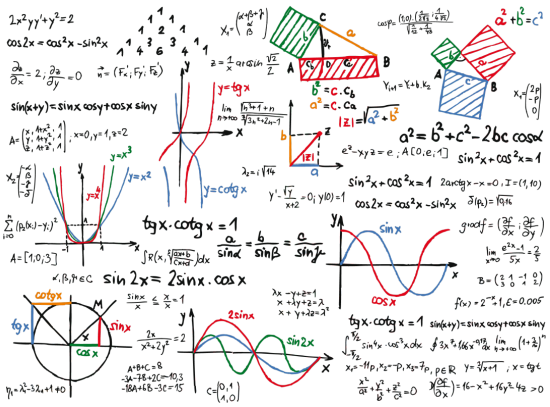
B5 - Mathematics

B-MAT-500

301dannon

Sort Benchmark



301dannon

binary name: 301dannon
language: everything working on "the dump"
compilation: when necessary, via Makefile, including re, clean and fclean rules

- The totality of your source files, except all useless files (binary, temp files, obj files,...), must be included in your delivery.
- All the bonus files (including a potential specific Makefile) should be in a directory named *bonus*.
- Error messages have to be written on the error output, and the program should then exit with the 84 error code (0 if there is no error).

You've been hired by Dannon to sort all the information from their databases. There are a few thousand petabytes of data, and it is critical to implement the most optimal sort possible.

Therefore, you are going to benchmark different sorting algorithms by comparing their execution speed, or rather the number of elementary operations performed by the algorithm (in order to be independent of the machine and its power). This is known as the time complexity of an algorithm.

There are numerous elementary operations that can be relevant: variable declaration, variable assignment, variable access, function call, calculation, comparison, test, etc. To keep it simple, you will only count the number of comparisons between the given elements.

You have to implement and benchmark the following algorithms:

- Selection sort
- Insertion sort
- Bubble sort
- Quicksort
- Merge sort

To ensure you get the proper results, please follow these implementation guidelines:

- Whenever you go through the list of elements (whether you are looking for, selecting or inserting an element), always go from left to right.
- For quicksort, always pick the first element as pivot, and keep the relative order of the elements in both partitions.
- Don't optimize the algorithms, or you will skew the results. For example, don't use a flag to stop bubble sort early when nothing was swapped.

USAGE

Terminal

```
~/B-MAT-500> ./301dannon -h
USAGE
    ./301dannon file
DESCRIPTION
    file    file that contains the numbers to be sorted, separated by spaces
```

Sort functions are obviously unauthorized, regardless of the language. You must code the sorts yourself.

SUGGESTED BONUSES

- Add other algorithms
- Benchmark some optimizations of the algorithms to see which ones are truly efficient
- Produce statistics, plot graphs of the number of operations according to the size of the data

EXAMPLES

Terminal

```
~/B-MAT-500> cat list
3.3 5 9.89 -6
~/B-MAT-500> ./301dannon list
4 elements
Selection sort: 6 comparisons
Insertion sort: 4 comparisons
Bubble sort: 6 comparisons
Quicksort: 4 comparisons
Merge sort: 5 comparisons
```

Terminal

```
~/B-MAT-500> cat list
-564 1340 42 129 858 1491 1508 246 -1281 655 1506 306 290 -768 116 765 -48 -512
2598 42 2339
~/B-MAT-500> ./301dannon list
21 elements
Selection sort: 210 comparisons
Insertion sort: 125 comparisons
Bubble sort: 210 comparisons
Quicksort: 80 comparisons
Merge sort: 67 comparisons
```