Lab 6: Runtime Comparisons of Different Sorting Algorithms

Vashisth Tiwari
CSC 172

(Dated: April 10th, 2022)

I. SUMMARY OF RESULTS

A. Tables

Note that NAN indicates an excessive runtime (> 10 minutes).

Sorting	Array Size (in thousands)						
	1	**2**	**4**	**8**	**16**	**32**	**1000**
Java Default	0	0	0	0	1	1	40
Bubble Sort	2	6	17	36	119	480	NAN
Selection Sort	1	6	18	37	111	456	NAN
Insertion Sort	1	3	4	10	12	42	27800
Mergesort	0	0	0	1	2	4	105
Quicksort	0	0	1	1	2	5	46

TABLE I: List a

Sorting	Array Size (in thousands)						
	1	**2**	**4**	**8**	**16**	**32**	**1000**
Java Default	0	0	0	1	0	0	2
Bubble Sort	1	1	6	30	89	326	NAN
Selection Sort	0	1	7	31	117	403	NAN
Insertion Sort	0	0	0	0	0	0	1
Mergesort	0	0	1	1	1	3	71
Quicksort	0	0	0	0	1	2	11

TABLE II: List b

	Array Size (in thousands)						
Sorting	1	2	4	8	16	32	1000
Java Default	0	0	1	1	1	0	3
Bubble Sort	1	1	6	22	60	244	NAN
Selection Sort	1	1	5	24	85	337	NAN
Insertion Sort	1	1	44	16	66	257	24462
Mergesort	0	0	1	1	1	1	46
Quicksort	1	1	0	0	0	1	13

TABLE III: List c

	Array Size (in thousands)						
Sorting	1	2	4	8	16	32	1000
Java Default	0	0	0	0	0	0	2
Bubble Sort	0	1	2	7	62	161	NAN
Selection Sort	0	1	6	23	96	397	NAN
Insertion Sort	0	0	0	0	1	0	1
Mergesort	1	0	1	0	1	2	56
Quicksort	0	0	0	0	1	1	11

TABLE IV: List d

B.   Plots

Run time vs array length for list a
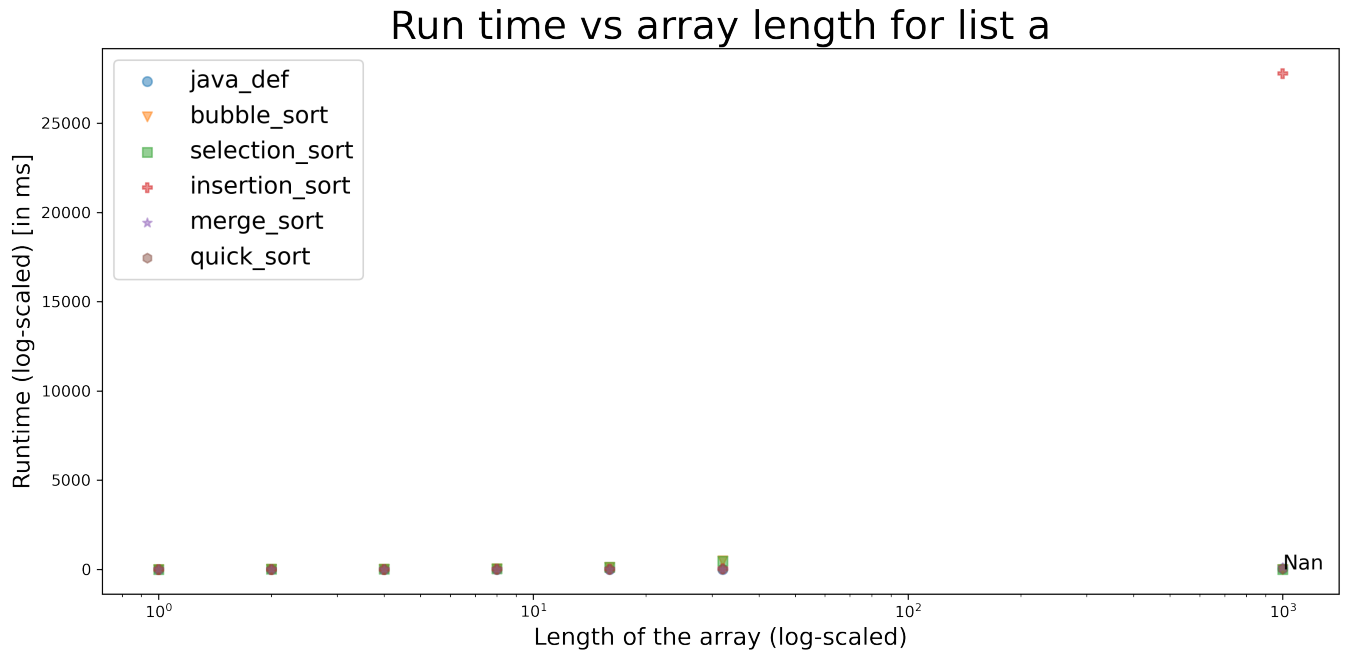
FIG. 1: Plot summarizing the comparison of run times for different sorting algorithms for List a (indicated in the legend) for array of different sizes
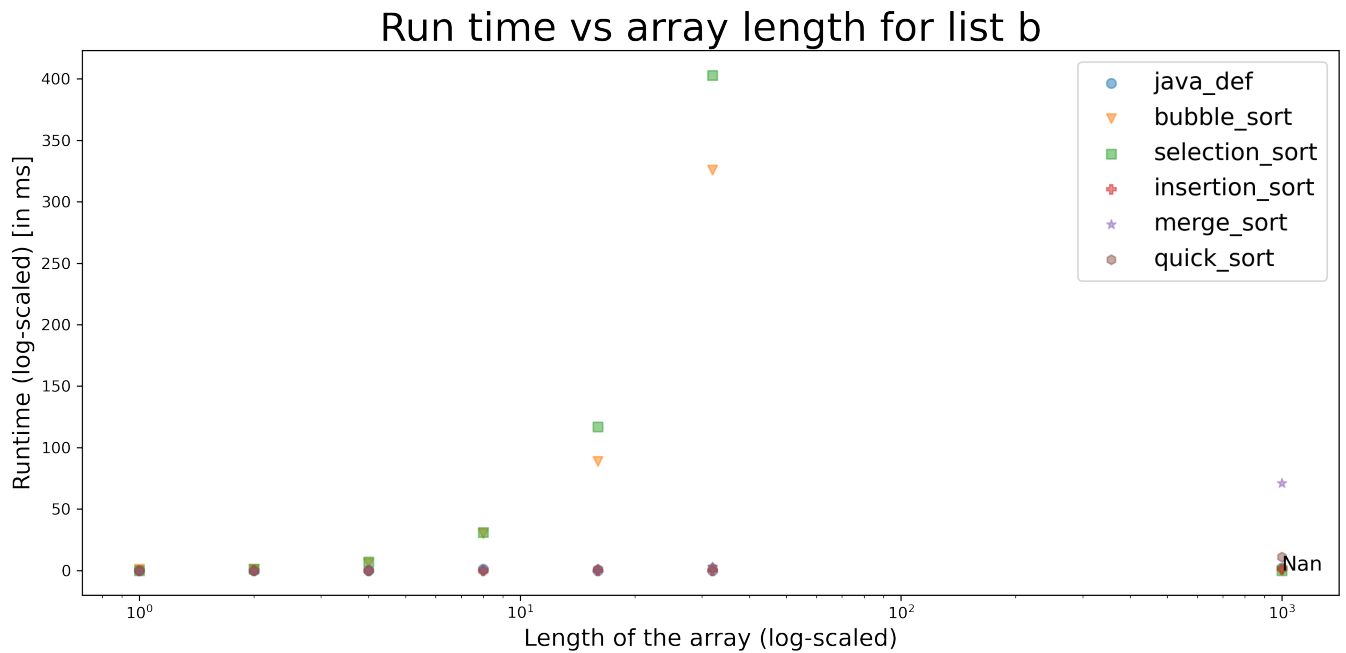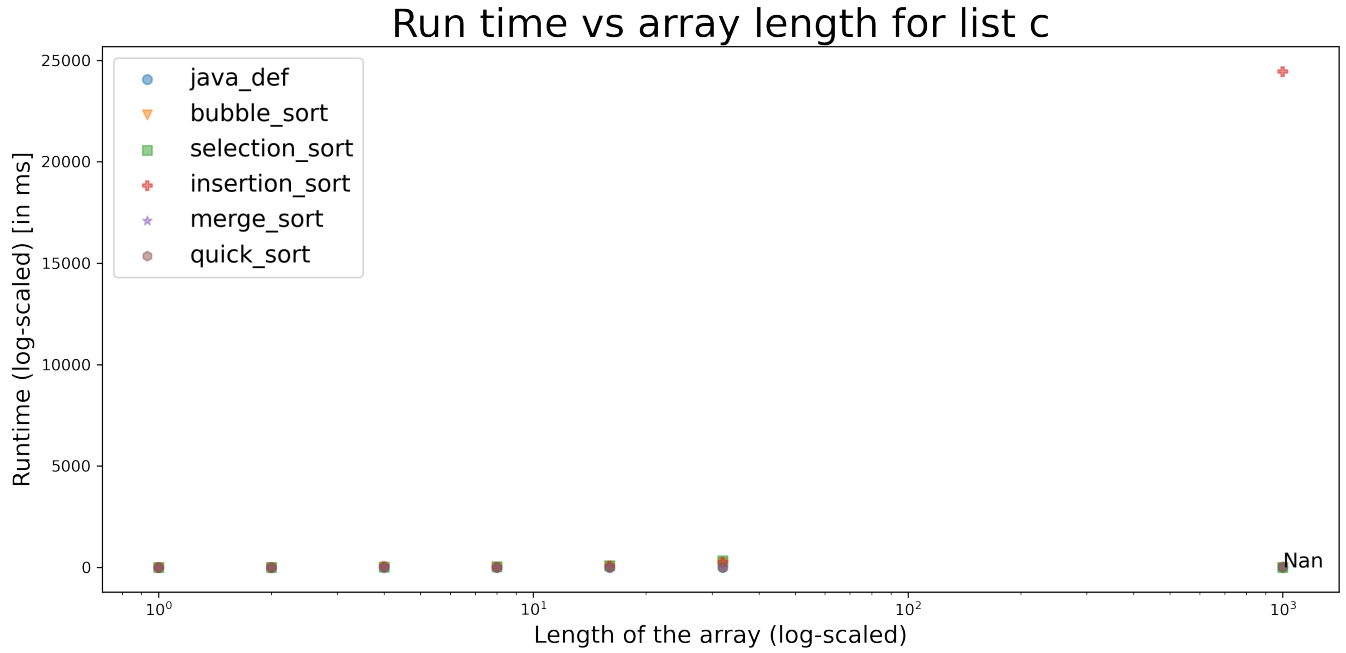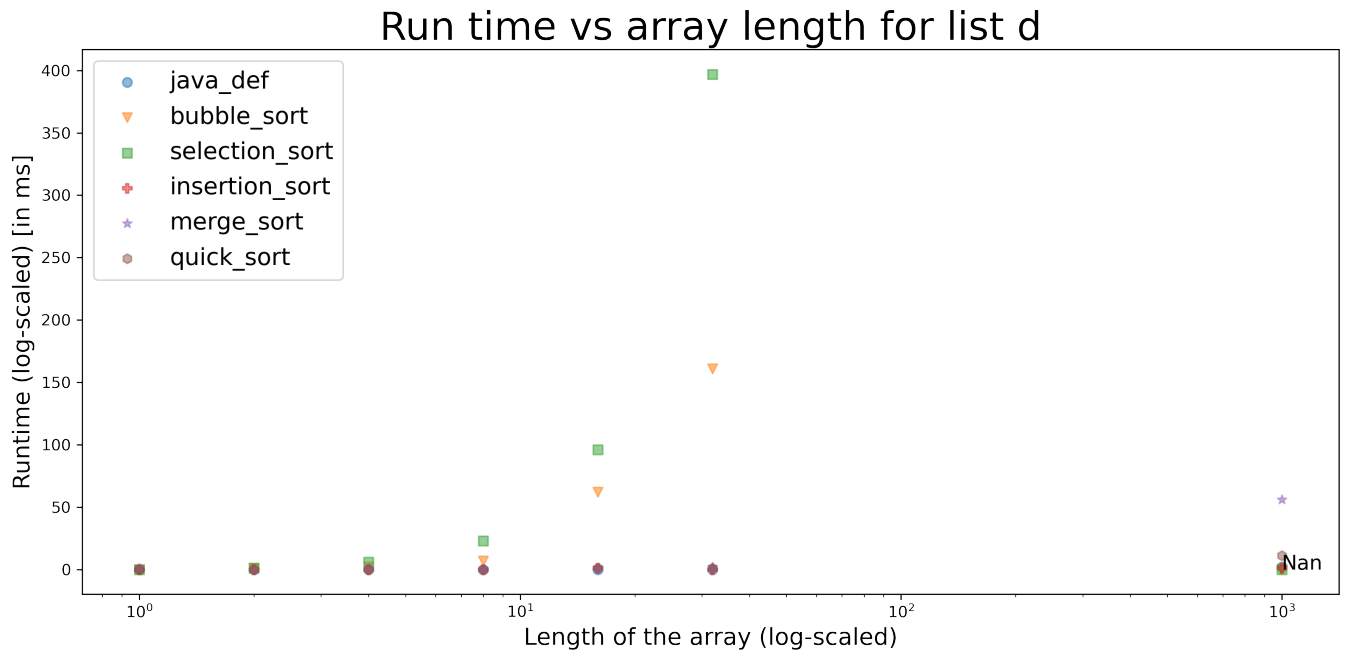
Run time vs array length for list b

FIG. 2: Plot summarizing the comparison of run times for different sorting algorithms for List b (indicated in the legend) for array of different sizes

Run time vs array length for list c

FIG. 3: Plot summarizing the comparison of run times for different sorting algorithms for List c (indicated in the legend) for array of different sizes

Run time vs array length for list d

FIG. 4: Plot summarizing the comparison of run times for different sorting algorithms for List d (indicated in the legend) for array of different sizes

II. SCREENSHOTS FROM THE CODE

```
vashisth@Vashisths-MacBook-Pro src_vashisth % javac Sorting.java
vashisth@Vashisths-MacBook-Pro src_vashisth % java Sorting 1Kints.txt 0
defaultSort() a      0.0    20220410_153235  vtiwari2  1Kints.txt
defaultSort() b      0.0    20220410_153235  vtiwari2  1Kints.txt
defaultSort() c      0.0    20220410_153235  vtiwari2  1Kints.txt
defaultSort() d      0.0    20220410_153235  vtiwari2  1Kints.txt
vashisth@Vashisths-MacBook-Pro src_vashisth % java Sorting 1Kints.txt 1
Bubble Sort a     2.0    20220410_153237  vtiwari2  1Kints.txt
Bubble Sort b     1.0    20220410_153237  vtiwari2  1Kints.txt
Bubble Sort c     1.0    20220410_153237  vtiwari2  1Kints.txt
Bubble Sort d     0.0    20220410_153237  vtiwari2  1Kints.txt
vashisth@Vashisths-MacBook-Pro src_vashisth % java Sorting 1Kints.txt 2
Selection Sort a      1.0    20220410_153239  vtiwari2  1Kints.txt
Selection Sort b      0.0    20220410_153239  vtiwari2  1Kints.txt
Selection Sort c      1.0    20220410_153239  vtiwari2  1Kints.txt
Selection Sort d      0.0    20220410_153239  vtiwari2  1Kints.txt
vashisth@Vashisths-MacBook-Pro src_vashisth % java Sorting 1Kints.txt 3
Insertion Sort a      1.0    20220410_153241  vtiwari2  1Kints.txt
Insertion Sort b      0.0    20220410_153241  vtiwari2  1Kints.txt
Insertion Sort c      1.0    20220410_153241  vtiwari2  1Kints.txt
Insertion Sort d      0.0    20220410_153241  vtiwari2  1Kints.txt
vashisth@Vashisths-MacBook-Pro src_vashisth % java Sorting 1Kints.txt 4
Merge Sort a     0.0    20220410_153243  vtiwari2  1Kints.txt
Merge Sort b     0.0    20220410_153243  vtiwari2  1Kints.txt
Merge Sort c     0.0    20220410_153243  vtiwari2  1Kints.txt
Merge Sort d     1.0    20220410_153243  vtiwari2  1Kints.txt
vashisth@Vashisths-MacBook-Pro src_vashisth % java Sorting 1Kints.txt 5
Quick Sort a     0.0    20220410_153245  vtiwari2  1Kints.txt
Quick Sort b     0.0    20220410_153245  vtiwari2  1Kints.txt
Quick Sort c     0.0    20220410_153245  vtiwari2  1Kints.txt
Quick Sort d     0.0    20220410_153245  vtiwari2  1Kints.txt
```

FIG. 5: 1k

FIG. 6: 2k

```
vashisth@Vashisths-MacBook-Pro src_vashisth % java Sorting 4Kints.txt 0
defaultSort() a        0.0    20220410_153506  vtiwari2  4Kints.txt
defaultSort() b        0.0    20220410_153506  vtiwari2  4Kints.txt
defaultSort() c        0.0    20220410_153506  vtiwari2  4Kints.txt
defaultSort() d        1.0    20220410_153506  vtiwari2  4Kints.txt
vashisth@Vashisths-MacBook-Pro src_vashisth % java Sorting 4Kints.txt 1
Bubble Sort a        17.0    20220410_153508  vtiwari2  4Kints.txt
Bubble Sort b         6.0    20220410_153508  vtiwari2  4Kints.txt
Bubble Sort c         6.0    20220410_153508  vtiwari2  4Kints.txt
Bubble Sort d         2.0    20220410_153508  vtiwari2  4Kints.txt
vashisth@Vashisths-MacBook-Pro src_vashisth % java Sorting 4Kints.txt 2
Selection Sort a       18.0    20220410_153510  vtiwari2  4Kints.txt
Selection Sort b        7.0    20220410_153510  vtiwari2  4Kints.txt
Selection Sort c        5.0    20220410_153510  vtiwari2  4Kints.txt
Selection Sort d        6.0    20220410_153510  vtiwari2  4Kints.txt
vashisth@Vashisths-MacBook-Pro src_vashisth % java Sorting 4Kints.txt 3
Insertion Sort a        4.0    20220410_153511  vtiwari2  4Kints.txt
Insertion Sort b        0.0    20220410_153511  vtiwari2  4Kints.txt
Insertion Sort c       44.0    20220410_153511  vtiwari2  4Kints.txt
Insertion Sort d        0.0    20220410_153511  vtiwari2  4Kints.txt
vashisth@Vashisths-MacBook-Pro src_vashisth % java Sorting 4Kints.txt 4
Merge Sort a        0.0    20220410_153513  vtiwari2  4Kints.txt
Merge Sort b        1.0    20220410_153513  vtiwari2  4Kints.txt
Merge Sort c        0.0    20220410_153513  vtiwari2  4Kints.txt
Merge Sort d        0.0    20220410_153513  vtiwari2  4Kints.txt
vashisth@Vashisths-MacBook-Pro src_vashisth % java Sorting 4Kints.txt 5
Quick Sort a        1.0    20220410_153515  vtiwari2  4Kints.txt
Quick Sort b        0.0    20220410_153515  vtiwari2  4Kints.txt
Quick Sort c        0.0    20220410_153515  vtiwari2  4Kints.txt
Quick Sort d        0.0    20220410_153515  vtiwari2  4Kints.txt
```

FIG. 7: 4k

```
vashisth@Vashisths-MacBook-Pro src_vashisth % java Sorting 8Kints.txt 0
defaultSort() a       0.0    20220410_153533  vtiwari2  8Kints.txt
defaultSort() b       1.0    20220410_153533  vtiwari2  8Kints.txt
defaultSort() c       1.0    20220410_153533  vtiwari2  8Kints.txt
defaultSort() d       0.0    20220410_153533  vtiwari2  8Kints.txt
vashisth@Vashisths-MacBook-Pro src_vashisth % java Sorting 8Kints.txt 1
Bubble Sort a      36.0    20220410_153534  vtiwari2  8Kints.txt
Bubble Sort b      30.0    20220410_153534  vtiwari2  8Kints.txt
Bubble Sort c      22.0    20220410_153534  vtiwari2  8Kints.txt
Bubble Sort d       7.0    20220410_153534  vtiwari2  8Kints.txt
vashisth@Vashisths-MacBook-Pro src_vashisth % java Sorting 8Kints.txt 2
Selection Sort a      37.0    20220410_153536  vtiwari2  8Kints.txt
Selection Sort b      31.0    20220410_153536  vtiwari2  8Kints.txt
Selection Sort c      24.0    20220410_153536  vtiwari2  8Kints.txt
Selection Sort d      23.0    20220410_153536  vtiwari2  8Kints.txt
vashisth@Vashisths-MacBook-Pro src_vashisth % java Sorting 8Kints.txt 3
Insertion Sort a      10.0    20220410_153538  vtiwari2  8Kints.txt
Insertion Sort b       0.0    20220410_153538  vtiwari2  8Kints.txt
Insertion Sort c      16.0    20220410_153538  vtiwari2  8Kints.txt
Insertion Sort d       1.0    20220410_153538  vtiwari2  8Kints.txt
vashisth@Vashisths-MacBook-Pro src_vashisth % java Sorting 8Kints.txt 4
Merge Sort a      1.0    20220410_153540  vtiwari2  8Kints.txt
Merge Sort b      1.0    20220410_153540  vtiwari2  8Kints.txt
Merge Sort c      1.0    20220410_153540  vtiwari2  8Kints.txt
Merge Sort d      0.0    20220410_153540  vtiwari2  8Kints.txt
vashisth@Vashisths-MacBook-Pro src_vashisth % java Sorting 8Kints.txt 5
Quick Sort a      1.0    20220410_153542  vtiwari2  8Kints.txt
Quick Sort b      0.0    20220410_153542  vtiwari2  8Kints.txt
Quick Sort c      0.0    20220410_153542  vtiwari2  8Kints.txt
Quick Sort d      0.0    20220410_153542  vtiwari2  8Kints.txt
```

FIG. 8: 8k

```
vashisth@Vashisths-MacBook-Pro src_vashisth % java Sorting 16Kints.txt 0
defaultSort() a      1.0    20220410_153610   vtiwari2   16Kints.txt
defaultSort() b      0.0    20220410_153610   vtiwari2   16Kints.txt
defaultSort() c      1.0    20220410_153610   vtiwari2   16Kints.txt
defaultSort() d      0.0    20220410_153610   vtiwari2   16Kints.txt
vashisth@Vashisths-MacBook-Pro src_vashisth % java Sorting 16Kints.txt 1
Bubble Sort a    119.0    20220410_153612   vtiwari2   16Kints.txt
Bubble Sort b     89.0    20220410_153612   vtiwari2   16Kints.txt
Bubble Sort c     60.0    20220410_153612   vtiwari2   16Kints.txt
^[[ABubble Sort d     62.0    20220410_153612   vtiwari2   16Kints.txt
vashisth@Vashisths-MacBook-Pro src_vashisth % java Sorting 16Kints.txt 2
Selection Sort a    111.0    20220410_153614   vtiwari2   16Kints.txt
Selection Sort b    117.0    20220410_153614   vtiwari2   16Kints.txt
Selection Sort c     85.0    20220410_153614   vtiwari2   16Kints.txt
Selection Sort d     96.0    20220410_153614   vtiwari2   16Kints.txt
vashisth@Vashisths-MacBook-Pro src_vashisth % java Sorting 16Kints.txt 3
Insertion Sort a     12.0    20220410_153616   vtiwari2   16Kints.txt
Insertion Sort b      0.0    20220410_153616   vtiwari2   16Kints.txt
Insertion Sort c     66.0    20220410_153616   vtiwari2   16Kints.txt
Insertion Sort d      0.0    20220410_153616   vtiwari2   16Kints.txt
vashisth@Vashisths-MacBook-Pro src_vashisth % java Sorting 16Kints.txt 4
Merge Sort a     2.0    20220410_153618   vtiwari2   16Kints.txt
Merge Sort b     1.0    20220410_153618   vtiwari2   16Kints.txt
Merge Sort c     1.0    20220410_153618   vtiwari2   16Kints.txt
Merge Sort d     1.0    20220410_153618   vtiwari2   16Kints.txt
vashisth@Vashisths-MacBook-Pro src_vashisth % java Sorting 16Kints.txt 5
Quick Sort a     2.0    20220410_153619   vtiwari2   16Kints.txt
Quick Sort b     1.0    20220410_153619   vtiwari2   16Kints.txt
Quick Sort c     0.0    20220410_153619   vtiwari2   16Kints.txt
Quick Sort d     1.0    20220410_153619   vtiwari2   16Kints.txt
```

FIG. 9: 16k

```
vashisth@Vashisths-MacBook-Pro src_vashisth % java Sorting 32Kints.txt 0
defaultSort() a        1.0     20220410_153712   vtiwari2   32Kints.txt
defaultSort() b        0.0     20220410_153712   vtiwari2   32Kints.txt
defaultSort() c        0.0     20220410_153712   vtiwari2   32Kints.txt
defaultSort() d        0.0     20220410_153712   vtiwari2   32Kints.txt
vashisth@Vashisths-MacBook-Pro src_vashisth % java Sorting 32Kints.txt 1
Bubble Sort a     480.0     20220410_153714   vtiwari2   32Kints.txt
Bubble Sort b     326.0     20220410_153714   vtiwari2   32Kints.txt
Bubble Sort c     244.0     20220410_153715   vtiwari2   32Kints.txt
Bubble Sort d     161.0     20220410_153715   vtiwari2   32Kints.txt
vashisth@Vashisths-MacBook-Pro src_vashisth % java Sorting 32Kints.txt 2
Selection Sort a     456.0     20220410_153718   vtiwari2   32Kints.txt
Selection Sort b     403.0     20220410_153718   vtiwari2   32Kints.txt
Selection Sort c     337.0     20220410_153718   vtiwari2   32Kints.txt
Selection Sort d     397.0     20220410_153719   vtiwari2   32Kints.txt
vashisth@Vashisths-MacBook-Pro src_vashisth % java Sorting 32Kints.txt 3
Insertion Sort a      42.0     20220410_153721   vtiwari2   32Kints.txt
Insertion Sort b       0.0     20220410_153721   vtiwari2   32Kints.txt
Insertion Sort c     257.0     20220410_153721   vtiwari2   32Kints.txt
Insertion Sort d       0.0     20220410_153721   vtiwari2   32Kints.txt
vashisth@Vashisths-MacBook-Pro src_vashisth % java Sorting 32Kints.txt 4
Merge Sort a     4.0     20220410_153723   vtiwari2   32Kints.txt
Merge Sort b     3.0     20220410_153723   vtiwari2   32Kints.txt
Merge Sort c     1.0     20220410_153723   vtiwari2   32Kints.txt
Merge Sort d     2.0     20220410_153723   vtiwari2   32Kints.txt
vashisth@Vashisths-MacBook-Pro src_vashisth % java Sorting 32Kints.txt 5
Quick Sort a     5.0     20220410_153725   vtiwari2   32Kints.txt
Quick Sort b     2.0     20220410_153725   vtiwari2   32Kints.txt
Quick Sort c     1.0     20220410_153725   vtiwari2   32Kints.txt
Quick Sort d     1.0     20220410_153725   vtiwari2   32Kints.txt
```

FIG. 10: 32k

```
vashisth@Vashisths-MacBook-Pro src_vashisth % java Sorting 1Mints.txt 0
defaultSort() a      40.0    20220410_153754   vtiwari2   1Mints.txt
defaultSort() b       2.0    20220410_153754   vtiwari2   1Mints.txt
defaultSort() c       3.0    20220410_153754   vtiwari2   1Mints.txt
defaultSort() d       2.0    20220410_153754   vtiwari2   1Mints.txt
vashisth@Vashisths-MacBook-Pro src_vashisth % java Sorting 1Mints.txt 1
^C%
vashisth@Vashisths-MacBook-Pro src_vashisth % java Sorting 1Mints.txt 2
^C%
vashisth@Vashisths-MacBook-Pro src_vashisth % java Sorting 1Mints.txt 3
Insertion Sort a  27800.0    20220410_153843   vtiwari2   1Mints.txt
Insertion Sort b      1.0    20220410_153843   vtiwari2   1Mints.txt
Insertion Sort c 244462.0    20220410_154248   vtiwari2   1Mints.txt
Insertion Sort d      1.0    20220410_154248   vtiwari2   1Mints.txt
vashisth@Vashisths-MacBook-Pro src_vashisth % java Sorting 1Mints.txt 4
Merge Sort a     105.0    20220410_154736   vtiwari2   1Mints.txt
Merge Sort b      71.0    20220410_154736   vtiwari2   1Mints.txt
Merge Sort c      46.0    20220410_154736   vtiwari2   1Mints.txt
Merge Sort d      56.0    20220410_154737   vtiwari2   1Mints.txt
vashisth@Vashisths-MacBook-Pro src_vashisth % java Sorting 1Mints.txt 5
Quick Sort a      46.0    20220410_154739   vtiwari2   1Mints.txt
Quick Sort b      11.0    20220410_154739   vtiwari2   1Mints.txt
Quick Sort c      13.0    20220410_154739   vtiwari2   1Mints.txt
Quick Sort d      11.0    20220410_154739   vtiwari2   1Mints.txt
```

FIG. 11: 100k