PA#1 Report

B06703025 劉致豪

ALL DATA RUNNING ON **edaU6**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Input size | IS | | MS | | QS(with RP) | | HS | |
|  | CPU time (ms) | Memory (KB) | CPU time (ms) | Memory (KB) | CPU time (ms) | Memory (KB) | CPU time (ms) | Memory (KB) |
| 4000.case2 | 0.134 | 5904 | 11.726 | 6040 | 2.690 | 5904 | 0.838 | 5904 |
| 4000.case3 | 9.328 | 5904 | 11.493 | 6040 | 3.697 | 5904 | 0.863 | 5904 |
| 4000.case1 | 6.962 | 5904 | 11.990 | 6040 | 2.733 | 5904 | 0.961 | 5904 |
| 16000.case2 | 0.198 | 6056 | 90.498 | 6056 | 7.387 | 6056 | 1.599 | 6056 |
| 16000.case3 | 73.293 | 6056 | 97.778 | 6056 | 7.664 | 6056 | 1.742 | 6056 |
| 16000.case1 | 39.355 | 6056 | 91.806 | 6056 | 8.566 | 6056 | 1.820 | 6056 |
| 32000.case2 | 0.116 | 6188 | 357.483 | 6188 | 13.260 | 6188 | 3.355 | 6188 |
| 32000.case3 | 281.168 | 6188 | 361.095 | 6188 | 14.397 | 6188 | 2.633 | 6188 |
| 32000.case1 | 140.338 | 6188 | 355.798 | 6188 | 13.857 | 6188 | 3.671 | 6188 |
| 1000000.case2 | 1.485 | 12144 | 372444 | 14000 | 423.858 | 12144 | 82.69 | 12144 |
| 1000000.case3 | 301548 | 12144 | 366693 | 14000 | 443.793 | 12144 | 81.797 | 12144 |
| 1000000.case1 | 304134 | 12144 | 381283 | 14000 | 480.659 | 12144 | 139.192 | 12144 |

OPTIMIZING QUICKSORT BY CHOOSING **RANDOM PIVOT**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Input size | QS | | QS(Random pivot) | |
|  | CPU time (ms) | Memory (KB) | CPU time (ms) | Memory (KB) |
| 4000.case2 | 15.726 | 5968 | 2.690 | 5904 |
| 4000.case3 | 16.298 | 5904 | 3.697 | 5904 |
| 4000.case1 | 0.786 | 5904 | 2.733 | 5904 |
| 16000.case2 | 164.979 | 6680 | 7.387 | 6056 |
| 16000.case3 | 121.063 | 6304 | 7.664 | 6056 |
| 16000.case1 | 1.706 | 6056 | 8.566 | 6056 |
| 32000.case2 | 617.425 | 7500 | 13.260 | 6188 |
| 32000.case3 | 468.357 | 6744 | 14.397 | 6188 |
| 32000.case1 | 2.219 | 6188 | 13.857 | 6188 |
| 1000000.case2 | X | X | 423.858 | 12144 |
| 1000000.case3 | X | X | 443.793 | 12144 |
| 1000000.case1 | X | X | 480.659 | 12144 |

QS is better than others in average input case, but becoming the worst when the input size grows.

With random pivot, the average performance improves when the average case gets a little bit worse.

Average case: **HS < QS < IS < MS**

IS = O(n2), MS =Θ(n log n), MS(size>106) = O(n2), QS =Θ(n log n), QS(w/RP)=Θ(n log n), HS =Θ(n log n)

Best case: **IS < HS < QS < MS**

IS = O(n), MS =Θ(n log n), MS(size>106) = O(n2), QS =Θ(n log n), QS(w/RP)=Θ(n log n), HS = O(n log n)

Worst case: **HS < QS < IS < MS**

IS = O(n2), MS =Θ(n log n), MS(size>106) = O(n2), QS =Θ(n2), QS(w/RP)=Θ(n log n), HS = O(n log n)