21800612 Data Structure

임건호

On my honour, I pledge that I have neither received nor provided improper assistance in the completion of this assignment.

Signed: 임건호 Section: 01 Student Number: 21800612

The maximum sample data size is 1000000

insertionSort(): already sorted - best case.

Data will NOT be randomized before use.

n repetitions sort(sec)

500 472 0.000002

600 408 0.000002

700 364 0.000003

800 315 0.000003

900 295 0.000003

1000 270 0.000004

2000 142 0.000007

3000 97 0.000010

4000 73 0.000014

5000 57 0.000018

6000 49 0.000020

7000 42 0.000024

8000 37 0.000027

9000 33 0.000031

10000 30 0.000034

20000 14 0.000073

30000 8 0.000127

40000 7 0.000162

50000 6 0.000186

60000 5 0.000204

70000 5 0.000238

80000 4 0.000273

90000 4 0.000306

100000 3 0.000340

200000 2 0.000691

300000 1 0.001038

400000 1 0.001429

500000 1 0.001783

600000 1 0.002219

700000 1 0.002495

800000 1 0.002894

900000 1 0.003242

1000000 1 0.003609

insertionSort(): randomized - average case.

Randomized Data will be used during sorting.

n repetitions sort(sec)

500 7 0.000150

600 5 0.000214

700 4 0.000293

800 3 0.000369

900 3 0.000471

1000 2 0.000593

2000 1 0.002402

3000 1 0.005298

4000 1 0.009155

5000 1 0.014204

6000 1 0.020213

7000 1 0.027445

8000 1 0.035842

9000 1 0.045187

10000 1 0.058263

20000 1 0.236640

30000 1 0.509485

40000 1 0.897346

50000 1 1.413124

60000 1 2.093919

70000 1 2.824511

80000 1 3.648818

90000 1 4.601179

100000 1 5.589124

200000 1 22.039087

300000 1 49.117878

400000 1 88.064344

500000 1 137.223613

600000 1 195.486470

700000 1 267.725972

800000 1 352.596387

900000 1 439.700619

1000000 1 574.664303

insertionSort(): sorted reversed - worst case.

Data will NOT be randomized before use.

n repetitions sort(sec)

500 4 0.000284

600 3 0.000409

700 2 0.000570

800 2 0.000723

900 2 0.000916

1000 1 0.001134

2000 1 0.004677

3000 1 0.010240

4000 1 0.018236

5000 1 0.028485

6000 1 0.040963

7000 1 0.055855

8000 1 0.072891

9000 1 0.091947

10000 1 0.116314

20000 1 0.459567

30000 1 1.037333

40000 1 1.830074

50000 1 2.836203

60000 1 4.061866

70000 1 5.534413

80000 1 7.272205

90000 1 9.220424

100000 1 11.412012

200000 1 46.428246

300000 1 103.262777

400000 1 182.521327

500000 1 287.080899

600000 1 413.959537

700000 1 567.613273

800000 1 737.305284

900000 1 934.821484

1000000 1 1151.318472

quickSort(): randomized - average case.

Randomized Data will be used during sorting.

n repetitions sort(sec)

500 19 0.000055

600 18 0.000058

700 15 0.000070

800 12 0.000090

900 11 0.000097

1000 10 0.000110

2000 4 0.000253

3000 3 0.000400

4000 2 0.000549

5000 2 0.000712

6000 2 0.000913

7000 2 0.000986

8000 1 0.001231

9000 1 0.001311

10000 1 0.001537

20000 1 0.003252

30000 1 0.005164

40000 1 0.007214

50000 1 0.009215

60000 1 0.011177

70000 1 0.013130

80000 1 0.015005

90000 1 0.017367

100000 1 0.019107

200000 1 0.041931

300000 1 0.062889

400000 1 0.086321

500000 1 0.108135

600000 1 0.136118

700000 1 0.153916

800000 1 0.186335

900000 1 0.209194

1000000 1 0.246206

quickSort(): already sorted - worst case.

Data will NOT be randomized before use.

n repetitions sort(sec)

500 2 0.000728

600 1 0.001067

700 1 0.001400

800 1 0.001828

900 1 0.002309

1000 1 0.002889

2000 1 0.011423

3000 1 0.025587

4000 1 0.045546

5000 1 0.071560

6000 1 0.101949

7000 1 0.139061

8000 1 0.181283

9000 1 0.229320

10000 1 0.283345

20000 1 1.137399

30000 1 2.552484

40000 1 4.542999

50000 1 7.085451

60000 1 10.253734

70000 1 14.062342

80000 1 18.309576

90000 1 23.071306

100000 1 28.435523

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | ,  **a=2.011547514125811e-08 b=0.9475325801058645**   insertionSort – Best | | ,  **a=1.1339666809669158e-08 b=1.9690193515498104** insertionSort – Average | | ,  **a=2.2006468280758344e-28  b=8.639459744451658**  insertionSort – Worst | |
| N | 4,000 | Time for Million | 4,000 | Time for Million | 4,000 | Time for Million |
| Time | 0.000014 | Estimated:  0.00974374200080373  Measured:  0.003609 | 0.009155 | Estimated:  7391.224663544177  Measured:  574.664303 | 0.018236 | Estimated:  1.511154319526914e+24  Measured:  1151.318472 |
| N | 8,000 | 8,000 | 8,000 |
| Time | 0.000027 | 0.035842 | 7.272205 |

|  |  |  |
| --- | --- | --- |
|  | ,  **a=1.7567672312705713e-07  b=1.1649527074792587** Average quickSort O**(N log N)** | |
| N | 4,000 | Time for Million |
| Time | 0.000549 | Estimated:  1.7156570013092372  Measured:  0.246206 |
| N | 8,000 |
| Time | 0.001231 |

**위 그래프를 통해서**

**best 케이스가 확실히 worst 케이스 보다 빠르다는 것을 알 수 있다.**

|  |  |  |
| --- | --- | --- |
|  | ,  **a=1.9640495380721876  b=1.8868166113699953e-08**   selectionSort – Best | |
| N | 4,000 | Time for Million |
| Time | 0.014719 | Estimated:  11482.24791399805  Measured: |
| N | 8,000 |
| Time | 0.057427 |

**표와 그래프를 통해서**

**quick sort > insertion sort > selection sort 순으로 빠르다**