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.

9) Write a program that will do following;

a) Reads the photos of the user from an external file called **photos.txt** and creates the array of **photosInfo** structure which contains the **photoName, photoSize** and **photoPlace**. Please note that you <u>cannot</u> make any assumptions about the number of photos information available in an external file and there is <u>no</u> upper limit for the number of photos information.

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

c) Write a function **sortPhotosSize()** which will take the array of **photosInfo** structure created, and also the number of photos stored in the array, then sorts (by using selection sort algorithm) the photos based on **photoSize** and calls the **displayPhotos()** to displays the sorted array of structure.

d) Write a function **searchPhoto()** which will take the array of **photosInfo** structure created, and also the number of photos stored in the array and search (using sequential search algorithm) the photos based on **photoSize** and displays the name of the photo and the country which corresponds to the searched **photoSize**.

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

> **Please note that you have to implement sort and search algorithms as provided in the lecture notes.

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

```
IMG_5949.JPG;128; Cyprus
IMG_5250.JPG;712; UK
IMG_5120.JPG;86; Turkey
```

Then, A sample run would be as follows:

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

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

IMG_5949.JPG;128; Cyprus
IMG_5250.JPG;712; UK
IMG_5120.JPG;86; Turkey

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

IMG_5120.JPG;86; Turkey
IMG_5949.JPG;128; Cyprus
IMG_5250.JPG;712; UK

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


Enter size of the photo: 80
There is not any photo with size 80!
1)Display photos
2)Sort photos
3)Search photos
4)Exit
```

```
What would you like to do? 3

Enter size of the photo: 86
IMG_5120.JPG;86; Turkey

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