Second Smallest Element FJ Report
November 2020
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1) Number of Cores Available:

NOTE: ALL following data is an average of being ran five times.

2) Proving Sequential Algorithm is O(n):

Sequential Algorithm		
n	Run Times	Ratio Between
1,048,576	0.004	1
2,097,152	0.007	1.75
4,194,304	0.012	1.714285714
8,388,608	0.021	1.75
16,777,216	0.042	2
33,554,432	0.081	1.928571429
67,108,864	0.158	1.950617284
134,217,728	0.329	2.082278481
268,435,456	0.670	2.036474164
536,870,912	1.335	1.992537313

This chart represents a doubling test on the sequential algorithm used. The chart clearly shows a doubling ratio that approaches 2 which is a signifies that the algorithm is O(n).

3) Table and Graph Comparing FJ and Sequential Algorithm:

	Threshold						
n	1.0	0.9	0.75	0.5	0.2	0.1	0.0
1,048,576	0.004	0.019	0.014	0.002	0.029	0.024	0.321
2,097,152	0.007	0.008	0.002	0.002	0.007	0.002	0.043
4,194,304	0.012	0.004	0.004	0.003	0.003	0.003	0.086
8,388,608	0.021	0.006	0.005	0.006	0.004	0.004	0.162
16,777,216	0.042	0.011	0.011	0.010	0.008	0.009	0.328
33,554,432	0.081	0.020	0.020	0.020	0.016	0.013	0.536
67,108,864	0.158	0.039	0.035	0.039	0.033	0.027	1.314
134,217,728	0.329	0.084	0.072	0.073	0.056	0.055	2.451
268,435,456	0.670	0.156	0.145	0.141	0.104	0.102	4.982
536,870,912	1.335	0.31	0.294	0.285	0.209	0.204	9.663

		Ratio To Sequential Time					
n	Sequential Time	0.9	0.75	0.5	0.25	0.1	0.0
1,048,576	0.004	0.21	0.29	2.11	0.14	0.17	0.01
2,097,152	0.007	0.88	3.50	3.50	1.00	3.50	0.16
4,194,304	0.012	3.00	3.00	4.00	4.00	4.00	0.14
8,388,608	0.021	3.50	4.20	3.50	5.25	5.25	0.13
16,777,216	0.042	3.82	3.82	4.20	5.25	4.67	0.13
33,554,432	0.081	4.05	4.05	4.05	5.06	6.23	0.15
67,108,864	0.158	4.05	4.51	4.05	4.79	5.85	0.12
134,217,728	0.329	3.92	4.57	4.51	5.88	5.98	0.13
268,435,456	0.670	4.29	4.62	4.75	6.44	6.57	0.13
536,870,912	1.335	4.31	4.54	4.68	6.39	6.54	0.14

4) Analysis of Provided Data To Determine When FJ Does Better or Worse Than Sequential:

Through analyzing the chart it is clear that the larger the fraction the longer it will take to the program to run. Once the program has an input of around five million there is a significant difference between a sequential and parallel algorithm. Furthermore, one can see that a fraction close to 1.0 will have output increasingly similar to a sequential algorithm, while fractions closer to zero will have much faster output. However, for smaller cases the output will vary more for parallel algorithms since there will not be as many splits. Additionally, when the threshold fraction is set to 0.0 it will be slower than the sequential method due to having to split so many times. We can see that the parallel algorithms are approaching closer and closer to being 6x as the fraction approaches 0.1 where it achieves 6x faster performance.