Assignment 5 (Parallel Sorting)

Problem Description: Implement the parallel sorting algorithm with varying cutoff sizes and threads.

The cutoff size of the parallel sorting algorithm determines the number of elements to which the sequential sorting algorithm will be applied. If we increase the cutoff size, the depth of the parallel sort tree will reduce, and fewer sorts will be conducted in parallel.

On the other hand, a smaller cutoff size can increase the tree depth, and more sorting is conducted in parallel.

Relationship Conclusion:

A very high cutoff results in too many parallel sorts, causing the overhead to increase significantly. This causes the parallel sort to slow down. Higher cutoff leads to lower running time, irrespective of the number of threads.

Cutoff	Time(8 Thread)	Time(16 Thread)	Time(32 Thread)	Time(64 Thread)
2500	89	83	91	80
5000	42	37	44	40
10000	23	24	23	26
20000	18	21	19	18
40000	18	17	17	18

Table 1: Time(ms) for different cutoff sizes for an array of length 50000.

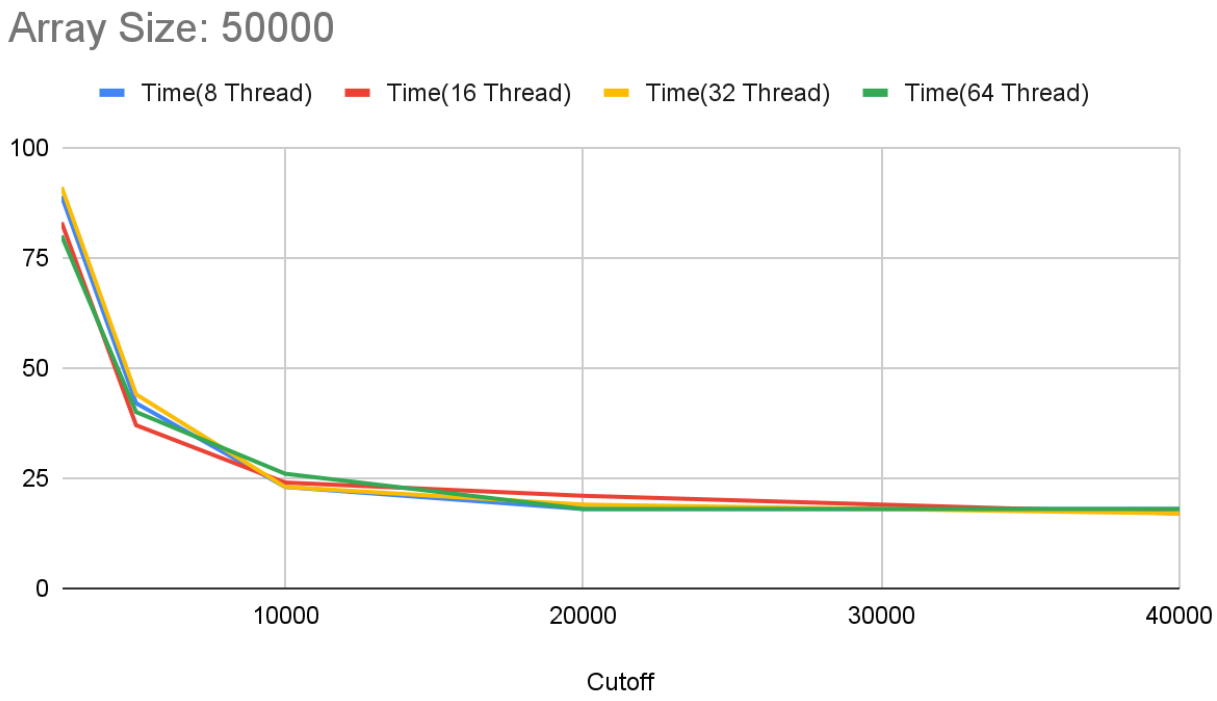

Figure 1: Graph shows the relationship between cutoff and running time for an array of size 50000

Cutoff	Time(8 Thread)	Time(16 Thread)	Time(32 Thread)	Time(64 Thread)
2500	148	147	145	140
5000	80	90	85	96
10000	80	63	63	71
20000	48	43	39	37
40000	32	31	32	31

Table 2: Time(ms) for different cutoff sizes for an array of length 100000.

Figure 2: Graph shows the relationship between cutoff and running time for an array of size 100000.

```
/Library/Java/JavaVirtualMachines/jdk-19.jdk/Contents/Home/bin/java ...
Degree of parallelism: 7
cutoff: 2500        10times Time:89ms
cutoff: 5000        10times Time:42ms
cutoff: 7500        10times Time:47ms
cutoff: 10000       10times Time:23ms
cutoff: 12500       10times Time:22ms
cutoff: 15000       10times Time:26ms
cutoff: 17500       10times Time:17ms
```

Figure 3: Evidence of the parallel sort result

```
/Library/Java/JavaVirtualMachines/jdk-19.jdk/Contents/Home/bin/java ...
Degree of parallelism: 7
cutoff: 2500        10times Time:150ms
cutoff: 5000        10times Time:66ms
cutoff: 7500        10times Time:67ms
cutoff: 10000       10times Time:59ms
cutoff: 12500       10times Time:61ms
cutoff: 15000       10times Time:48ms
cutoff: 17500       10times Time:47ms
```

Figure 4: Evidence of the parallel sort result