Program Structures & Algorithms

Assignment No. 4 - Parallel Sorting

Mayannk Kumaar - 001537115

Task:

- Step 1: A cutoff (defaults to, say, 1000) which you will update according to the first argument in the command line when running. It's your job to experiment and come up with a good value for this cutoff. If there are fewer elements to sort than the cutoff, then you should use the system sort instead.
- Step 2: Recursion depth or the number of available threads. Using this determination, you might decide on an ideal number (*t*) of separate threads (stick to powers of 2) and arrange for that number of partitions to be parallelized (by preventing recursion after the depth of *lg t* is reached).

Output Values:

```
C:\Users\mayan\.jdks\openjdk-17.0.1\bin\java.exe ...
Degree of parallelism: 15
Size of the Array ::: 50000
Current pool of threads ::: 2
cutoff: 5000        10times Time:183ms
cutoff: 10000       10times Time:115ms
cutoff: 15000       10times Time:68ms
cutoff: 20000       10times Time:46ms
cutoff: 25000       10times Time:45ms
cutoff: 30000       10times Time:100ms
cutoff: 35000       10times Time:39ms
cutoff: 40000       10times Time:41ms
cutoff: 45000       10times Time:98ms
cutoff: 50000       10times Time:39ms
Degree of parallelism: 15
Size of the Array ::: 50000
Current pool of threads ::: 4
cutoff: 5000        10times Time:53ms
cutoff: 10000       10times Time:42ms
cutoff: 15000       10times Time:40ms
cutoff: 20000       10times Time:97ms
cutoff: 25000       10times Time:43ms
```

```
Size of the Array ::: 3000000
Current pool of threads ::: 32
cutoff: 25000        10times Time:2394ms
cutoff: 50000        10times Time:1571ms
cutoff: 75000        10times Time:1483ms
cutoff: 100000       10times Time:1544ms
cutoff: 125000       10times Time:1514ms
cutoff: 150000       10times Time:1490ms
cutoff: 175000       10times Time:1483ms
cutoff: 200000       10times Time:1417ms
cutoff: 225000       10times Time:1440ms
cutoff: 250000       10times Time:1439ms
cutoff: 275000       10times Time:1527ms
cutoff: 300000       10times Time:1396ms
cutoff: 325000       10times Time:1564ms
cutoff: 350000       10times Time:1455ms
cutoff: 375000       10times Time:1618ms
cutoff: 400000       10times Time:1528ms
cutoff: 425000       10times Time:1525ms
```

```
C:\Users\mayan\.jdks\openjdk-17.0.1\bin\java.exe ...
Degree of parallelism: 15
Size of the Array ::: 5000000
Current pool of threads ::: 32
cutoff: 25000        10times Time:3595ms
cutoff: 50000        10times Time:2521ms
cutoff: 75000        10times Time:2628ms
cutoff: 100000       10times Time:2470ms
cutoff: 125000       10times Time:2512ms
cutoff: 150000       10times Time:2374ms
cutoff: 175000       10times Time:2286ms
cutoff: 200000       10times Time:2209ms
cutoff: 225000       10times Time:2398ms
cutoff: 250000       10times Time:2416ms
cutoff: 275000       10times Time:2324ms
cutoff: 300000       10times Time:2362ms
cutoff: 325000       10times Time:2230ms
cutoff: 350000       10times Time:2484ms
cutoff: 375000       10times Time:2315ms
cutoff: 400000       10times Time:2327ms
cutoff: 425000       10times Time:2433ms
cutoff: 450000       10times Time:2242ms
```

```
C:\Users\mayan\.jdks\openjdk-17.0.1\bin\java.exe ...
Degree of parallelism: 15
Size of the Array ::: 2000000
Current pool of threads ::: 32
cutoff: 25000        10times Time:1994ms
cutoff: 50000        10times Time:986ms
cutoff: 75000        10times Time:1039ms
cutoff: 100000       10times Time:1161ms
cutoff: 125000       10times Time:1098ms
cutoff: 150000       10times Time:1019ms
cutoff: 175000       10times Time:1014ms
cutoff: 200000       10times Time:1024ms
cutoff: 225000       10times Time:1164ms
cutoff: 250000       10times Time:958ms
cutoff: 275000       10times Time:939ms
cutoff: 300000       10times Time:1014ms
cutoff: 325000       10times Time:1048ms
cutoff: 350000       10times Time:1131ms
cutoff: 375000       10times Time:1100ms
cutoff: 400000       10times Time:1131ms
cutoff: 425000       10times Time:925ms
cutoff: 450000       10times Time:1135ms
cutoff: 475000       10times Time:1092ms
cutoff: 500000       10times Time:1134ms
cutoff: 525000       10times Time:1133ms
cutoff: 550000       10times Time:1124ms
cutoff: 575000       10times Time:1338ms
```

Code:

Main.java, ParSort.java files attached.

Observations:

As per observation, **32** threads are performing sorting better as the array size increases. So, performing sorting on various high array size by using only 32 threads we found a cutoff value to be approximately **300000**