

CS 115 - Introduction to Programming in Python

Lab Guide 9

Lab Objectives: Searching and Sorting.

- a) Download the file `Element.py` which contains the definition for the `Element` type. The class should be in its own file. Do not make any changes to this class.
- b) Create a class `ChemicalOrder` in the file `ChemicalOrder.py`, which represents an order for a set of elements. Each `ChemicalOrder` has a private attribute `e_list`, which stores a list of `Elements` to be ordered. A `ChemicalOrder` object should have the following methods.

Methods:

- `__init__()__`:
 - takes a string file name as a parameter.
 - Initializes an empty list to store `Elements`.
 - Calls the `load_elements()` method (see below) to load the `Elements` in the file into the `e_list`.
- `load_elements()`: takes a filename as a parameter, and loads all elements from the file into the `ChemicalOrder`'s list of `Elements`, `e_list`. **Note:** you should use the algorithm already defined in Lab 07.
- `get_element_count()`: returns the length of the element list (`e_list`)
- `sort_elements()`: sorts the element list by the default `Element` sort field.
- `selection_sort_by_field()`: takes the name of a field/property as a parameter, and sorts the element list by the given field. Method should use the **selection sort algorithm**.
- `search_element()`: takes the name of an element as a parameter, and returns the element with the given name. Method should use the **binary search** algorithm.
- `get_element_by_quantity()`: takes a maximum quantity and the number of elements in the list as parameters. Method returns a list of elements whose quantity is below the value given. You **MUST** use a **recursive algorithm**, and no loop.
- `repr()__`: returns a string representation of a `ChemicalOrder` object. See Sample Run for details.

HINT: for the searching and sorting algorithms, you may copy the algorithms from the class examples and update to reflect the data being sorted.

- c) Write an application, `yourname_Lab09.py` that does the following:
 - Create a `ChemicalOrder` using the data from the file `data.txt`.
 - Sort the `ChemicalOrder` by the Atomic Number and display the sorted `ChemicalOrder`.
 - Input an element name from the user and display the `Element` in the `ChemicalOrder` with the given name. Hint: what do you need to do BEFORE you invoke the search method?
 - Input a quantity from the user and display all elements whose quantity is less than the input value. Sort the output list of elements by the Atomic Name.

Sample Run:

Elements Sorted by Atomic Number:

Element Name:	:	Hydrogen
Chemical symbol	:	H
Atomic Number	:	1.00
Atomic mass	:	100794.00
Density at 20	:	0.08
Melting point	:	-259.10
Boiling point	:	-252.90
Quantity	:	93.00

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Element Name:	:	Plutonium
Chemical symbol	:	Pu
Atomic Number	:	94.00
Atomic mass	:	2440642.00
Density at 20	:	19.74
Melting point	:	641.00
Boiling point	:	3327.00
Quantity	:	23.00

Enter name of element to search: Gold

Element Name:	:	Gold
Chemical symbol	:	Au
Atomic Number	:	79.00
Atomic mass	:	19696654.00
Density at 20	:	19.32
Melting point	:	1064.40
Boiling point	:	2940.00
Quantity	:	107.00

Enter a quantity: 25

Elements with quantity below 25.0

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Element Name:	:	Bismuth
Chemical symbol	:	Bi
Atomic Number	:	83.00
Atomic mass	:	20898037.00
Density at 20	:	9.80
Melting point	:	271.40
Boiling point	:	1560.00
Quantity	:	22.00

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Element Name:	:	Chlorine
Chemical symbol	:	Cl
Atomic Number	:	17.00

Atomic mass	:	354527.00
Density at 20	:	2.95
Melting point	:	-34.60
Boiling point	:	-101.00
Quantity	:	23.00

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Element Name:	:	Magnesium
Chemical symbol	:	Mg
Atomic Number	:	12.00
Atomic mass	:	24305.00
Density at 20	:	1.74
Melting point	:	648.80
Boiling point	:	1107.00
Quantity	:	24.00

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Element Name:	:	Plutonium
Chemical symbol	:	Pu
Atomic Number	:	94.00
Atomic mass	:	2440642.00
Density at 20	:	19.74
Melting point	:	641.00
Boiling point	:	3327.00
Quantity	:	23.00

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Element Name:	:	Selenium
Chemical symbol	:	Se
Atomic Number	:	34.00
Atomic mass	:	79.00
Density at 20	:	4.82
Melting point	:	217.00
Boiling point	:	685.00
Quantity	:	21.00

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