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Faculty: Faculty of Exact Sciences
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Module: Scientific Programming
Level: 2nd Year LMD
Specialty: Physics/MCPC
Session: Practical Work N°11
Subject: Basic Sorting Algorithms

SESSION 11
Basic Sorting Algorithms

LEARNING GOALS

- Understand why sorting is useful.
- Follow the idea of bubble sort.
- Follow the idea of insertion sort.
- Follow the idea of selection sort.

SHORT THEORY

Sorting means arranging values in an order, usually increasing or decreasing. The syllabus introduces three basic methods: **bubble sort, insertion sort and selection sort**.

1. Bubble sort

LET'S TRY

The algorithm repeatedly compares neighboring elements and swaps them when they are in the wrong order.

```
        values = [5, 2, 4, 1]

        for i in range(len(values)):
        for j in range(0, len(values)-1-i):
        if values[j] > values[j+1]:
        values[j], values[j+1] = values[j+1], values[j]

        print(values)

```

2. Insertion sort – idea

GUIDED PRACTICE

Insertion sort builds a sorted part of the list one element at a time. For example:

$$[5, 2, 4, 1] \to [2, 5, 4, 1] \to [2, 4, 5, 1] \to [1, 2, 4, 5].$$

3. Selection sort – idea

LET'S TRY

Selection sort repeatedly finds the smallest remaining element and places it in the next position. For

$$[5, 2, 4, 1],$$

the smallest value is 1, then the next smallest is 2, then 4, giving

$$[1, 2, 4, 5].$$

SHORT THEORY

Comparison of the three ideas

- Bubble sort: compare neighboring values and swap.
- Insertion sort: insert each new value into the sorted part.
- Selection sort: select the smallest remaining value.

TRY IT YOURSELF – NO SOLUTION

1. Apply bubble sort to a short list and show the main swaps.
2. Explain the main idea of insertion sort.
3. Explain the main idea of selection sort.
4. State why sorting is useful before binary search.

TRY IT YOURSELF – NO SOLUTION

1. Apply bubble sort to $[7, 3, 5, 2]$.
2. Show the steps of insertion sort for $[6, 2, 4, 1]$.
3. Show the selections made by selection sort for $[8, 3, 5, 1]$.
4. Explain in one sentence why a sorted list is required for binary search.