

Multicore Programming Programming Assignment 1 Report

1. Project Description

According to the requirements of programming assignment 1, I need to implement two types of locks using Tournament Algorithm as well as Bakery Algorithm. Below, I will discuss about the implementation of these two algorithms and compare the performance of them.

2. How to Implement

I have created an abstract class, AbstractLock, which has two unimplemented method, lock, unlock, with IncrementCounter object as the input parameter, since I will pass IncrementCounter with threadId and path info(for Tournament Lock only) to the lock to decide which thread can access the critical section.

For Tournament Lock, since it is based on Peterson Algorithm, I first implement the Peterson Lock. The most important part of Tournament Lock is to record the lock path of a thread which can finally enter the critical section. I used an array for each IncrementCounter to record the path, which can be used to find the path when unlock a thread.

Also, I used a simple counter for the critical section the threads need to compete for. I let each thread execute 100000 times, thread quantity varies from 2 to 32. The experiment runs 5 times and our results are based on the average of the 5 times test.

3. Conclusion

Bakery Lock and Tournament Lock's performance don't have too much difference when the thread quantity is small(less than 16). However, as the thread quantity increases, Tournament Lock performs much better than Bakery Lock, since Tournament Lock uses a tree based Peterson Lock. It dramatically decreases the number of contentions needed for threads to enter into critical section. Therefore, Tournament Lock will be a better choice if I use large number of threads to realize mutual exclusion operations. For detailed experimental results, please check below result table and chart.

Bakery VS Tournament (100000 requests per thread)

	Round1 (Time: ms)		Round2 (Time: ms)		Round 3 (Time: ms)		Round 4 (Time: ms)		Round 5 (Time: ms)		Average (Time: ms)	
Thread	Bakery	Tournament	Bakery	Tournament	Bakery	Tournament	Bakery	Tournament	Bakery	Tournament	Bakery	Tournament
2	152	112	114	68	211	90	147	104	83	132	141	101
3	197	256	221	214	228	191	190	182	224	183	212	205
4	268	314	236	245	299	345	379	243	328	245	302	278
5	391	382	422	356	398	389	410	420	428	376	409	384
6	477	351	597	443	471	430	472	359	484	398	500	396
7	685	507	791	543	622	474	581	567	666	512	669	520
8	634	556	783	639	734	724	711	658	795	589	731	633
9	713	767	740	753	883	700	949	733	822	736	821	737
10	1073	765	999	897	1046	659	1288	700	789	858	1039	775
11	906	861	1004	890	955	957	1005	894	1026	771	979	874
12	1189	1060	1761	1010	1107	933	1172	977	1095	839	1264	963
13	1716	1073	1797	653	1256	1040	1611	898	1214	1141	1518	961
14	1271	1093	1616	1005	1595	1256	1207	816	1585	1108	1454	1055
15	1285	1331	1749	922	1629	1153	1434	711	1841	1584	1587	1140
16	2469	1171	1915	1316	1933	1312	1411	1423	1684	1247	1882	1293
17	2206	1541	1615	1418	2956	1346	4742	1258	1637	1471	2631	1406
18	1713	1467	1783	1226	1802	1399	1666	1520	2078	1618	1808	1446
19	8739	1563	1700	1703	5674	1654	1821	1494	2039	1583	3994	1599
20	2112	1522	1842	1500	2420	1621	3908	1433	4646	1392	2985	1493
21	3601	1656	2549	1640	13802	1807	4244	2920	5181	1770	5875	1958
22	2863	1440	3523	1562	12908	1972	2797	1430	5956	1492	5609	1579
23	7173	1624	7125	1808	6851	1790	6948	1638	7039	1948	7027	1761
24	3135	3298	2193	2132	5278	2227	4999	1866	2601	1786	3641	2261
25	3485	2060	6430	2067	17936	1591	6673	2213	13911	1945	9687	1975
26	41909	1762	9128	2701	3516	1888	28097	2349	2859	2353	17101	2210
27	5214	2017	15165	2520	8454	2335	27850	2488	8673	1807	13071	2233
28	2656	1920	13909	2412	5311	1797	10456	3938	2894	1964	7045	2406
29	4288	2258	14224	1884	17540	2263	15460	2173	7609	2825	11824	2280
30	38535	2172	4469	1862	9683	2644	43623	2134	4237	1803	20109	2123
31	82070	2397	179612	2567	21655	2787	38916	2116	9596	2550	66369	2483
32	16085	2498	14685	2522	15476	2275	14745	2442	11619	2818	14522	2511

