## Python programming Lab. Work nº 4 : Searching

**Preliminaries :** Please remind that teachers can be called to help you on any problem you get. Don't get stuck on an issue for too long.

## Exercise $n^{\circ}1$ : Search

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1. In the module myarray.py add a function sorted\_array(n) that creates an array of n elements, all stored in ascending order, such that  $A[i+1] - A[i] \in [0, 5]$ . Test it :

```
Size?10
[2, 5, 6, 10, 15, 17, 21, 25, 27, 30]
```

- 2. Create a module search.py
- 3. In module search.py, write a function linear\_search(a,e) that returns True if element *e* in in the sorted array *a* and False if not. Test it in a module search\_main.py :

```
[3, 6, 7, 9, 13, 15, 15, 15, 19, 21, 26, 31]

Value to search? 4

False

[3, 6, 7, 9, 13, 15, 15, 15, 19, 21, 26, 31]

Value to search? 15

True

[3, 6, 7, 9, 13, 15, 15, 15, 19, 21, 26, 31]

Value to search? 3

True

[3, 6, 7, 9, 13, 15, 15, 15, 19, 21, 26, 31]

Value to search? 31

True

[3, 6, 7, 9, 13, 15, 15, 15, 19, 21, 26, 31]

Value to search? 31

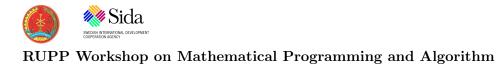
True

[3, 6, 7, 9, 13, 15, 15, 15, 19, 21, 26, 31]

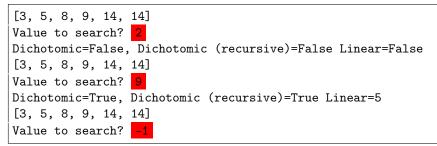
Value to search? -1 \leftarrow value \ to \ stop...
```

4. In module search.py, add a function dichotomic\_search(a,e) that return True>
▷ if element e in the sorted array a and False if not, using the iterative dichotomic method. Test it in the module search\_main.py such that both linear\_search and dichotomic\_search are computed :

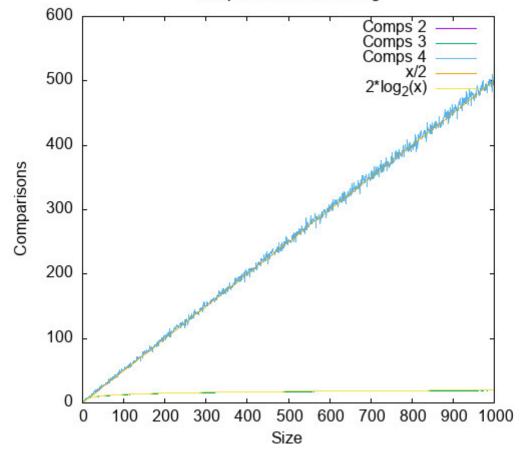
[0, 2, 6, 11, 12] Value to search? 3 Dichotomic=False Linear=False [0, 2, 6, 11, 12] Value to search? 5 Dichotomic=False Linear=False [0, 2, 6, 11, 12] Value to search? 12 Dichotomic=True Linear=True [0, 2, 6, 11, 12] Value to search? -1



5. In module search.py add a function recursive\_dichotomic\_search(a,e) that computes the same as linear\_search in a recursive way. Modify search\_main.py to test it against the two others :



- 6. In search\_main.py add a function test that tests if all three searching algorithms have consistent results over N sorted arrays  $\{A_{1 \leq s \leq N}\}$ ,  $\forall s \in [1, N], |A_i| = s$ . For each  $A_k$ , you may test consistency for all integer values in  $[A_k[0] 1, A[k-1] + 1]$ . If results are not consistent, then you need to find the bug!
- 7. Modify all of these such that you will be able to collect the number of comparisons made in the mean for all three algorithms and draw the corresponding functions (compare with fx() = x and  $g(x) = \log_2 x$ ) :



Complexities of Searching