My computer:

MacBook pro

13-inch, 2017

Processor: 2,3 GHz Dual-Core Intel Core i5

Memory: 8 GB

Cores: 4

How to run program (in the oblig_4 folder):

Compile

- javac ConvexHull.java

Run

- java ConvexHull <n> <seed>

Introduction

This is a report about my sequential and parallel program for a convex hull and my findings about the timings of the program.

Sequential program

I used the algorithm described in the oblig paper.

Parallel program

My parallel implementation I believe is somewhat different than the algorithms that we have been shown. The parallelization is simply a split of workload to each thread where all threads work concurrently on their set of points, the program can either be set to have 2 or 4 threads where each thread works on finding the points on the convex hull for their size of the pointset. The best analogy is splitting the pointset to either 2 or 4 pieces of the same size depending on how many threads you want. Handling for correct order is done separately and sequentially after all threads are done running. The algorithm for finding the correct order in the parallel version is included in the timing as its running time is insignificant compared to finding all points on the convex hull.

I used semaphore as a synchronization method. Each thread waits for permits to add new points to the list of points on the convex hull whenever a new point is found. When a new point is added the thread releases its permit and lets a new thread access the same list. The list of points is located in the parent class ConvexHull.java.

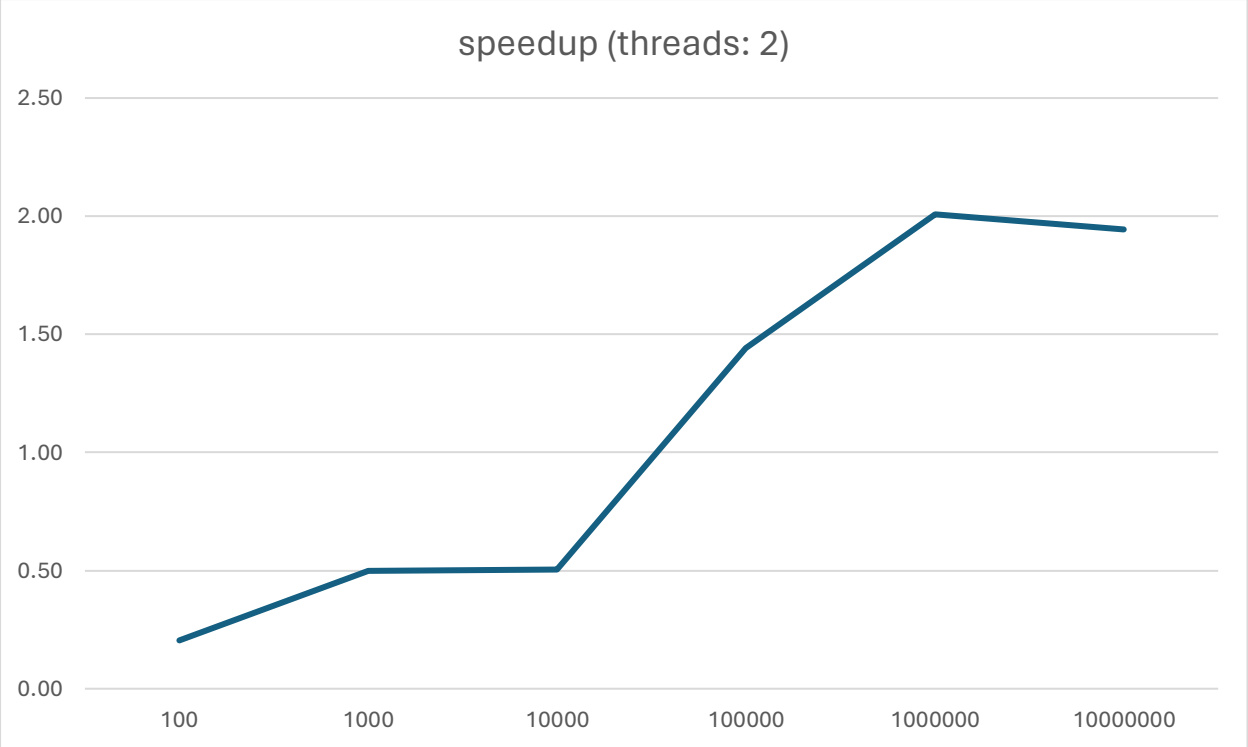
MEDIAN TIME (ms) & SPEEDUPS WITH 2 THREADS

TIME

n	Seq (ms)	par (threads: 2)
100	0,09	0,44
1000	1	2
10000	2,47	4,89
100000	17	11,8
1000000	171,9	85,62
10000000	1577	811,3

SPEEDUP

n	speedup
100	0,20
1000	0,50
10000	0,51
100000	1,44
1000000	2,01
10000000	1,94



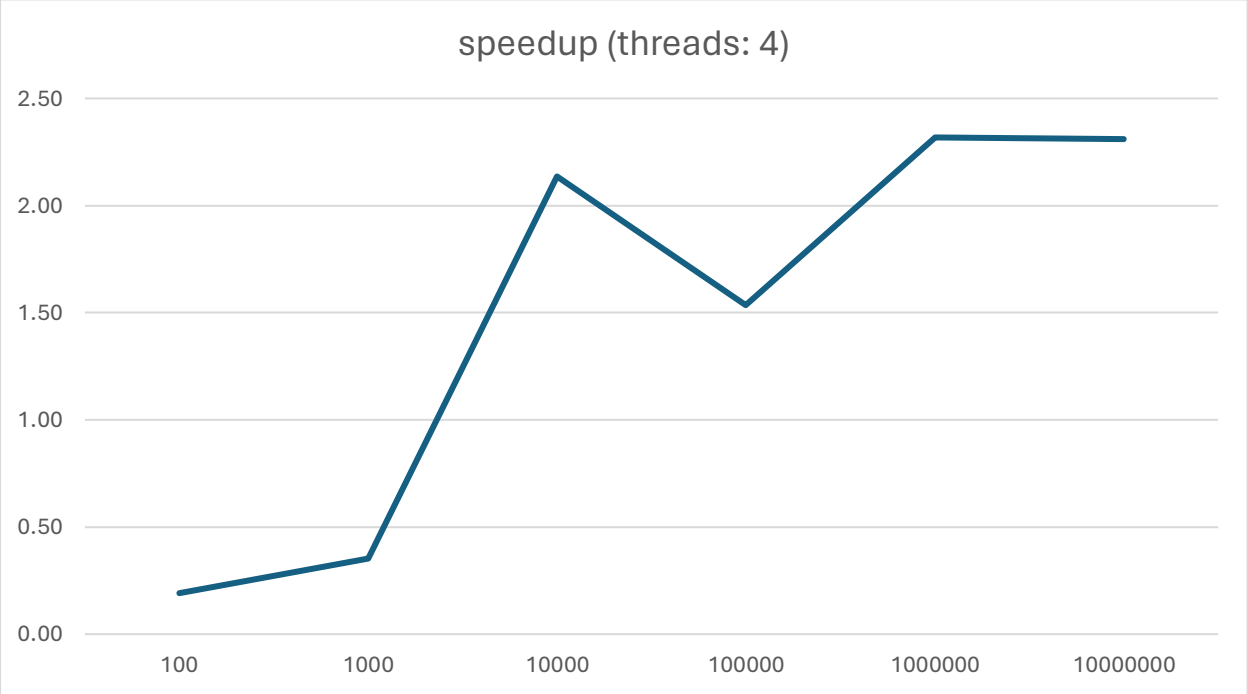
TIME (ms) & SPEEDUPS WITH 4 THREADS

TIME

n	Seq (ms)	par (threads: 4)
100	0,12	0,62
1000	0,99	2,79
10000	6,14	2,87
100000	16,12	10,50
1000000	175,00	75,50
10000000	1507,00	652,00

SPEEDUP

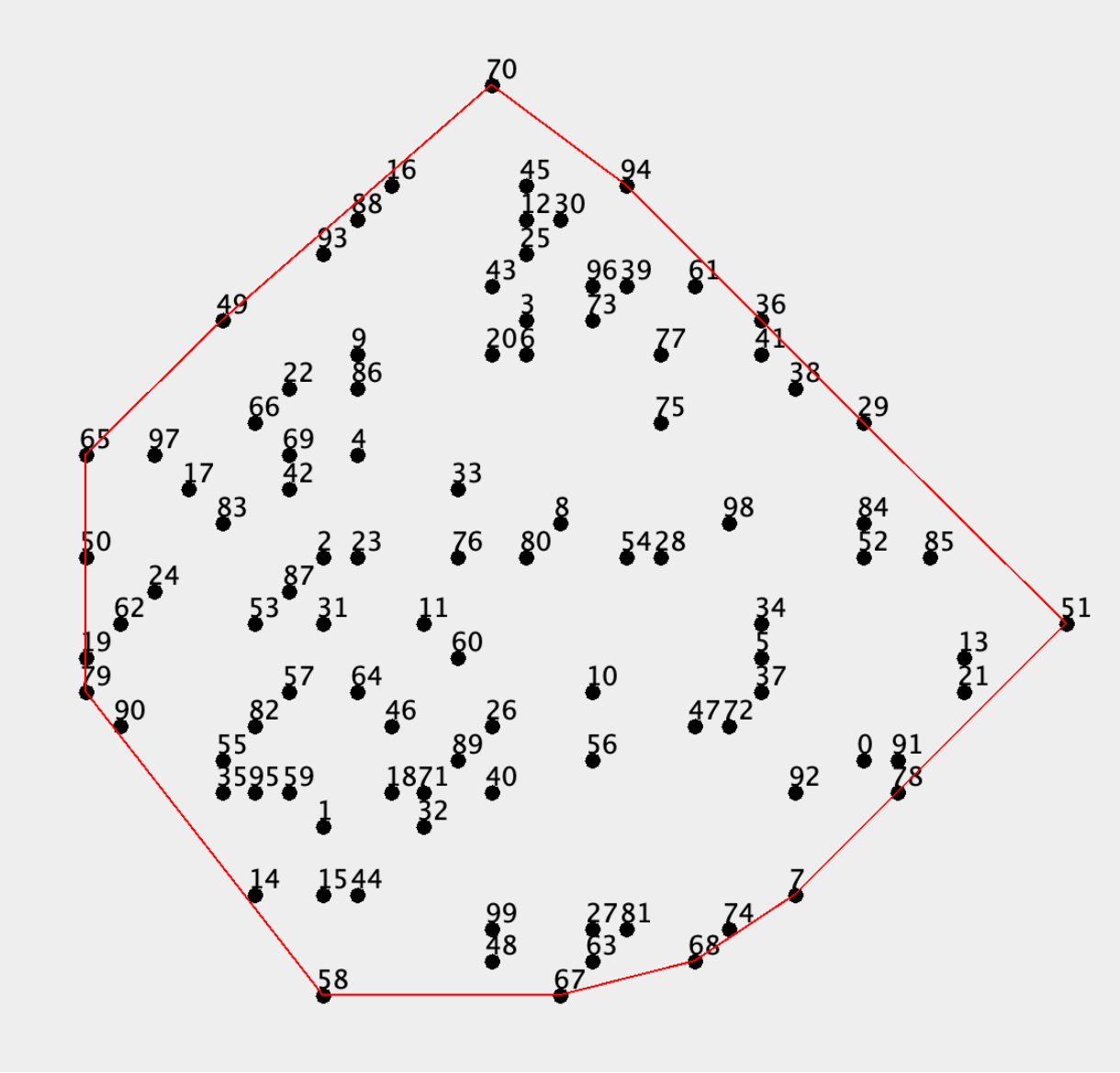
n	speedup
100	0,19
1000	0,35
10000	2,14
100000	1,54
1000000	2,32
10000000	2,31



As we can see there is speedup > 1 achieved for n > 1 000 000 in both versions. If we compare 2 and 4 threads, we can see that with 4 threads, we get a significantly larger speedup for n = 10 000. This is most likely a cause of the doubling of threads that leads to a bigger split in concurrent workload. Based on the graph I believe there is an appropriate extrapolation to say that the speedups become asymptotical at 2,5. This, and the fact that we observe a significant difference in speedup at medium sizes of n might be a symptom of an underlying weakness in my parallel implementation. The fact that I am separately finding the correct order in the convex hull sequentially might be the cause. When we get larger sets of points, the number of points on the convex hull increases and a separate algorithm that only handles the points on the convex hull might become significant and blunts further speedups. But anyway, I am satisfied with a speedup of 2 for n > 1 000 000.

N = 100

Seed = 42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