

Performance Analysis

The program is implemented in such manner that for both the sorted lists; search will be performed using Binary Search Algorithm. Therefore as these are sorted Lists' expected outcome should be a complexity of Log N

To provide testing capabilities the program is implemented such that it will run under 2 modes.

1. User Interaction Mode
2. Test Mode

Generating Data Set

To improve the randomness of the data first the provided files are read and data in each file is stored in an individual List. In order to create a Person Object leveraging random details the following approach was followed

Using `java.util.Random` a random number was generated that lies within the size of each list & the particular entry at that random index was retrieved. This approach was followed in obtaining a random Last Name, First Name and Area Code for a Person.

To generate the phone number, again `java.util.Random` functionality was incorporated ensuring it's a valid number. A Person object hence consist of random elements as its attributes which provides the following advantage

1. During multiple test rounds the Person Objects generated will contain random set of attributes which will increase the randomness of the dataset where test is not carried upon the same set of Person Objects which enhances the accuracy

Measuring Execution Time

Before searching elements in the List starts the current time would be tracked in nano seconds. After the binary search ends for the given input current time would be again tracked in nano seconds. Hence total time used for the search is as below

Time Taken = End Time – Start Time ... (1)

In order to improve the accuracy of the results the tests are averaged as stated below

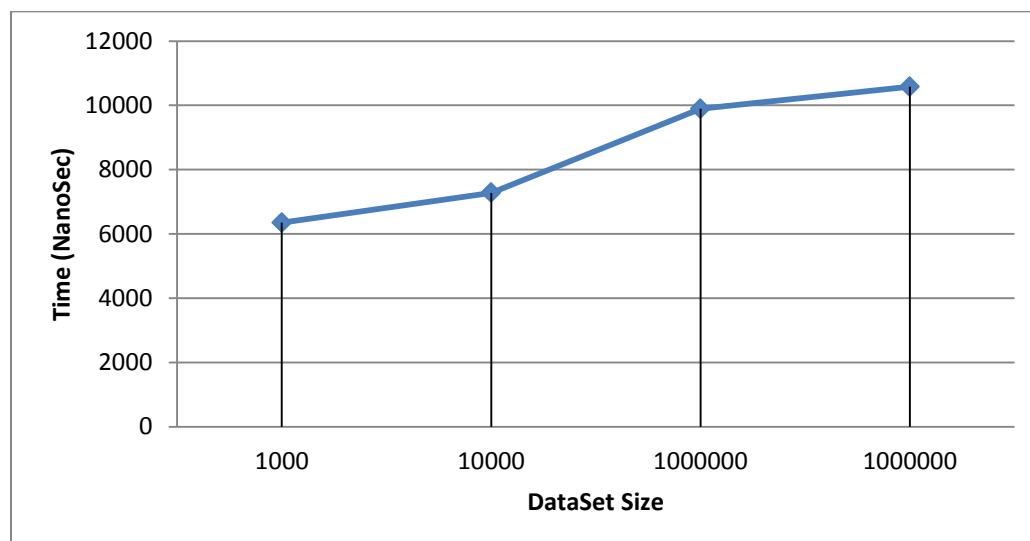
1. 4 random entries are extracted from the already loaded List. These are the data that are available in the List where it's a random successful search. 1 invalid entry is added to cover the worst case scenario. Total 5 entries are searched in the map and the time take for each search is measured as specified in above (1). Time Take in each search is then accumulated.

2. This step is carried out for both the Sorted Lists(List sorted by Phone Number, List Sorted by Name) and the Total Cumulative Time Taken is averaged by the number of cumulative searches performed upon both the Lists (=10). Through this the Avg time taken for the list search for the given dataset size is obtained
3. The above 2 procedures are carried across data set sizes ranging from 1000 – 1000000 in multiplications of 10.
4. Same experiment is carried out 3 times and the graph is plotted using the average of time taken at each data set sizes

Test Results

DataSetSize/Iteration	N = 1,000	N = 10,000	N = 100,000	N = 1,000,000
Iteration 1	12891	13383	14450	15682
Iteration 2	2586	4351	8251	8867
Iteration 3	3563	4105	6979	7184
Avg Time	6346.67	7279.67	9893.33	10577.67

Using the above mentioned data a Time (Nano Sec) – DataSize(N) graph is plotted below



Proof of Output Result

```
Run: PhoneBook PhoneBook
Starting Project.....
Enable User Mode (Yes/No):
No
.....Test Results.....
Data Load Up is Complete .....
Data Size : 1000
Test Results for DataSize : 1000Avg Search Time: 12891
Data Load Up is Complete .....
Data Size : 10000
Test Results for DataSize : 10000Avg Search Time: 13383
Data Load Up is Complete .....
Data Size : 100000
Test Results for DataSize : 100000Avg Search Time: 14450
Data Load Up is Complete .....
Data Size : 1000000
Test Results for DataSize : 1000000Avg Search Time: 15682
Data Load Up is Complete .....
Data Size : 1000
Test Results for DataSize : 1000Avg Search Time: 2586
Data Load Up is Complete .....
Data Size : 10000
Test Results for DataSize : 10000Avg Search Time: 4351
Data Load Up is Complete .....
Data Size : 100000
Test Results for DataSize : 100000Avg Search Time: 8251
Data Load Up is Complete .....
Data Size : 1000000
Test Results for DataSize : 1000000Avg Search Time: 8867
Data Load Up is Complete .....
Data Size : 1000
Test Results for DataSize : 1000Avg Search Time: 3653
Data Load Up is Complete .....
Data Size : 10000
Test Results for DataSize : 10000Avg Search Time: 4105
Data Load Up is Complete .....
Data Size : 100000
Test Results for DataSize : 100000Avg Search Time: 6979
Data Load Up is Complete .....
Data Size : 1000000
Test Results for DataSize : 1000000Avg Search Time: 7184

Process finished with exit code 0
```