**Program Structures & Algorithms**

**Spring 2022**

**Assignment No. 4**

Name: Deepali Kasture

(NUID): 001586375

* **Task**
* 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.
* 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).
* An appropriate combination of these.
* **Output screenshot**

**A screenshot of a computer

Description automatically generated**

* **Evidence / Graph**

**Part 1:** For different array size 2000000 and 4000000 and thread count 8, we observe that the best cutoff value is observed if the array size 20% of its own.

|  |  |
| --- | --- |
| array size: | 2000000 |
| cutoff | time |
| 200000 | 1178 |
| 400000 | 577 |
| 600000 | 585 |
| 800000 | 584 |
| 1000000 | 580 |
| 1200000 | 791 |
| 1400000 | 797 |
| 1600000 | 792 |
| 1800000 | 793 |
| 2000000 | 790 |

|  |  |
| --- | --- |
| array size: | 4000000 |
| cutoff | time |
| 400000 | 2171 |
| 800000 | 1170 |
| 1200000 | 1278 |
| 1600000 | 1302 |
| 2000000 | 1291 |
| 2400000 | 1727 |
| 2800000 | 1735 |
| 3200000 | 1734 |
| 3600000 | 1732 |
| 4000000 | 1729 |

**PART 2:**

1.Keeping the array size constant and observing best cutoff for different thread count.

2. We observed that for thread count 16 we get our best cut off value(1099)

3. We observe that when we increase thread count, running time increases

|  |  |
| --- | --- |
| thread count :1 | |
| cutoff | time |
| 400000 | 2259 |
| 800000 | 2062 |
| 1200000 | 2560 |
| 1600000 | 2609 |
| 2000000 | 2663 |
| 2400000 | 2754 |
| 2800000 | 2752 |
| 3200000 | 2747 |
| 3600000 | 2760 |
| 4000000 | 2774 |

|  |  |
| --- | --- |
| thread count 2 |  |
| cutoff | time |
| 400000 | 2193 |
| 800000 | 1633 |
| 1200000 | 1791 |
| 1600000 | 1821 |
| 2000000 | 1814 |
| 2400000 | 1701 |
| 2800000 | 1691 |
| 3200000 | 1695 |
| 3600000 | 1691 |
| 4000000 | 1696 |

|  |  |  |
| --- | --- | --- |
| thread count :4 | | |
| cutoff | | time |
| 400000 | | 2175 |
| 800000 | | 1298 |
| 1200000 | | 1200 |
| 1600000 | | 1206 |
| 2000000 | | 1205 |
| 2400000 | | 1657 |
| 2800000 | | 1656 |
| 3200000 | | 1656 |
| 3600000 | | 1653 |
| 4000000 | | 1655 |
| thread count:8 | | |
| cutoff | time | |
| 400000 | 1934 | |
| 800000 | 1104 | |
| 1200000 | 1206 | |
| 1600000 | 1212 | |
| 2000000 | 1208 | |
| 2400000 | 1655 | |
| 2800000 | 1665 | |
| 3200000 | 1672 | |
| 3600000 | 1671 | |
| 4000000 | 1675 | |

|  |  |
| --- | --- |
| thread count:16 | |
| cutoff | time |
| 400000 | 1948 |
| 800000 | 1099 |
| 1200000 | 1199 |
| 1600000 | 1186 |
| 2000000 | 1182 |
| 2400000 | 1620 |
| 2800000 | 1617 |
| 3200000 | 1615 |
| 3600000 | 1612 |
| 4000000 | 1617 |

|  |  |
| --- | --- |
| thread count:32 |  |
| cutoff | time |
| 400000 | 2139 |
| 800000 | 1134 |
| 1200000 | 1291 |
| 1600000 | 1212 |
| 2000000 | 1208 |
| 2400000 | 1669 |
| 2800000 | 1668 |
| 3200000 | 1672 |
| 3600000 | 1668 |
| 4000000 | 1683 |
|  |  |

**PART 3:**

1. To combine part 1 and part 2 and plot graph for observed thread counts with array size 4000000 and best cutoff time 800000 which is 20% of the array size
2. Also, as observed best thread count is 16