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Producer - Consumer Problem

In this assignment we have analyzed the producer-consumer problem using different number of threads and calculating the **speed-ups** and **efficiencies**.

1. 100k items, 1 producer, 1 consumer: 0.354995 seconds
2. 100k items, 2 producer, 2 consumer: 0.250267 seconds
3. 100k items, 4 producer, 4 consumer: 0.163751 seconds
4. 100k items, 8 producer, 8 consumer: 0.110517 seconds
5. 100k items, 16 producer, 16 consumer: 0.062718 seconds
6. 100k items, 32 producer, 32 consumer: 0.069113 seconds

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7. 500k items, 1 producer, 1 consumer: 1.841511 seconds
8. 500k items, 2 producer, 2 consumer: 1.202008 seconds
9. 500k items, 4 producer, 4 consumer: 0.733947 seconds
10. 500k items, 8 producer, 8 consumer: 0.349389 seconds
11. 500k items, 16 producer, 16 consumer: 0.270967 seconds
12. 500k items, 32 producer, 32 consumer: 0.284285 seconds

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13. 1 million items, 1 producer, 1 consumer: 3.621625 seconds
14. 1 million items, 2 producer, 2 consumer: 2.680527 seconds
15. 1 million items, 4 producer, 4 consumer: 1.665333 seconds
16. 1 million items, 8 producer, 8 consumer: 0.669284 seconds
17. 1 million items, 16 producer, 16 consumer: 0.512958 seconds
18. 1 million items, 32 producer, 32 consumer: 0.537250 seconds

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19. 1 billion items, 1 producer, 1 consumer: 36.741636 seconds
20. 1 billion items, 2 producer, 2 consumer: 26.225366 seconds
21. 1 billion items, 4 producer, 4 consumer: 14.574149 seconds
22. 1 billion items, 8 producer, 8 consumer: 8.333493 seconds
23. 1 billion items, 16 producer, 16 consumer: 5.607777 seconds
24. 1 billion items, 32 producer, 32 consumer: 5.576558 seconds

Scalability Analysis:

As we can see from the results, the efficiency does not stay fixed as we increase the number of producer-consumer pairs for the same problem sizes. Thus, it is not strongly scalable.

Size of the problem	1 producer 1 consumer	2 producers 2 consumers	4 producers 4 consumers	8 producers 8 consumers	16 producers 16 consumers	32 producers 32 consumers
100000 items	0.354995	0.250267	0.163751	0.110517	0.062718	0.069113
500000 items	1.841511	1.202008	0.733947	0.349389	0.270967	0.284285
1000000 items	3.621625	2.680527	1.665333	0.669284	0.512958	0.53725
10000000 items	36.741636	26.225366	14.574149	8.333493	5.607777	5.576558

Size of the problem	p	1 producer 1 consumer	2 producers 2 consumers	4 producers 4 consumers	8 producers 8 consumers	16 producers 16 consumers	32 producers 32 consumers
100000 items	Speed-up	1	1.418	2.168	3.212	5.660	5.136
	Efficiency	1	0.355	0.271	0.201	0.177	0.080
500000 items	Speed-up	1	0.653	2.509	5.271	6.796	6.478
	Efficiency	1	0.163	0.314	0.329	0.212	0.101
1000000 items	Speed-up	1	1.351	2.175	5.411	7.060	6.741
	Efficiency	1	0.338	0.272	0.338	0.221	0.105
10000000 items	Speed-up	1	1.401	2.521	4.409	6.552	6.589
	Efficiency	1	0.350	0.315	0.276	0.205	0.103