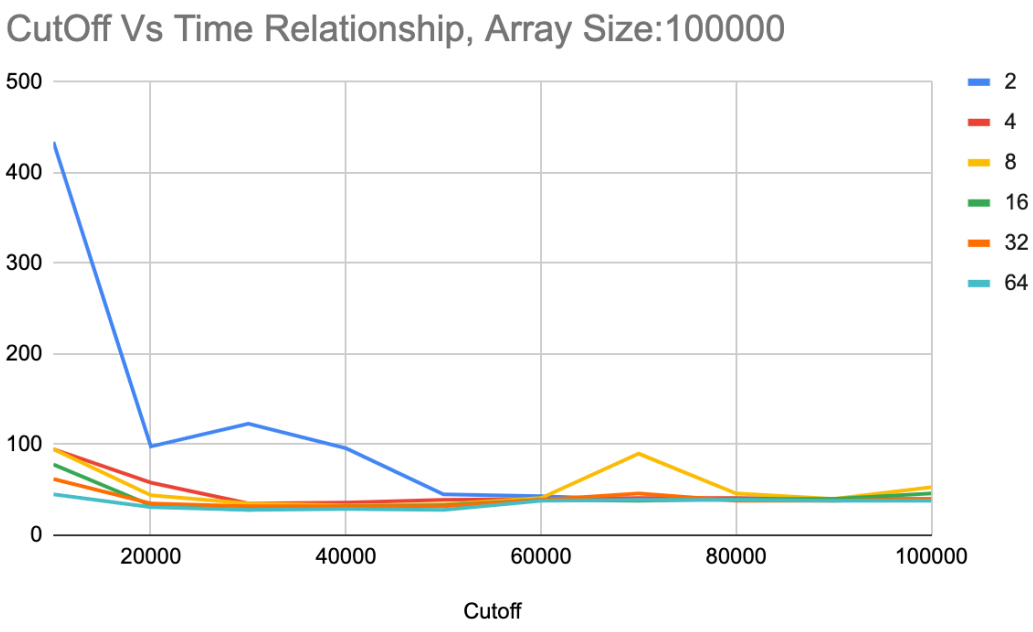
Evidence:

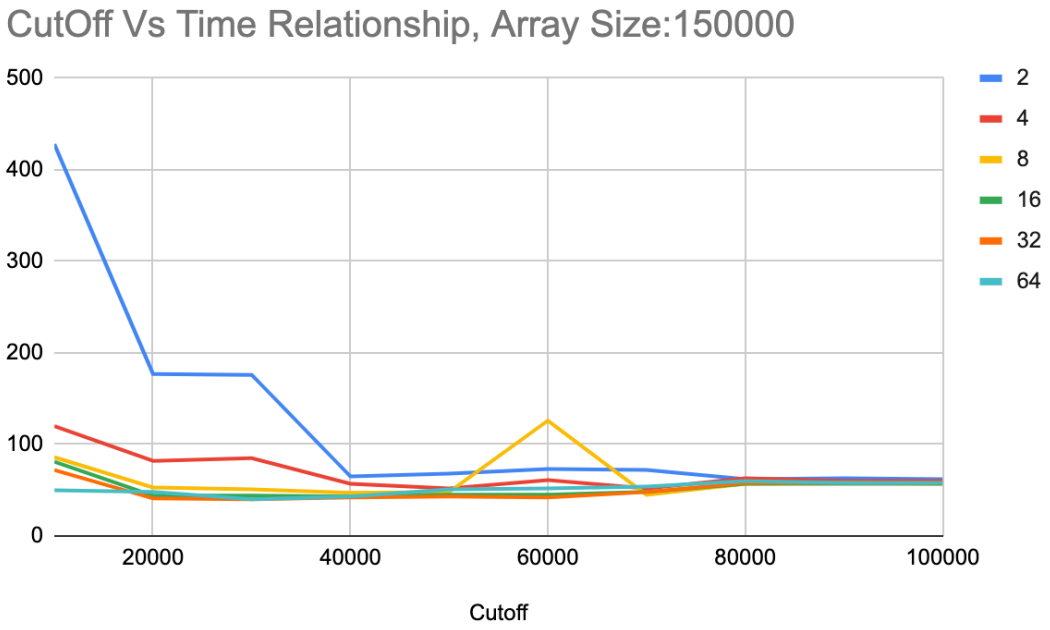
Have performed parallel sort experiment on different sizes of array for increasing threads and cutoffs.

Plotted all the resulting values on the graph.

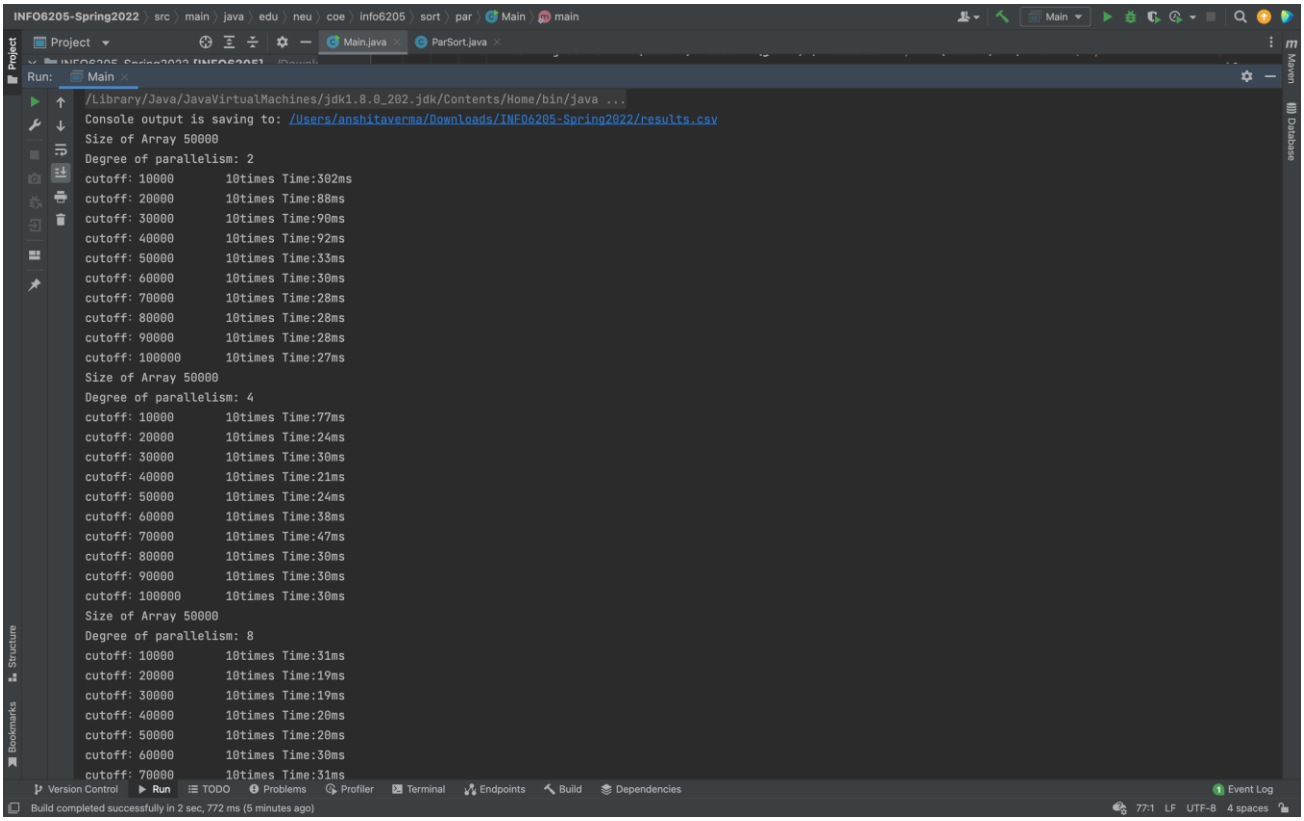
Graph:


CutOff Vs Time Relationship, Array Size:50000
400
300
200
100
0
20000
40000
60000
80000
100000
Cutoff
2
4
8
16
32
64


CutOff Vs Time Relationship, Array Size:100000
500
400
300
200
100
0
20000
40000
60000
80000
100000
Cutoff
2
4
8
16
32
64



Console Output:


INFO6205-Spring2022 src main java edu neu coe info6205 sort par Main main
Main
Project
Main.java
ParSort.java
Run: Main
/Library/Java/JavaVirtualMachines/jdk1.8.0_202.jdk/Contents/Home/bin/java ...
Console output is saving to: /Users/anshitaverma/Downloads/INFO6205-Spring2022/results.csv
Size of Array 50000
Degree of parallelism: 2
cutoff: 10000 10times Time:302ms
cutoff: 20000 10times Time:88ms
cutoff: 30000 10times Time:90ms
cutoff: 40000 10times Time:92ms
cutoff: 50000 10times Time:33ms
cutoff: 60000 10times Time:30ms
cutoff: 70000 10times Time:28ms
cutoff: 80000 10times Time:28ms
cutoff: 90000 10times Time:28ms
cutoff: 100000 10times Time:27ms
Size of Array 50000
Degree of parallelism: 4
cutoff: 10000 10times Time:77ms
cutoff: 20000 10times Time:24ms
cutoff: 30000 10times Time:30ms
cutoff: 40000 10times Time:21ms
cutoff: 50000 10times Time:24ms
cutoff: 60000 10times Time:38ms
cutoff: 70000 10times Time:47ms
cutoff: 80000 10times Time:30ms
cutoff: 90000 10times Time:30ms
cutoff: 100000 10times Time:30ms
Size of Array 50000
Degree of parallelism: 8
cutoff: 10000 10times Time:31ms
cutoff: 20000 10times Time:19ms
cutoff: 30000 10times Time:19ms
cutoff: 40000 10times Time:20ms
cutoff: 50000 10times Time:20ms
cutoff: 60000 10times Time:30ms
cutoff: 70000 10times Time:31ms
Version Control Run TODO Problems Profiler Terminal Endpoints Build Dependencies Event Log
Build completed successfully in 2 sec, 772 ms (5 minutes ago)
77:1 LF UTF-8 4 spaces