Programming Assignment 1 Report

Hanlin He[*], Lizhong Zhang[†]

September 25, 2018

We run experiments using 24, 36 and 48 cores, with threads number ranging from 2 up to the number of cores. Each experiment runs 20 to 30 times and the average running times were used to minimize Java GC overhead.

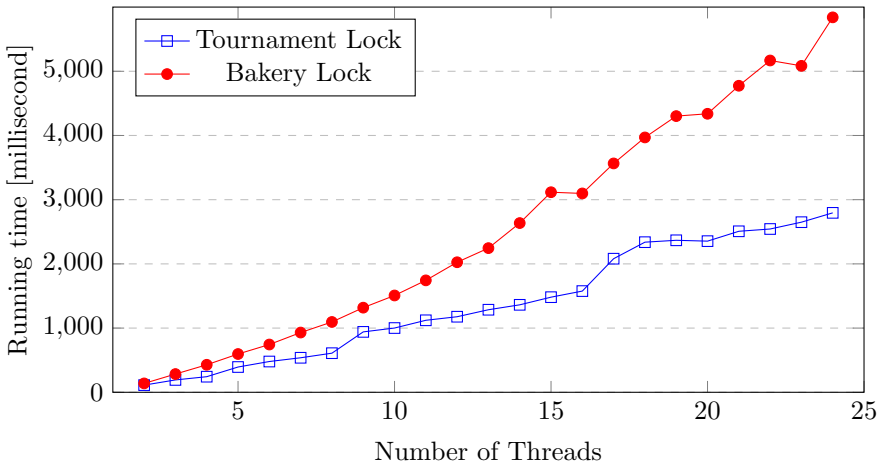
Result & Analysis

Note: All time result is in millisecond.

24 Cores

The experiment results for 24 cores are plotted in fig. 1 and detailed results are shown in table 1.

Figure 1: Experiment Results 1
Running Time Comparison for 24 Cores



[*] hxh160630@utdallas.edu
[†] lxz160730@utdallas.edu

Table 1: Result Detail of Lock Benchmark Experiment on 24 Cores

Cores	Running Time		Cores	Running Time	
	Tournament	Bakery		Tournament	Bakery
2	111.67	138.10	14	1362.33	2635.80
3	192.40	284.00	15	1481.53	3116.20
4	242.87	428.50	16	1576.43	3097.20
5	393.63	596.03	17	2080.53	3564.60
6	479.20	743.97	18	2338.17	3969.47
7	537.57	930.50	19	2367.43	4301.77
8	609.07	1095.20	20	2354.27	4338.03
9	940.77	1318.07	21	2507.73	4774.53
10	1000.73	1507.87	22	2543.33	5168.03
11	1121.40	1743.23	23	2649.60	5084.77
12	1176.90	2025.40	24	2794.80	5839.93

36 Cores

The experiment results for 36 cores are plotted in fig. 2 and detailed results are shown in table 2.

Figure 2: Experiment Results 2
Running Time Comparison for 36 Cores

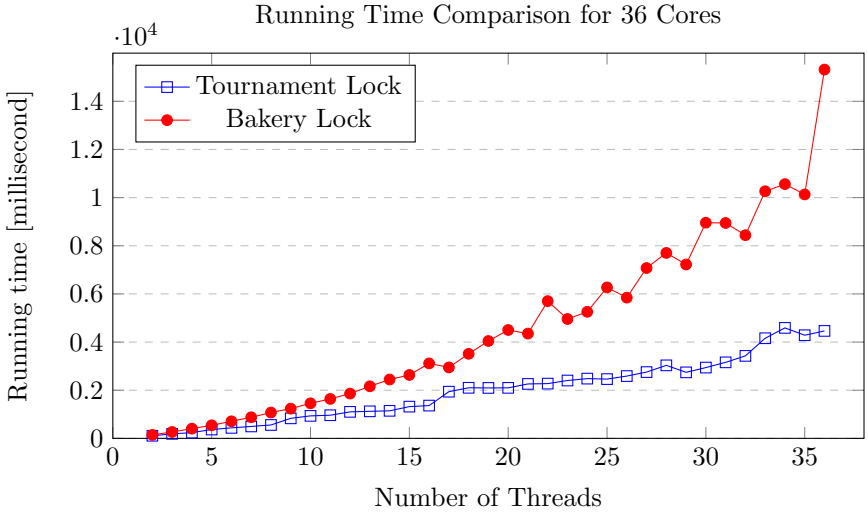


Table 2: Result Detail of Lock Benchmark Experiment on 36 Cores

Cores	Running Time		Cores	Running Time	
	Tournament	Bakery		Tournament	Bakery
2	108.60	144.30	20	2098.40	4501.37
3	187.50	267.10	21	2260.77	4351.93
4	237.90	403.43	22	2274.37	5700.77
5	367.83	542.77	23	2402.97	4957.57
6	435.90	708.53	24	2481.80	5256.73
7	495.70	877.13	25	2462.07	6271.00
8	556.00	1072.63	26	2587.23	5844.63
9	832.43	1234.83	27	2753.10	7074.47
10	934.57	1456.87	28	3033.20	7702.20
11	961.30	1638.50	29	2742.43	7222.77
12	1100.77	1859.93	30	2940.60	8957.37
13	1123.20	2162.27	31	3157.70	8946.53
14	1144.30	2445.57	32	3425.97	8439.90
15	1318.83	2633.50	33	4159.00	10263.80
16	1361.93	3114.20	34	4588.13	10560.00
17	1938.60	2947.57	35	4284.10	10131.47
18	2100.47	3511.90	36	4462.57	15317.33

48 Cores

The experiment results for 48 cores are plotted in fig. 3 and detailed results are shown in table 3.

Figure 3: Experiment Results 1
Running Time Comparison for 48 Cores

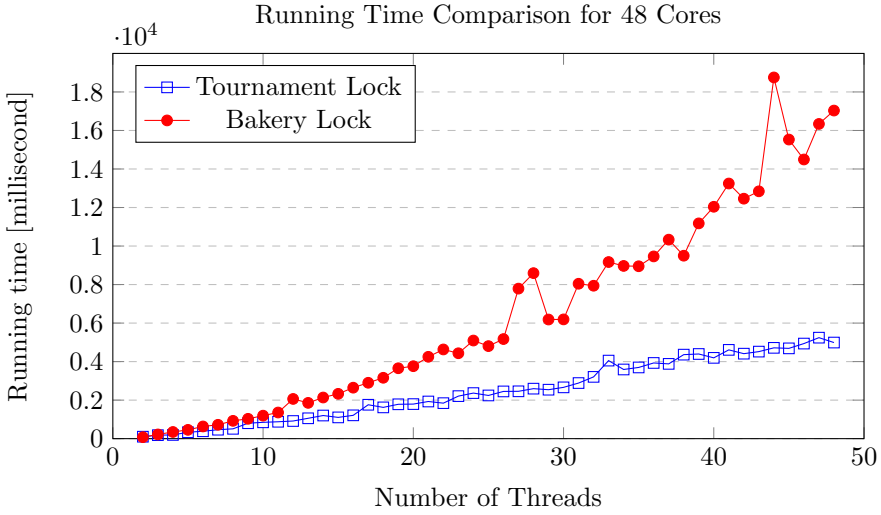


Table 3: Result Detail of Lock Benchmark Experiment on 48 Cores

Cores	Running Time		Cores	Running Time	
	Tournament	Bakery		Tournament	Bakery
2	100.80	75.27	26	2451.73	5170.53
3	181.20	218.80	27	2458.00	7789.40
4	192.67	346.73	28	2595.27	8593.53
5	333.80	456.53	29	2540.93	6185.13
6	384.00	632.60	30	2663.00	6191.47
7	464.00	719.40	31	2886.33	8042.40
8	510.07	924.60	32	3206.93	7939.00
9	801.40	1030.13	33	4052.20	9169.60
10	847.80	1193.87	34	3591.13	8967.07
11	876.53	1356.93	35	3697.07	8950.40
12	915.87	2061.93	36	3929.40	9461.40
13	1057.20	1857.33	37	3882.00	10331.40
14	1200.60	2135.60	38	4361.53	9498.00
15	1103.40	2326.87	39	4395.13	11176.47
16	1210.73	2646.33	40	4194.53	12038.40
17	1759.60	2901.00	41	4608.87	13246.00
18	1623.20	3160.40	42	4411.53	12458.40
19	1784.00	3654.80	43	4518.93	12840.73
20	1794.40	3761.20	44	4714.53	18753.47
21	1928.93	4249.40	45	4687.53	15528.53
22	1843.27	4631.13	46	4936.40	14493.67
23	2208.07	4433.40	47	5242.67	16339.20
24	2365.73	5093.67	48	4989.13	17033.67

Conclusion

Based on our experiments, tournament lock's running time is approximately $\mathcal{O}(n)$, where n is the number of threads. Bakery lock's running time is longer than tournament lock, and closer to $\mathcal{O}(n^2)$.

A side node: For our implementation, tournament lock works fine if the number of threads is slightly larger than the number of cores, but the bakery lock's performance would drop dramatically in such scenarios.