CSC002 (UCIC) Lab 6.1

Simple Sorting

Goals

This lab will give you some practice with the Insertion, Selection and Shell Sort algorithms; in this lab you will:

- implement a reverse and minimum selection sort algorithm;
- explore the best, worst and average cases of an insertion sort algorithm and
- explore the effect of different sequences of sub list count on a shell sort algorithm.

You should be familiar with the material in Section 5.3 [1] of the textbook before attempting this lab.

Selection Sort

The `sorting.py` module provides maximum selection sort algorithm (listing 5.11 page 211) [2].

- Modify this implementation to produce a reverse-sorted list.
- Try to predict the number of data comparisons needed to sort a list of 1000 items.

  > ***Complete question 1.a and 1.b in lab quiz 6.1.***

- Include statements to count the data comparisons (this was covered in lab1). Test your implementation with the files (file0.txt, file1.txt, file2.txt and file3.txt containing 10, 100, 1000, 10000 elements respectively. Code needed to read the elements is provided in the `sorting.py` module.
- Implement a minimum selection sort that sorts the numbers in ascending order by selecting the minimum in each iteration. Test your implementation with the files provided.

  > ***Complete question 2 in lab quiz 6.1.***

Insertion Sort

The `sorting` module provides insertion sort algorithm (listing 5.12 page 215)[3]. You will be measuring how the program behaves in the worst case, average case and the best cases.

- Before running the insertion sort method, try to predict the number of data comparisons when insertion sort is given sorted and reverse sorted lists.

  > ***Complete questions 1.c and 1.d in lab quiz 6.1.***

- Include statements to count the data comparisons. Test your implementation with the files 1 to 7. Files 4 and 5 contain a sorted list of 1000 and 10000 numbers respectively. Files 6 and 7 contain a reverse sorted list of 1000 and 10000 numbers respectively.
- Why doesn't insertion sort on file6 or file7 use the worst case number of comparisons?

  > ***Complete questions 3 to 7 in lab quiz 6.1.***

[1] Online textbook: Sorting
[2] Online textbook: ActiveCode 1 in the Selection Sort section
[3] Online Textbook: ActiveCode 1 in the Insertion Sort section

Shell Sort

The `sorting.py` module provides the shell sort algorithm (listing 5.13 page 218, 1st edition listing 4.21 page 170)[4] with the gap starting at `gap = n // 2` and changing to `gap = gap // 2` in each subsequent iteration.

- Include statements to measure how shell sort behaves with sorted, reverse-sorted and random lists.
- Now write a shell sort function (called something like `shell_sort2`) that accepts a gap list as a parameter and try the sequence 31, 15, 7, 3, 1 to see if the performance improves.
- Compare the data comparisons for the new gap list version with the previous version.
- Can you find a better sequence?

> ***Complete questions 8 to 11 in lab quiz 6.1.***

(Extras)

- Write a small program to generate a file with 10000 items (called `file8.txt`) that will give a worst case number of comparisons for insertion sort. Confirm that it is a worst case.

[4] Online Textbook: ActiveCode 1 in the Shell Sort section.