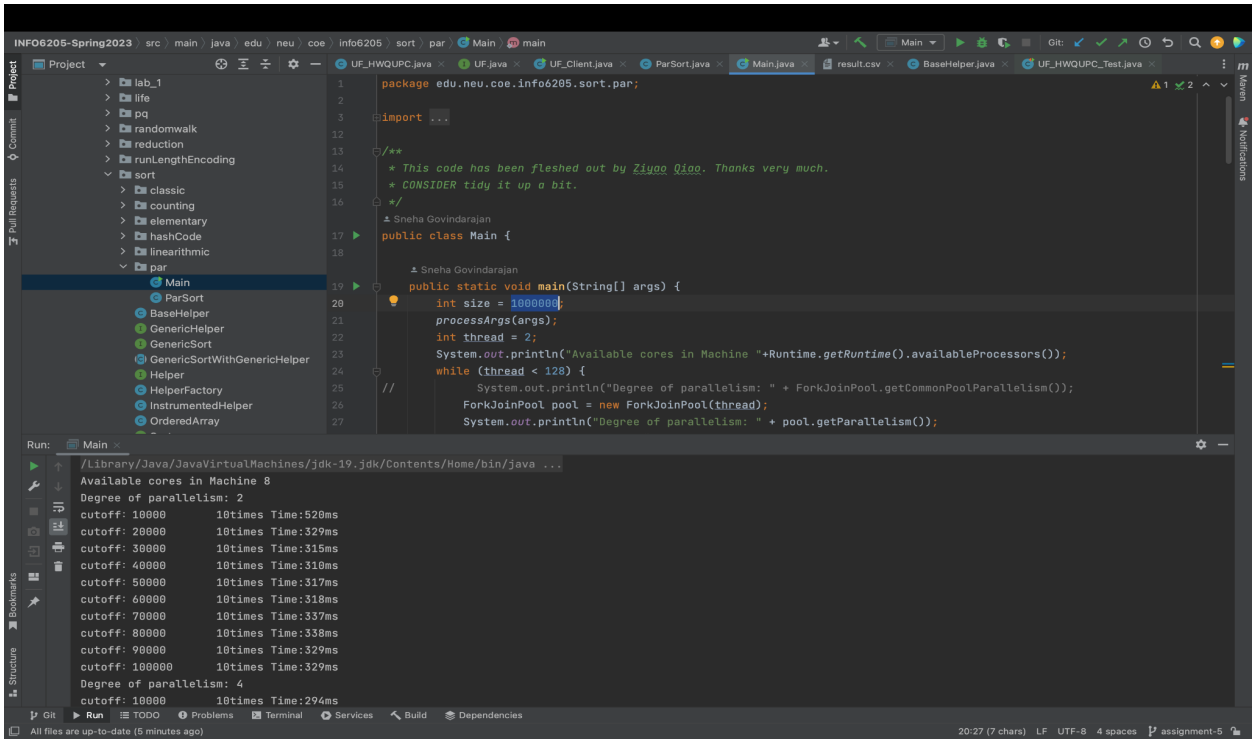
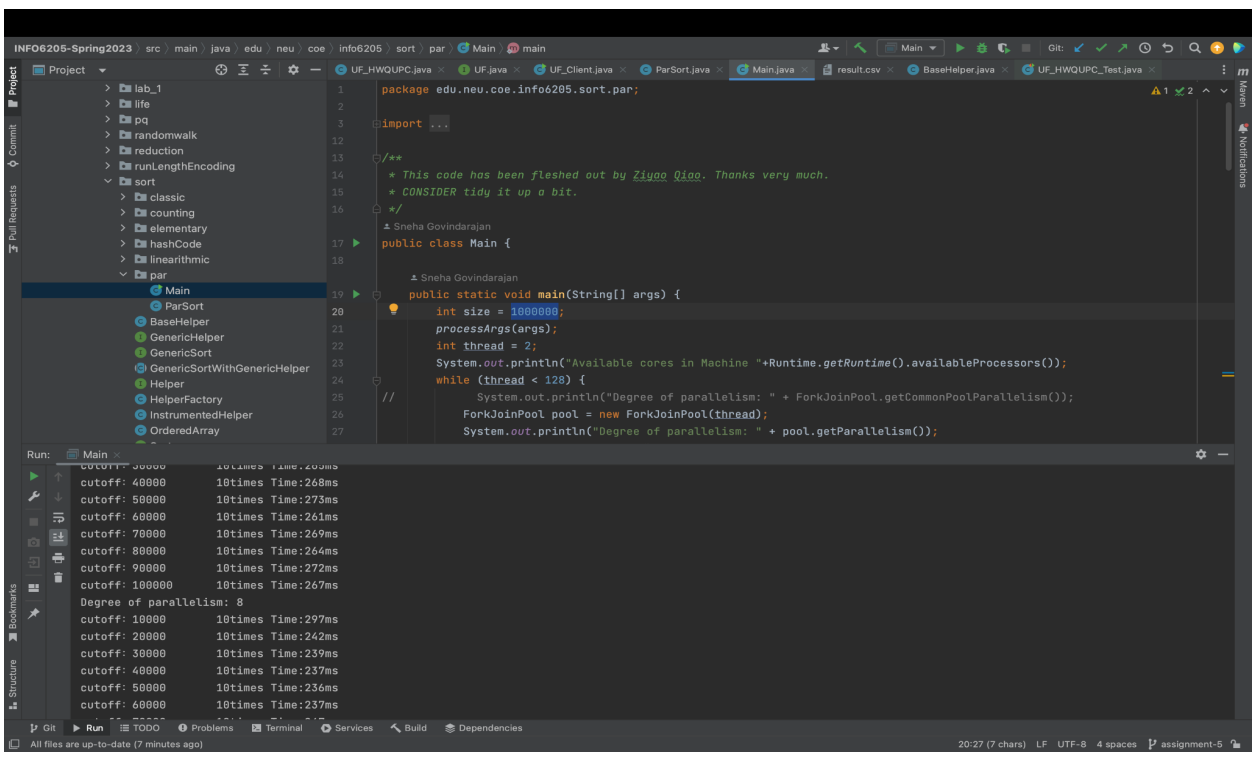
PSA Assignment - 5 Parallel Sorting

1) Screenshots of Parallel Sorting





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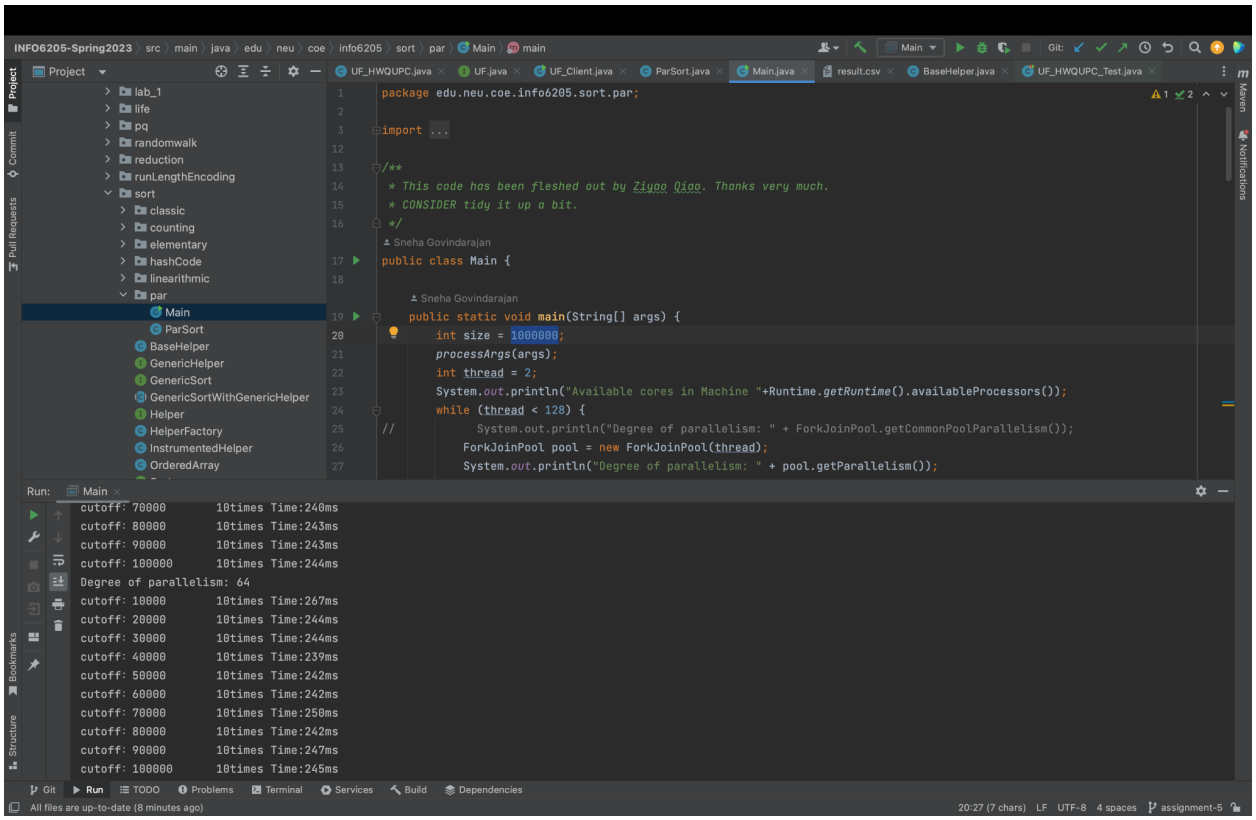

2) Relationship Conclusion:

The relationship between the cutoff value and the execution time is not straightforward. Increasing the cutoff value generally results in faster execution times, but there is a point beyond which further increases in the cutoff value provide no performance benefits and may even degrade performance. This threshold is determined by the characteristics of the input data and the machine on which the algorithm is executed.

The relationship between the number of threads and the execution time is generally inverse, i.e., increasing the number of threads leads to faster execution times. However, this relationship also depends on the characteristics of the input data and the machine on which the algorithm is executed. There is a limit to the number of threads that can be used efficiently on a given machine. Beyond this limit, adding more threads may lead to diminishing returns, or even performance degradation due to increased overheads and contention for system resources.

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3) Evidence to Support Relationship

Array size: 500000

Cut-off - [10000, 20000, 30000, 40000, 50000, 60000, 70000, 80000, 90000, 100000]

Thread 2 - [320, 178, 156, 162, 163, 159, 171, 174, 171, 170]

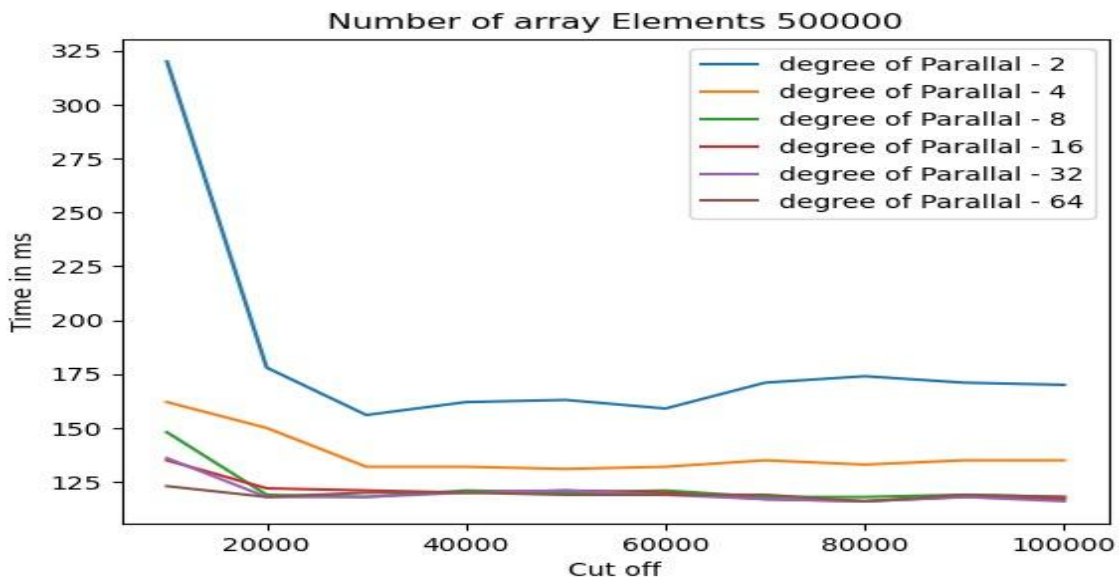
Thread 4 - [162, 150, 132, 132, 131, 132, 135, 133, 135,135]

Thread 8 - [148, 119, 118, 121, 120, 121, 118, 118, 119, 118]

Thread 16 - [135, 122, 121, 120, 121, 120, 117, 116, 118, 117]

Thread 32 - [136, 118, 118, 120, 121, 119, 117, 116, 118, 116]

Thread 64 - [123, 118, 120, 120, 119, 119, 119, 116, 119, 118]



Array size: 600000

Cut off - [10000, 20000, 30000, 40000, 50000, 60000, 70000, 80000, 90000, 100000]

Thread 2 - [351, 200, 198, 196, 199, 200, 209, 214, 210, 200]

Thread 4 - [203, 163, 156, 156, 158, 158, 157, 159, 159, 160]

Thread 8 - [187, 146, 148, 146, 146, 142, 145, 141, 143, 141]

Thread 16 - [180, 144, 144, 144, 142, 143, 144, 140, 141, 140]

Thread 32 - [179, 143, 143, 147, 143, 143, 145, 142, 143, 143]

Thread 64 - [152, 145, 144, 146, 149, 147, 145, 153, 144, 146]

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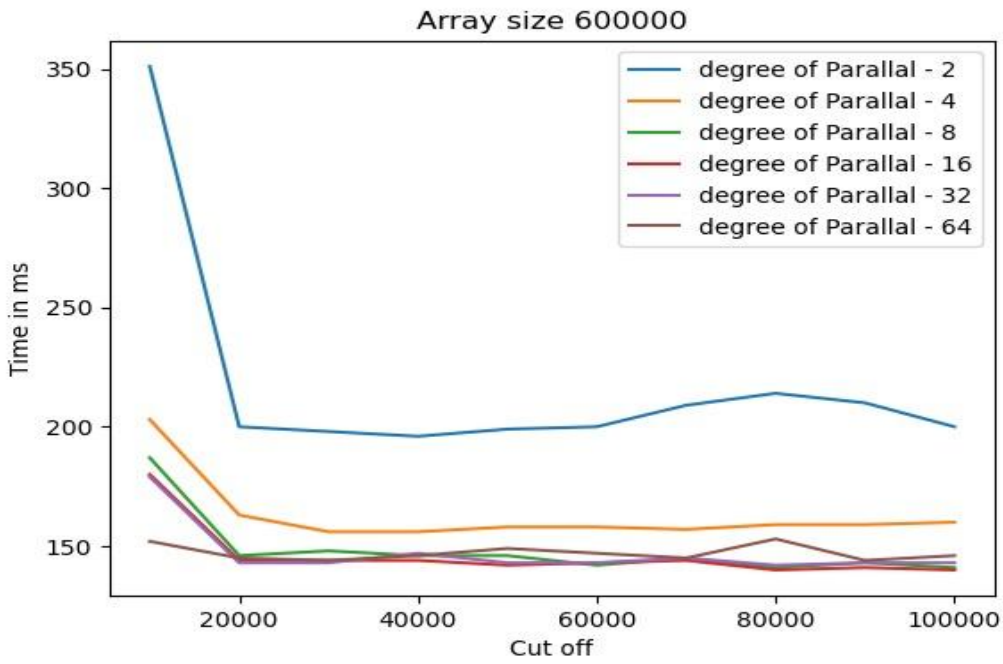

Array size - 1000000

Cut off - [10000, 20000, 30000, 40000, 50000, 60000, 70000, 80000, 90000, 100000]

Thread 2 - [500, 317, 308, 315, 322, 321, 331, 339, 335, 342]

Thread 4 - [308, 254, 261, 256, 261, 259, 267, 266, 270, 266]

Thread 8 - [297, 238, 241, 236, 236, 236,242, 242, 242, 241]

Thread 16 - [295, 237, 238, 236, 236,236, 240, 241, 244, 242]

Thread 32 - [289, 237, 237, 237, 237, 235, 241, 240, 244, 242]

Thread 64 - [267, 239, 238, 238, 237, 237, 241, 240, 241, 243]

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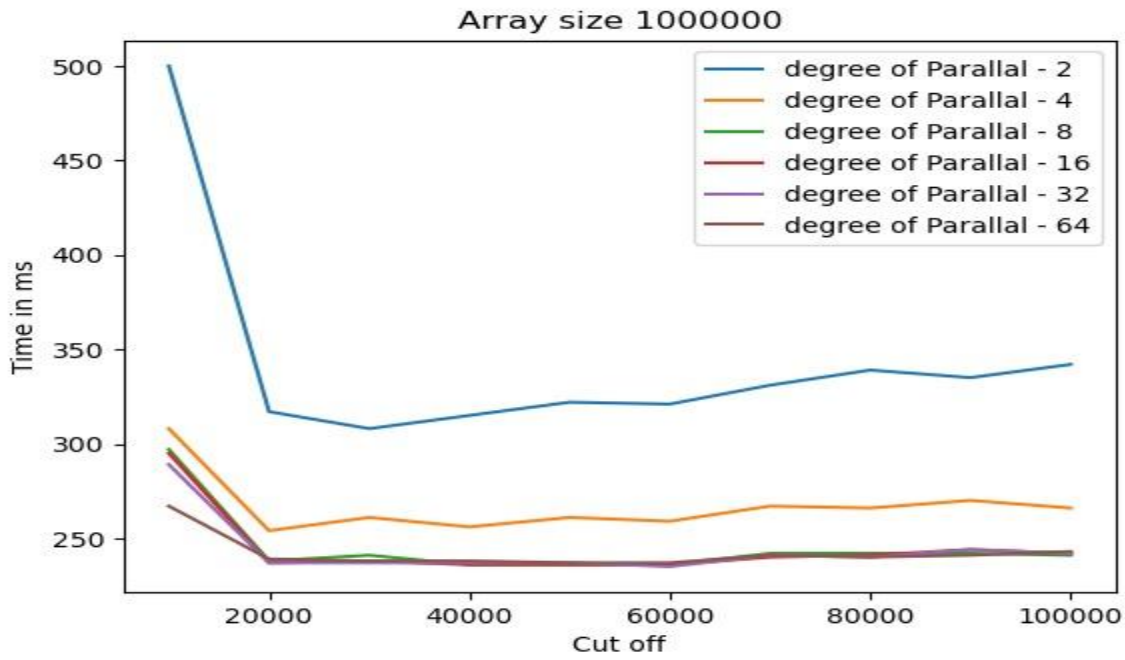

Conclusion

- After varying the cutoff value and the number of threads for various array sizes, the number of threads greater than four does not improve performance. Keeping four threads is thus the best option.
- According to the graph, the lowest performance time is achieved for a cutoff value of 25% of the array size.
- Thus, with a cutoff value of 25% and a thread count of 4, optimal performance can be observed.