Bilkent University
Computer Engineering

CS 342
Operating Systems

Project 2

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section 1

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Part C. Experiments

TABLE 1.
Testing properties.

Min value	Max value	Bin count	Input size
0	10	10	100

TABLE 2.
Turnaround time (μs) with different input and batch sizes

Input size	B = 1	B = 2	B = 4	B = 8	B = 16	B = 32	B = 64
1	3761	6245	3819	3786	4163	3248	6689
	6618	8453	3686	3438	3305	9566	12360
	3605	19009	3016	3375	3902	3597	3900
Average	4661.33	11235.7	3507	3533	3790	5470.33	7649.67
2	4578	12954	4374	11149	3240	3872	6440
	7887	3719	4559	3819	3581	4303	3818
	3974	4096	4172	3512	3707	4315	3844
Average	5479.67	6923	4368.33	6160	3509.33	4163.33	4700.67
4	6928	6404	16087	7041	6411	5151	5776
	5551	6880	6791	5660	5355	5347	17422
	5167	5871	6375	5631	5250	5357	6874
Average	5882	6385	9751	6110.67	5672	5285	10024
8	21345	8283	9896	9175	11086	8694	9792
	10306	9384	10540	10485	10372	10052	9306
	11521	11977	9827	9485	10412	11279	8613
Average	14390.7	9881.33	10087.7	9715	10623.3	10008.3	9237

The experiment has been decided to be done in a way that we can observe the relationship (if any) between input size (number of input files), batch size (number of values the thread reads at a time) and turnaround time. Table 2 denotes the experiment results which are the elapsed time values that obtained depending on different input and batch sizes. For each case, the code has been executed three times and as a result, the average of these three values have been considered as shown in the Table 2.

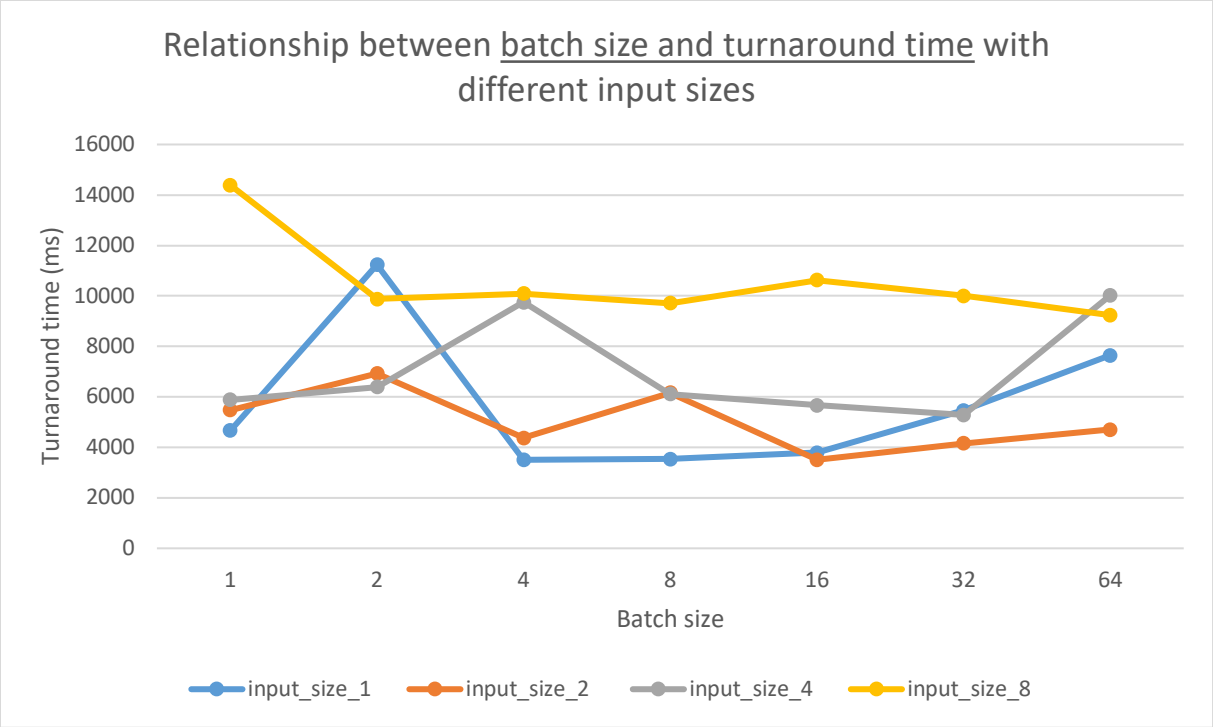

Figure 1. Relationship between batch size and elapsed time.

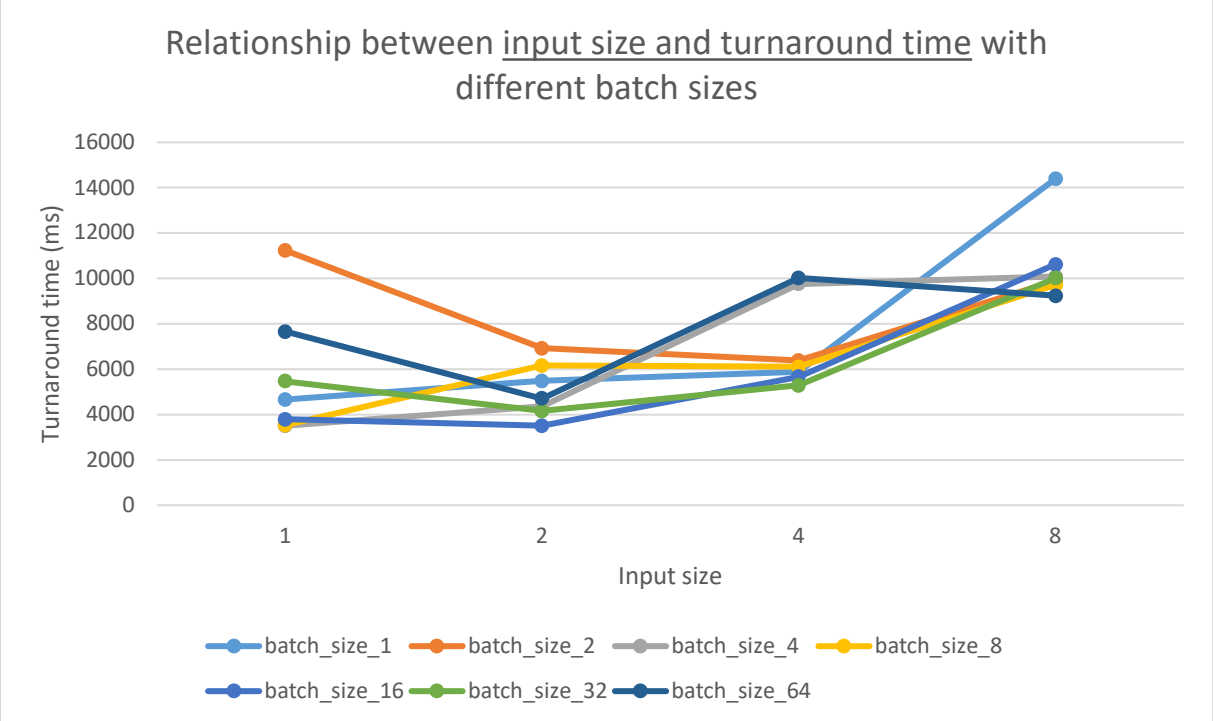

Figure 2. Relationship between input size and elapsed time.

The graph labeled by Figure 1 denotes the relationship between batch size and turnaround time. We observed that there is not any relationship between these two properties, which can also be seen from the graph. During the test execution of the program, the order of producer and consumer threads was changing in a random manner so that after a worker thread put a batch of values from an input file into the shared linked list, sometimes without the consumer read the values from the linked list, another thread or the same worker thread continued filling the linked list:

Producer inserted: 4.000000
Producer inserted: 1.000000
Producer inserted: 8.000000
Producer inserted: 6.000000
Producer inserted: 6.000000
Producer inserted: 10.000000
Producer inserted: 6.000000
Producer inserted: 5.000000
Producer inserted: 2.000000
Producer inserted: 4.000000
Consumer got: 4.000000
Consumer got: 1.000000
Consumer got: 8.000000
Consumer got: 6.000000
Consumer got: 6.000000
Consumer got: 10.000000
Consumer got: 6.000000
Consumer got: 5.000000
Consumer got: 2.000000
Consumer got: 4.000000

In another possible case consumer continuously read the values from the linked list as soon as one of the worker threads inserted a batch of values into the linked list:

Producer inserted: 3.000000
Consumer got: 3.000000
Producer inserted: 7.000000
Consumer got: 7.000000

Producer inserted: 9.000000
Consumer got: 9.000000
Producer inserted: 9.000000
Consumer got: 9.000000
Producer inserted: 9.000000
Consumer got: 9.000000
Producer inserted: 6.000000
Consumer got: 6.000000
Producer inserted: 9.000000
Consumer got: 9.000000
Producer inserted: 2.000000
Consumer got: 2.000000
Producer inserted: 3.000000
Consumer got: 3.000000
Producer inserted: 8.000000
Consumer got: 8.000000

Note: Changing *DEBUG* property from 0 to 1 in the C files, you can observe the outputs like above.

Despite these two different cases, execution time of the program even with different batch sized did not produce a completely different results with the same input size, which again can be observed from the Figure 1.

The graph labeled by Figure 2 also proves the previous observation that we made so that the graph lines that are represented with different batch sizes are almost on the same curve. In addition, the increase in the turnaround time while the input size was increasing is quite normal, because as the number of input files increases, the wait or signal of synchronized jobs, which should be handled by the CPU also increases. As a result, turnaround time increases.