**Assignment 4**

The observation on performing parallel merge sort based on different schemes is as follows.

1. Based on keeping cut off as the criteria to sort in parallel.

Captured run times for various values of cut offs. They are as follows.

**Data for varying cut off for an array size of 3000.**

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| --- | --- |
| **CutOff** | **TimeTaken(in milli seconds)** |
| 1100 | 3.5472388 |
| 1200 | 1.02136114 |
| 1300 | 0.34281391 |
| 1400 | 0.414867595 |
| 1500 | 0.53739483 |
| 1600 | 0.14386761 |
| 1700 | 0.092919775 |
| 1800 | 0.093057305 |
| 1900 | 0.3005528 |
| 2000 | 0.25734847 |
| 2100 | 0.098166715 |
| 2200 | 0.092069985 |
| 2300 | 0.09278579 |
| 2400 | 0.09238731 |
| 2500 | 0.093291785 |
| 2600 | 0.09260066 |
| 2700 | 0.09199413 |
| 2800 | 0.092129905 |
| 2900 | 0.102907635 |
| 3000 | 0.12027577 |

For an array size of 3000, an ideal cut off is at the point 1700.

**Data for varying cut off for an array size of 10000.**

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| **CutOff** | **TimeTaken** |
| 1500 | 5.101045865 |
| 2000 | 1.13380709 |
| 2500 | 0.453732985 |
| 3000 | 0.375408025 |
| 3500 | 0.37673562 |
| 4000 | 0.36518392 |
| 4500 | 0.36223424 |
| 5000 | 0.377583685 |
| 5500 | 0.35455425 |
| 6000 | 0.326151 |
| 6500 | 0.33424886 |
| 7000 | 0.35573554 |
| 7500 | 0.32759496 |
| 8000 | 0.321209085 |
| 8500 | 0.355347665 |
| 9000 | 0.3575286 |
| 9500 | 0.346334785 |
| 10000 | 0.368755915 |
| 10500 | 0.538623695 |
| 11000 | 0.49394716 |

For an array size of 10000, an ideal cut off is at the point 6000.

**Data for varying cut off for an array size of 100000.**

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| **CutOff** | **TimeTaken** |
| 1500 | 20.32305153 |
| 2000 | 7.59961331 |
| 2500 | 7.76836682 |
| 3000 | 9.69408569 |
| 3500 | 5.077416995 |
| 4000 | 5.040044905 |
| 4500 | 5.132737255 |
| 5000 | 7.2192193 |
| 5500 | 5.161732915 |
| 6000 | 5.454016855 |
| 6500 | 4.25551697 |
| 7000 | 4.320620565 |
| 7500 | 6.043639485 |
| 8000 | 4.321184725 |
| 8500 | 4.22898604 |
| 9000 | 4.33276823 |
| 9500 | 4.28885508 |
| 10000 | 5.576872025 |
| 10500 | 4.812184025 |
| 11000 | 4.27964652 |

For an array size of 100000, an ideal cut off is at the point 6500.

1. Following are the observations based on number of threads for parallel sorting. The experiment is run for a constant array size of 10000 and a cut off of 1000.

* The sort is run for 128 times with cut off 1000 and an average of time taken is taken for the 1000 times. The values are recorded in the excel sheet attached in the assignment folder. Based on the observation, for 128 threads that is **27** threads the average run time for 10000 array is **0.39648 milliseconds**.
* The sort is run for 64 times with cut off 1000 and an average of time taken is taken for the 1000 times. The values are recorded in the excel sheet attached in the assignment folder. Based on the observation, for 64 threads that is **26** threads the average run time for 10000 array is **0.29304 milliseconds**.
* The sort is run for 32 times with cut off 1000 and an average of time taken is taken for the 1000 times. The values are recorded in the excel sheet attached in the assignment folder. Based on the observation, for 32 threads that is **25** threads the average run time for 10000 array is **0.353868 milliseconds**.
* The sort is run for 16 times with cut off 1000 and an average of time taken is taken for the 1000 times. The values are recorded in the excel sheet attached in the assignment folder. Based on the observation, for 16 threads that is **25** threads the average run time for 10000 array is **0.334931 milliseconds**.

|  |  |
| --- | --- |
| Number of Threads | Time taken in milliseconds |
| 128 | **0.39648** |
| 64 | **0.29304** |
| 32 | **0.353868** |
| 16 | **0.334931** |

Hence for a cut off of 1000 and an array size of 10000 the ideal number of threads is **26**