Experiment 1: Quicksort Pivot Selection

Algorithmic choices:

1. C++ sort
2. Quicksort
   - **Pivot selection:**
     a. A[hi] as the pivot
     b. Random element in the array as the pivot

Type of input:

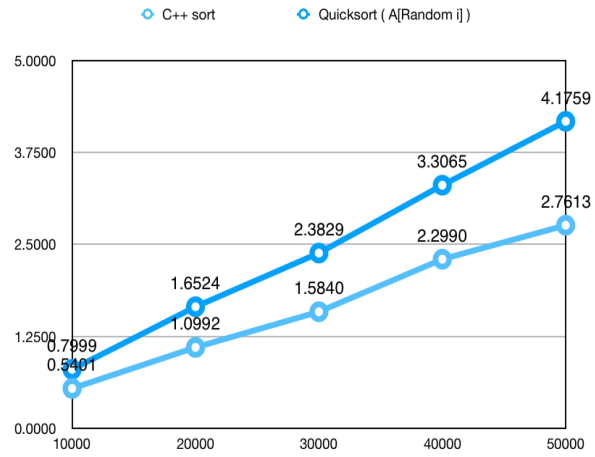
1. Reverse order
2. Random input

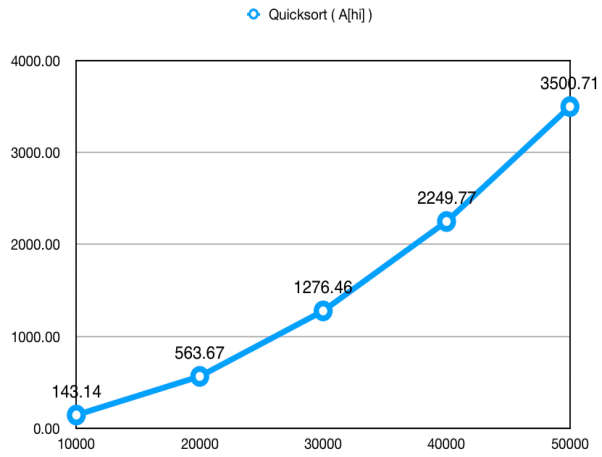
Table and plot:

Reverse order

	C++ sort	Quicksort (A[hi])	Quicksort (A[Random i])
10000	0.5401	143.14	0.7999
20000	1.0992	563.666	1.6524
30000	1.584	1276.46	2.3829
40000	2.299	2249.77	3.3065
50000	2.7613	3500.71	4.1759

The plot blow shows the reverse order input with C++ sort and Quicksort A[hi] as the pivot and Random element in the array as the pivot

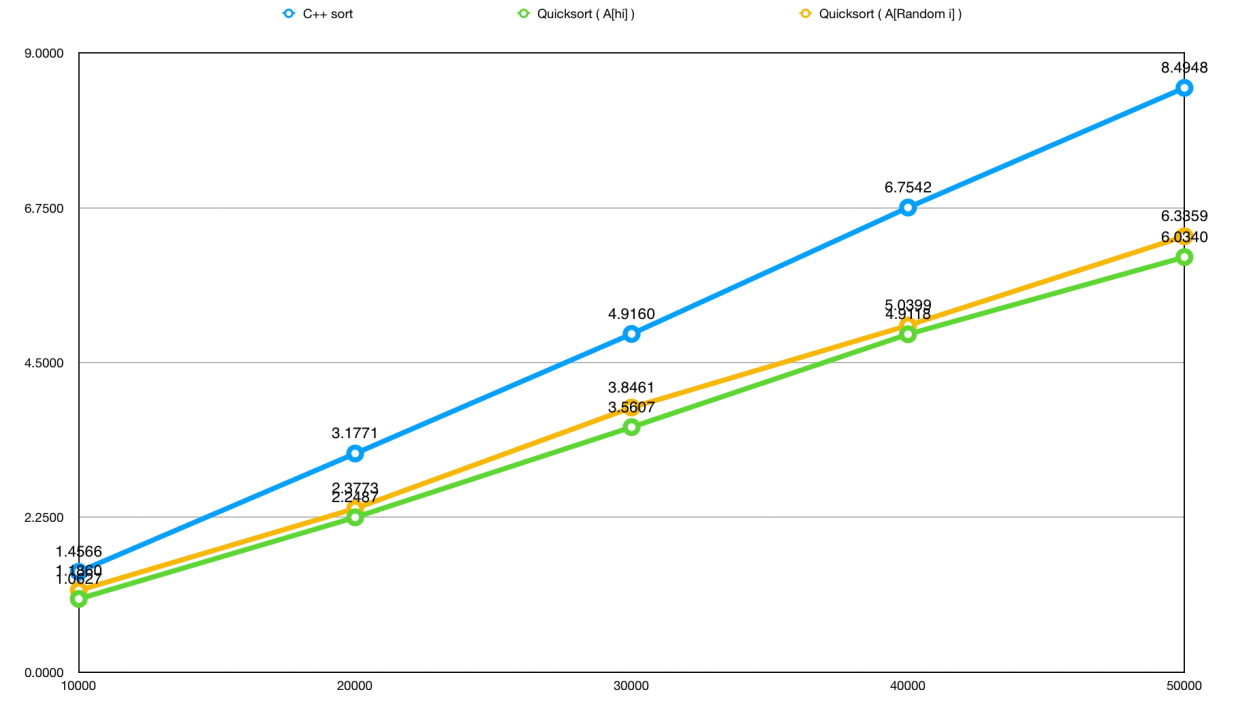




Random order

	C++ sort	Quicksort (A[hi])	Quicksort (A[Random i])
10000	1.4566	1.0627	1.186
20000	3.1771	2.2487	2.3773
30000	4.916	3.5607	3.8461
40000	6.7542	4.9118	5.0399
50000	8.4948	6.034	6.3359

The plot blow shows the random order input with C++ sort and Quicksort A[hi] as the pivot and Random element in the array as the pivot



observation:

Reverse order input with Quicksort A[hi] as pivot is extremely time consuming compare to the other five plots. It is because this is the worst scenario for quicksort with O(n^2) time complexity. C++ sort is more stable compare to quicksort with different input, and it is faster than the best scenario(approximately O(nlog(n))) in the four quicksort method with random input and random element as the pivot.

purpose of source code file:

experiment1.h: contains quicksort method with hi and random as pivot
test1.cpp: test the timing for each sorting method

Experiment 2: IntroSort

Algorithmic choices:

1. C++ sort
2. standard Quicksort
3. modified Quicksort
4. Insertion Sort

Type of input:

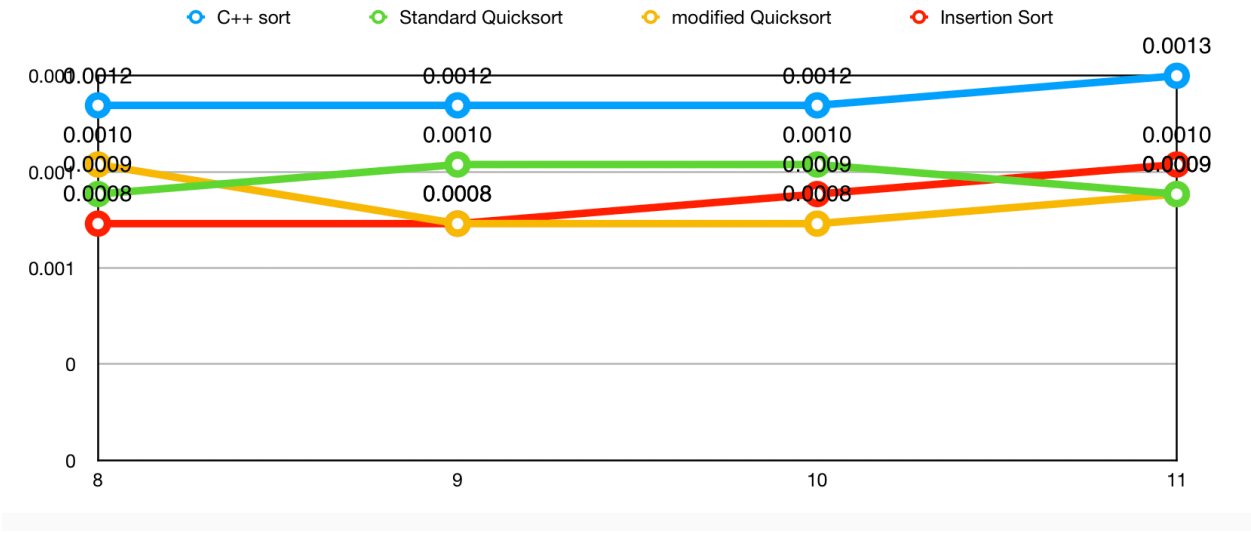
1. Reverse order
2. Random input

Table and plot:

Reverse order

	C++ sort	Standard Quicksort	modified Quicksort	Insertion Sort
8	0.0012	0.0009	0.001	0.0008
9	0.0012	0.001	0.0008	0.0008
10	0.0012	0.001	0.0008	0.0009
11	0.0013	0.0009	0.0009	0.001

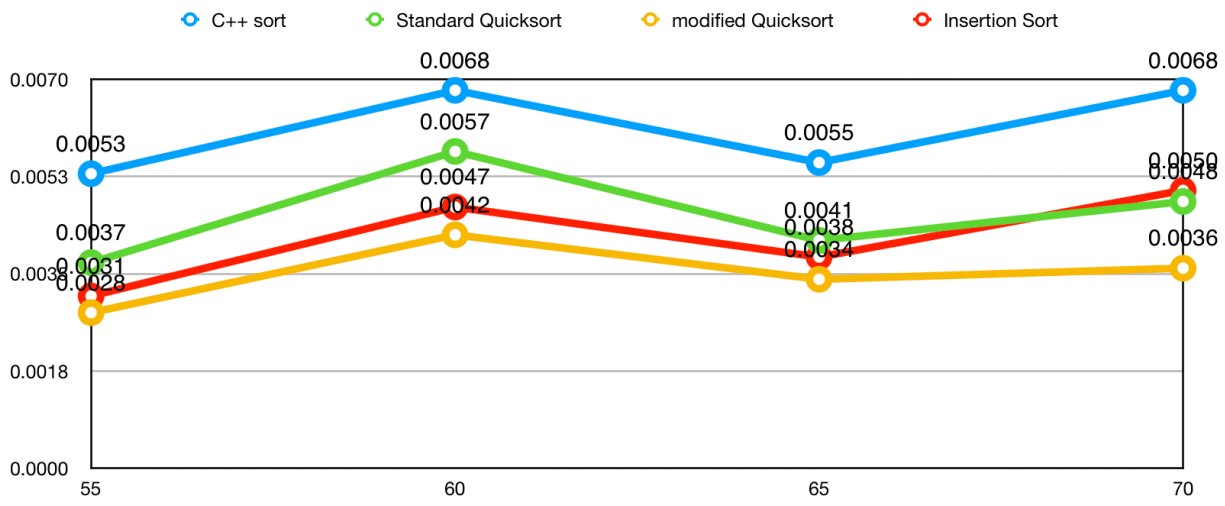
The plot blow shows the reverse order input with C++ sort, standard Quicksort, modified Quicksort and Insertion Sort.



Random order

	C++ sort	Standard Quicksort	modified Quicksort	Insertion Sort
55	0.0053	0.0037	0.0028	0.0031
60	0.0068	0.0057	0.0042	0.0047
65	0.0055	0.0041	0.0034	0.0038
70	0.0068	0.0048	0.0036	0.005

The plot blow shows the Random order input with C++ sort, standard Quicksort, modified Quicksort and Insertion Sort.



observation:

S is the intersection of Insertion sort curve and standard quicksort curve. Insertion sort is faster than standard Quicksort when the size is less than S, but slower than standard Quicksort when the size is greater than S. For reverse order input, S is 10, for random order input, S is 65.

purpose of source code file:

experiment2.h: contains standard and modified quicksort method with middle as pivot
test2.cpp: test the timing for each sorting method