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Algorithms Project 2

A.

Table 1-1 Running time in millisecond for case 1 (points are within a circle)

N*100	Running Time (ms)		
	Graham Scan	Jarvis March	Quickhull
10	31.25	31.25	15.625
100	31.25	31.25	46.875
1000	46.875	46.875	93.75
10000	2.50E+02	2.19E+02	1.02E+03
100000	2.16E+03	3.41E+03	1.74E+04
1000000	1.97E+04	5.05E+04	2.34E+05

Graph 3
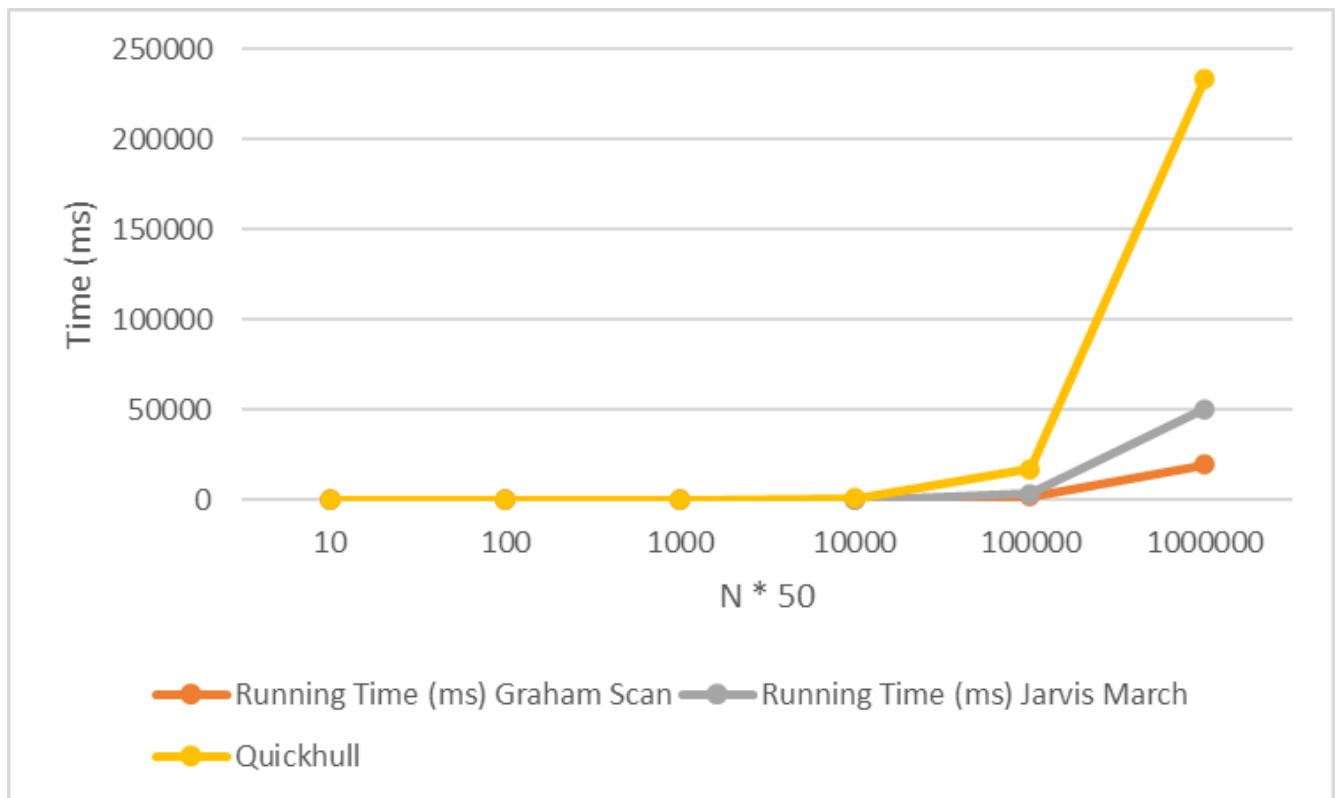
Table 1-2 Running time in millisecond for case 2 (points are on a circle)

N*100	Running Time (ms)		
	Graham Scan	Jarvis March	Quickhull
10	31.25	46.875	46.875
100	31.25	31.25	78.125
1000	62.5	171.875	484.375
10000	1.72E+02	1.23E+03	4.70E+03
100000	1.45E+03	1.21E+04	4.81E+04
1000000	1.60E+04	1.19E+05	4.71E+05

Graph 2
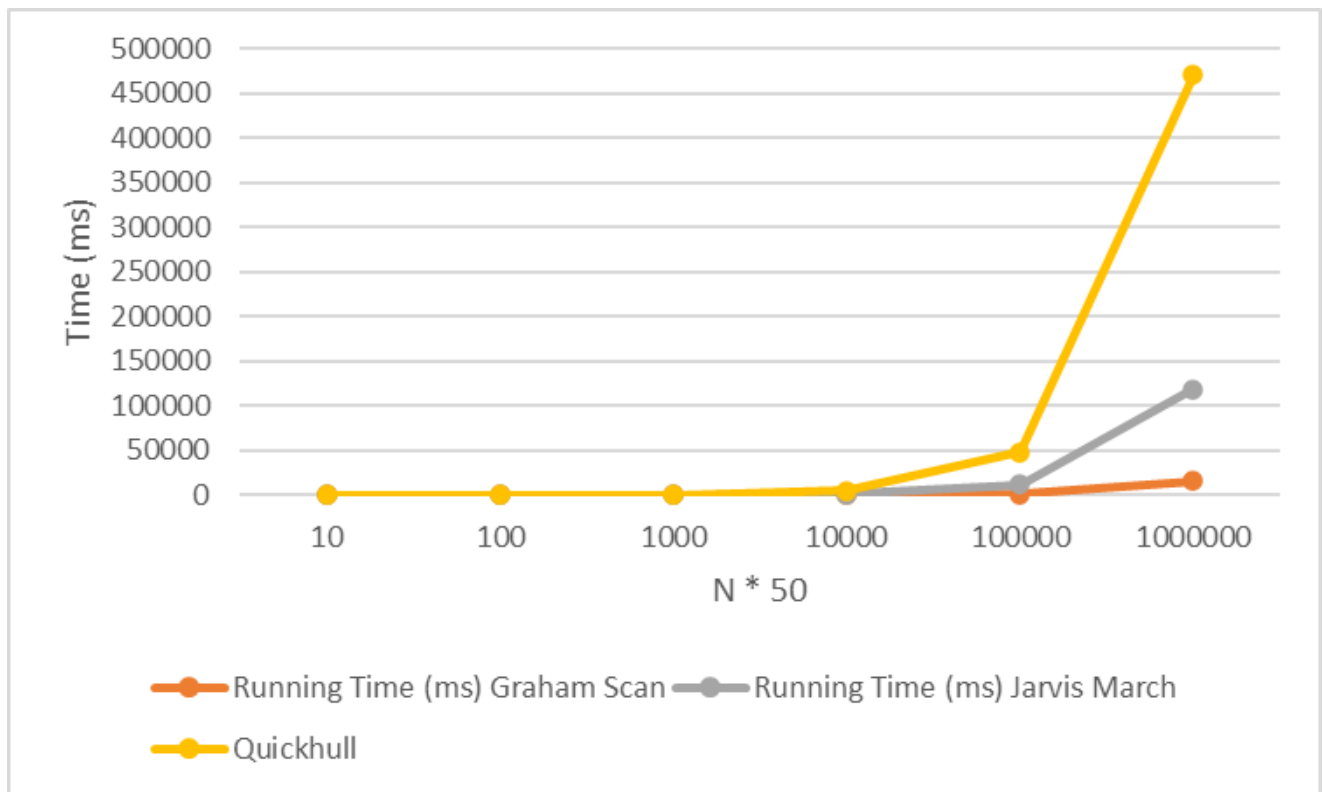
Table 1-3 Running time in millisecond for case 3 (points are within a rectangle)

N*100	Running Time (ms)		
	Graham Scan	Jarvis March	Quickhull
10	31.25	31.25	31.25
100	46.875	31.25	46.875
1000	46.875	31.25	78.125
10000	2.66E+02	1.56E+02	4.06E+02
100000	2.34E+03	1.72E+03	3.97E+03
1000000	2.08E+04	1.34E+04	1.70E+04

Graph 3
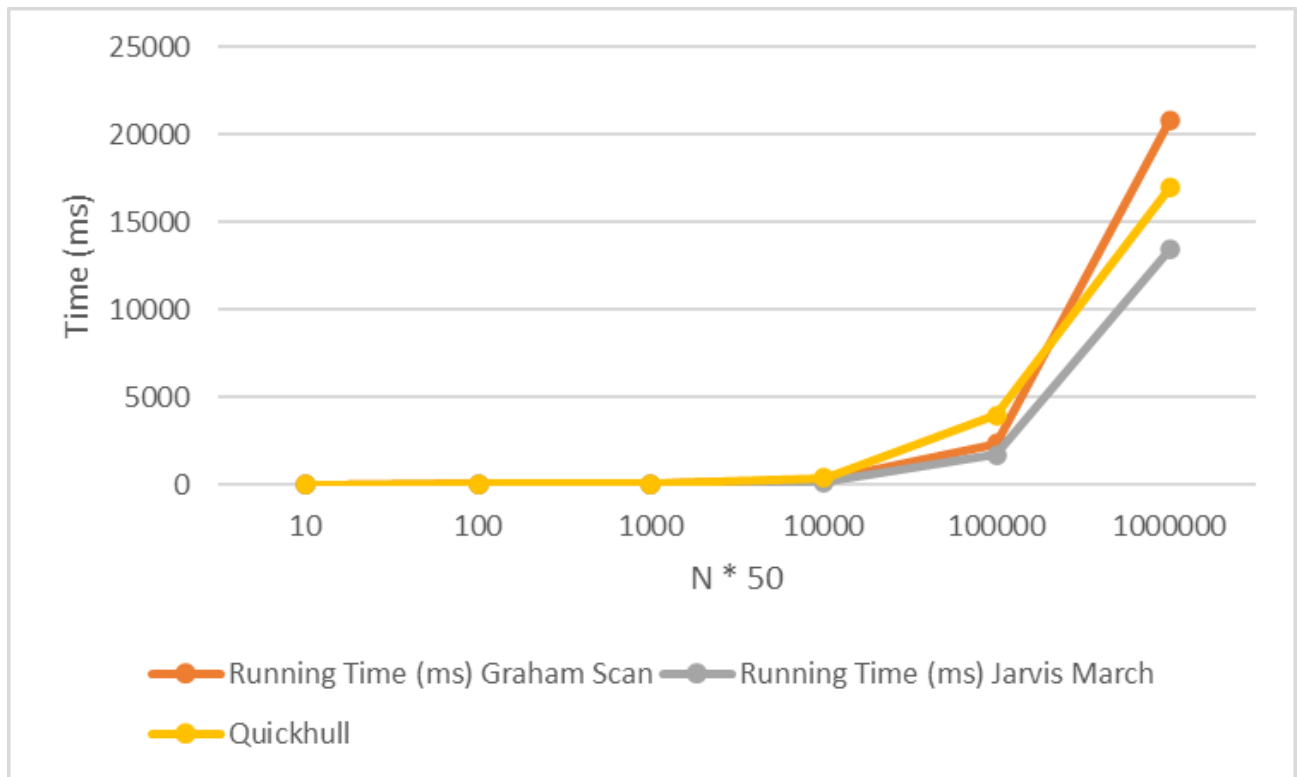
Table 1-4 Running time in millisecond for case 4 (points are within a triangle)

N*100	Running Time (ms)		
	Graham Scan	Jarvis March	Quickhull
10	46.875	0	31.25
100	31.25	0	46.875
1000	46.875	31.25	62.5
10000	2.34E+02	1.09E+02	3.13E+02
100000	2.17E+03	7.50E+02	1.73E+03
1000000	1.98E+04	3.95E+03	7.66E+03

Graph 4
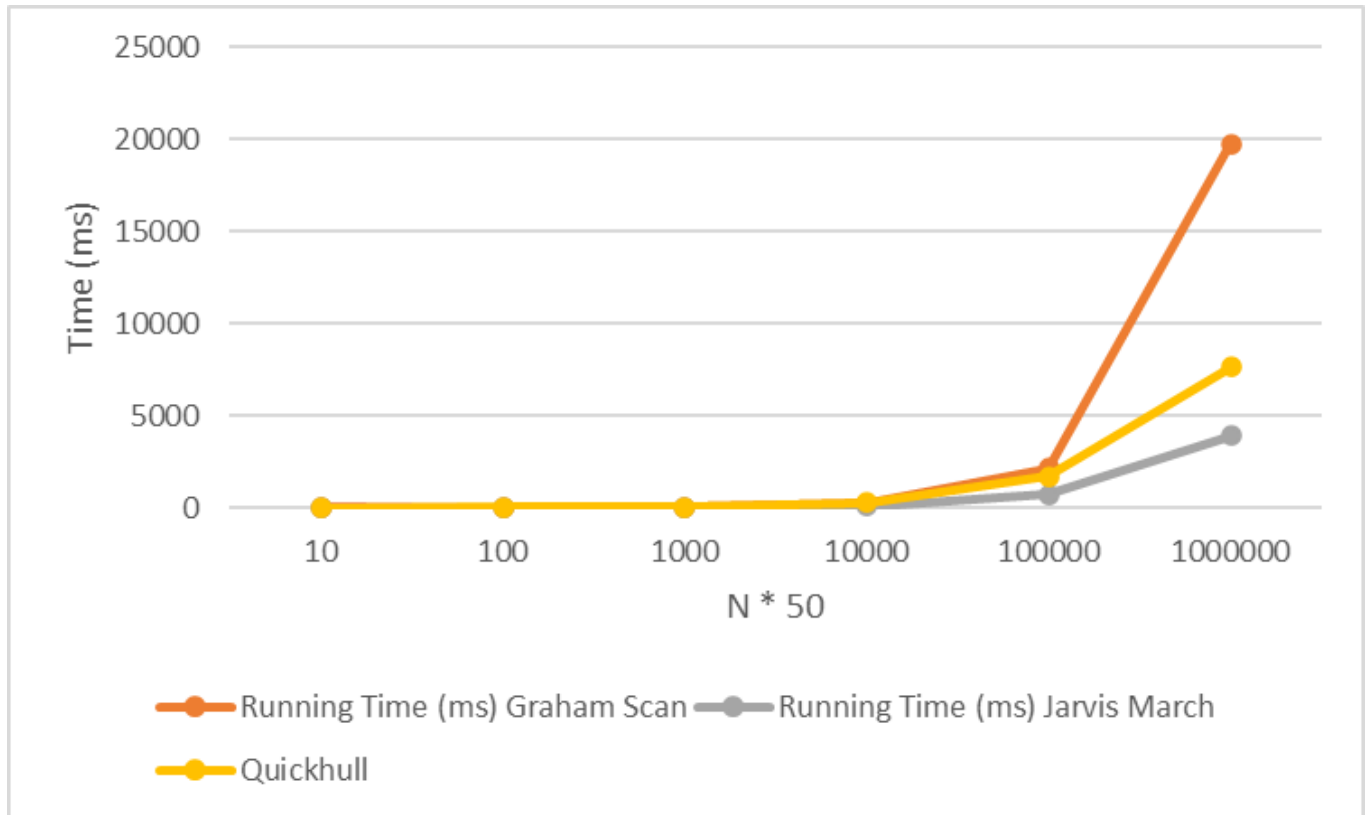
B.

	Running time complexity		
	Graham Scan	Jarvis March	Quickhull
Best Case	Θ(N log N)	Θ(N log N)	Θ(N log N)
Average Case	Θ(N log N)	Θ(N log N)	Θ(N log N)
Worst Case	Θ(N log N)	Θ(N^2)	Θ(N^2)

C.

The empirical analysis value match those of what we would expect based on the theoretical analysis of the three convex hull algorithms. For Graham scan we see very little change as the shape of the sample set changes as to be expected for its time complexity. For Jarvis March and Quickhull we see their worst case which would be when all points are on the convex hull in Graph 2 this would match was is expected from the theoretical analysis. Jarvis March shows the best performance with shapes that have straight line which is to be expected for how the algorithm approaches solving convex hull. Overall, the performance of all three algorithms behaved for all four cases as expected to their theoretical analysis.