Testing the speed of the heap sort algorithm

Homework #4

By

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CS 303 Algorithms and Data Structures

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1. **Problem Specification**

This assignment is supposed to measure the speed of heap sort on large inputs and compare its efficiency to insertion sort and merge sort.

2. **Program Design**

This program has a library file with the functions and a few test cases if the file itself is executed and a driver file to test the program on the .txt data files. The heap\_sort function works by building a heapform array and swapping the root and the youngest leaf until the input array is sorted. The swapping happens in the max\_heapify() call, and the process is repeated in the main heap\_sort() call.

The following steps were required to develop this program:

1. Implement heap sort as three separate functions and a wrapper class for the array.
2. Copy + paste the previous sorting algorithms into the file.
3. Import the data files in a loop in order to run all the algorithms on the data files' contents.
4. Print how long doing that takes.

3. **Testing Plan**

I compared the results of using my heap\_sort() with the Python built-in sort() function to see whether my outputs were correct using a hard-coded array before moving on.

4. **Test Cases**

I initially tested the inputs on lists eight elements long of random values one through twenty. I then moved up to four hundred elements and a range of four hundred, repeating this one five-hundred times and comparing the output with the sort() built in function. I next tested on zero elements, one element, and a descending order array; these arrays sorted by my heap sort function returned the same array that sort() returned.

The rest of the cases are from the input files.

5. **Analysis and Conclusions**

Heap sort here shows to be little faster than insertion sort. This comes as no surprise, given that it has three levels of while loops to go through when it sorts.

6. **References**

The following references were used:

<https://stackoverflow.com/questions/1614236/in-python-how-do-i-convert-all-of-the-items-in-a-list-to-floats>

<https://stackoverflow.com/a/2493962/9295513>

<https://realpython.com/python-range/#decrementing-with-range>

Individual assistance from TA Logan Creel to learn the meaning of the LEFT(i) and RIGHT(i) lines from the pseudocode.