

## 11 Stress Tests

### 11.1 StressTests - Timing Tests

Your job is now to be an algorithm detective. The program we give you allows you to run any of the six different sorting algorithms on data sets of five different sizes using three different `Comparators` to define the ordering of the data. When you run the program, the time that each of these algorithms took to complete the task is shown in the console.

To run the program you need to do the following:

- Create a new *Java Project* in Eclipse (e.g. *SortingTests*).
- Go to *Preferences* and choose to add a library then choose *Add External jars* to add the file **sorting.jar** to the project.
- Create a new *Package* in Eclipse and give it a name `student`. Import into this package the two files: **SortingHeapSort.java** and **Heapsort.java**.
- Download (or find on your computer) the file **citydb.txt** and save a copy in the Eclipse directory that has the **src** and **bin** directories for the *SortingTests* project.
- Go to the *Run* menu, choose *Run Configurations*, select to make a new configuration. Name it *SortingTests* then click on the button to *Select main*. One of the choices should be `sorting.Interactions`. Choose that one. You can now run the program. It will come up with a GUI with several buttons.
- To set up the timing tests you need to go through three steps:
  1. You need to read in the data for the 29470 cities from the file **citydb.txt**. The button *FileInput* opens a file chooser dialog. Select the **citydb.txt** file.
  2. Now hit the *TimerInput* button. It lets you select which algorithms to test, which `Comparators` to use, and what size data should be used in the tests.  
Start with just a few small tests, to see how the program behaves, before you decide to run all tests.

The last choice is *heapsort*. The two files in the `student` package provide only hooks to the stress test program — the method `heapsort` in the class `Heapsort` just returns the original unsorted `ArrayList`.

3. Now you can run the actual tests by hitting the **RunTests** button.

You can repeat the last two steps as many times as you want to.

**Exploration:**

Spend about fifteen minutes trying to answer some of the following questions. **Finish the work as a part of the Assignment 11.**

Run the program a few times with small data sizes, to get familiar with what it can do. Then run experiments and try to answer the following questions:

1. Which algorithms run mostly in quadratic time, i.e.  $O(n^2)$ ?
2. Which algorithms run mostly in  $O(n \log n)$  time?
3. Which algorithms use the functional style, using `Cons` lists?
4. Which algorithm is the *selection sort*?
5. Why is there a difference when the algorithms use a different `Comparator`?
6. Copy the results into a spreadsheet. You may save the result portion in a text editor with a `.csv` suffix and open it in *Excel* (or some other spreadsheet of your choice). You can now study the data and represent the results as charts. Do so for at least three algorithms, where there is one of each — a quadratic algorithm and a *linear-logarithmic* algorithm.

Produce a report with a paragraph that explains what you learned, using the *Excel* charts to illustrate this.