Analysis of Sorting Algorithms

Introduction

A normal computer science engineering student, like me, has to study sorting algorithms three times in his graduation. The first time in the first year in Introduction to programming course, the second time in the second year in the Data Structures course and third time in the third year in Analysis of Algorithms course. But every year students study sorting algorithms from new perspective.

There are several reasons for this :

- Sorting is the fundamental building block of many computer algorithms.
- Computers have historically spent more time sorting than doing anything else. One-fourth of all mainframe cycles were spent sorting data [Knu98].
- Most interesting ideas in algorithms design had come from sorting algorithms.
- There are at least a dozen sorting algorithms each has its unique properties.

In this article, we will compare the running time of **Insertion Sort, Bubble Sort, Quicksort, Mergesort**.

Approach used for comparison

I have selected four sorting algorithms mentioned above. Sorting algorithms will be executed on different size inputs. Sizes of input are 10,100, 1000,10000, 100000. Input will be an array of integers.

Every input has three cases, the first Input is already sorted in ascending order, the second input is already sorted in descending order and the third input is in random order. Each algorithm will sort input array in ascending order. Each input case sorting algorithm is executed four times and the running time of the algorithm is recorded in nanoseconds.

Technical specifications of System

Algorithm Implementation Language - GO

Compiler Version - go1.10.4 Linux/amd64

Operating System - Ubuntu 19.09

OS Type - 64-bit

Processor - Intel® Core™ i3-6006U CPU @ 2.00GHz × 4

Results

Time is in nanoseconds.

Sorting Algorithm	Size of Input	ASC	DSC	RAND	Overall Average
Insertion Sort	10	182	289	276	249
	100	333	7373	4796	4167
	1000	2146	645532	383318	343665
	10000	30201	58815371	28592995	29146189
	100000	246451	6546015964	3164514519	3236925644
Bubble Sort	10	377	363	543	427
	100	8592	11236	23460	14430
	1000	813285	1039039	2372530	1408285
	10000	84642519	107615370	259310452	259310452
	100000	8691913252	11337659869	27472045780	15833872967
Quicksort	10	589	666	543	599
	100	22824	11881	6517	13740
	1000	1153623	1090793	96349	780255
	10000	99688780	90764696	1109106	63854194
	100000	9725021763	9099467660	13528758	6279339394
Mergesort	10	1089	1024	991	1034
	100	12859	12474	17909	14414
	1000	129598	127112	187016	147908
	10000	1108897	1050053	1919509	1359486
	100000	12168209	12026626	24714453	16303096