MIDDLE EAST TECHNICAL UNIVERSITY, NORTHERN CYPRUS CAMPUS
CNG213 Data Structures – Worksheet 3

Sorting and Searching Algorithms

Purpose:
This worksheet is concerned with sorting and searching algorithms. You will implement algorithms and run some experiments.

1) Implement bubble sort. Your program should count and report the number of comparisons performed. Does that number depend on the initial order of the elements in the array? Sort this list with bubble sort: 7 8 26 44 13 23 98 57.

2) Implement insertion sort. Your program should count and report the number of comparisons performed. Does that number depend on the initial order of the elements in the array? Sort this list with insertion sort: 7 8 26 44 13 23 98 57.

3) Implement selection sort. Your program should count and report the number of comparisons performed. Does that number depend on the initial order of the elements in the array? Sort this list with selection sort: 7 8 26 44 13 23 98 57.

4) Implement merge sort. Your program should count and report the number of comparisons performed. Does that number depend on the initial order of the elements in the array? Sort this list with merge sort: 3, 1, 4, 1, 5, 9, 2, 6.

5) Implement quicksort. Your program should count and report the number of comparisons performed. Does that number depend on the initial order of the elements in the array? In particular, is there an order for which this algorithm performs no better than bubble sort? Sort this list with quicksort: 3, 1, 4, 1, 5, 9, 2, 6, 5, 3, 5.

6) Modify the above program for quicksort as follows: instead of choosing the first element as the pivot element, choose the median value as the pivot element (why?). Does this choice of the pivot element improve the algorithm's performance? Sort this list with quicksort: 3, 1, 4, 1, 5, 9, 2, 6, 5, 3, 5.

7) Which sorting algorithm is your favourite one and why?

8) Implement binary search algorithm.

Please note that from this worksheet, you need to submit the solution of the following question (9)

9) Write a program that will do following;

   a) Reads the songs of the user from an external file called **`songs.txt`** and creates the array of **`songsInfo`** structure which contains the **`songName, artistName`** and **`songYear`**. Please note that you cannot make any assumptions about the number of songs information available in an external file and there is no upper limit for the number of songs information.

   b) Write a function **`displaySongs()`** which will take the array of structure, and also the number of songs stored in the array and displays the sorted array of structure.

c) Write a function **sortSongsYear()** which will take the array of **songsInfo** structure created, and also the number of songs stored in the array, then sorts (by using insertion sort algorithm) the songs based on **songYear** and calls the **displaySongs()** to displays the sorted array of structure.

d) Write a function **searchSong()** which will take the array of **songsInfo** structure created, and also the number of songs stored in the array and search (using sequential search algorithm) the songs based on **songYear** and displays the name of the song and the artist which corresponds to the searched **songYear**.

e) Identify and discuss the big-O notation computation comlexity of your sorthing and searching algorithms in your own words.

Assume the content of file **songs.txt** is organized as below (note that there is no upper limit for the number of songs, i.e. it's size may not be 3):

```
Unutmamali;Tarkan;1994
Huzurum Kalmadi;Ferdi Tayfur;1976
Human Nature;Michael Jackson;1982
```

Then, A sample run would be as follows:

```
The songs.txt file has been loaded successfully!

1)Display songs
2)Sort songs
3)Search songs
4)Exit
What would you like to do? 1

   Unutmamali;Tarkan;1994
   Huzurum Kalmadi;Ferdi Tayfur;1976
   Human Nature;Michael Jackson;1982

1)Display songs
2)Sort songs
3)Search songs
4)Exit
What would you like to do? 2

   Unutmamali;Tarkan;1994
   Human Nature;Michael Jackson;1982
   Huzurum Kalmadi;Ferdi Tayfur;1976

1)Display songs
2)Sort songs
3)Search songs
4)Exit
What would you like to do? 3


Enter song year: 1999
There is not any song which is released in 1999!
```

```
1)Display songs
2)Sort songs
3)Search songs
4)Exit
What would you like to do? 3

   Enter song year: 1994
   Unutmamali;Tarkan;1994


1)Display songs
2)Sort songs
3)Search songs
4)Exit
What would you like to do? 4
```