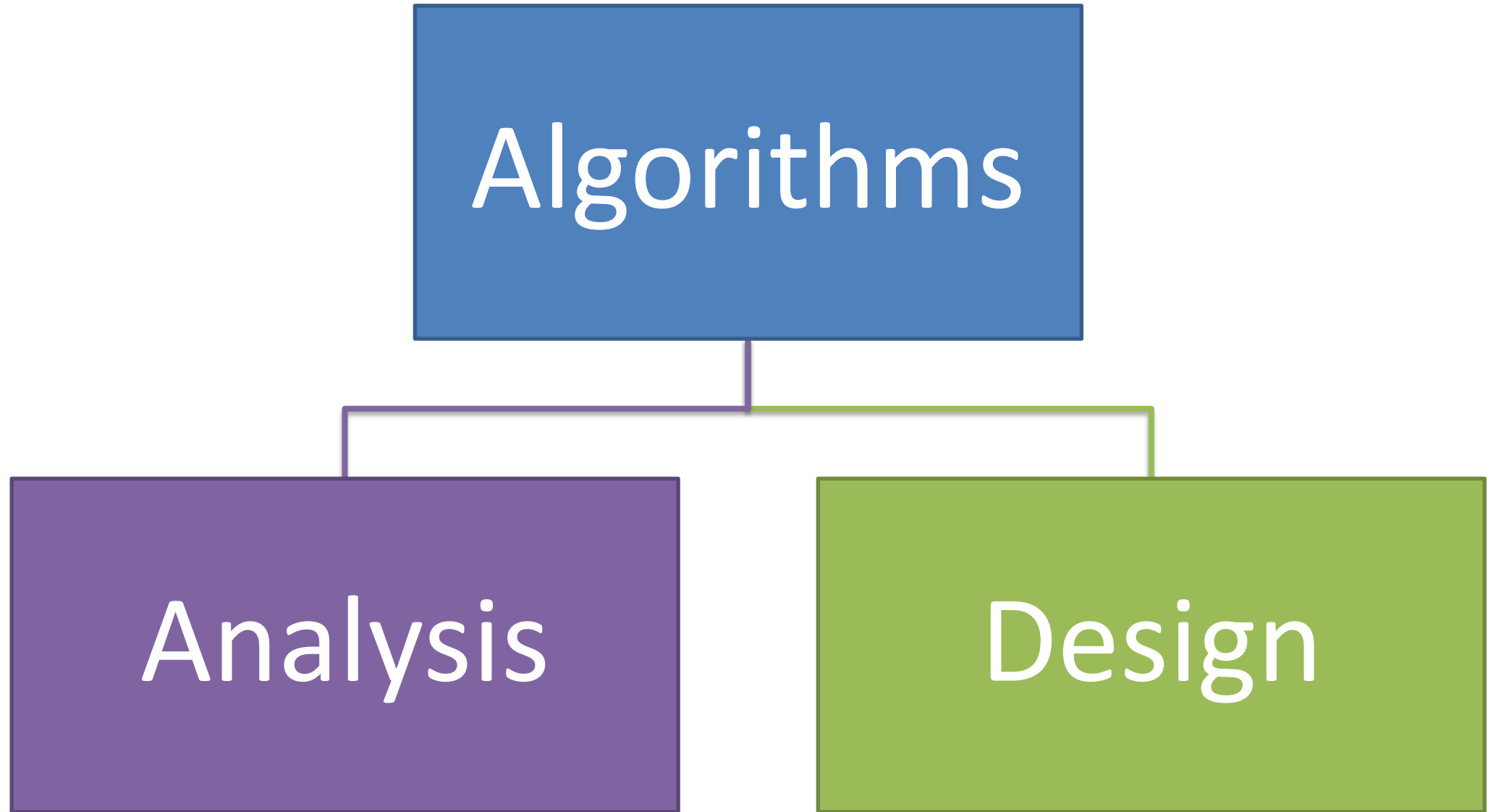


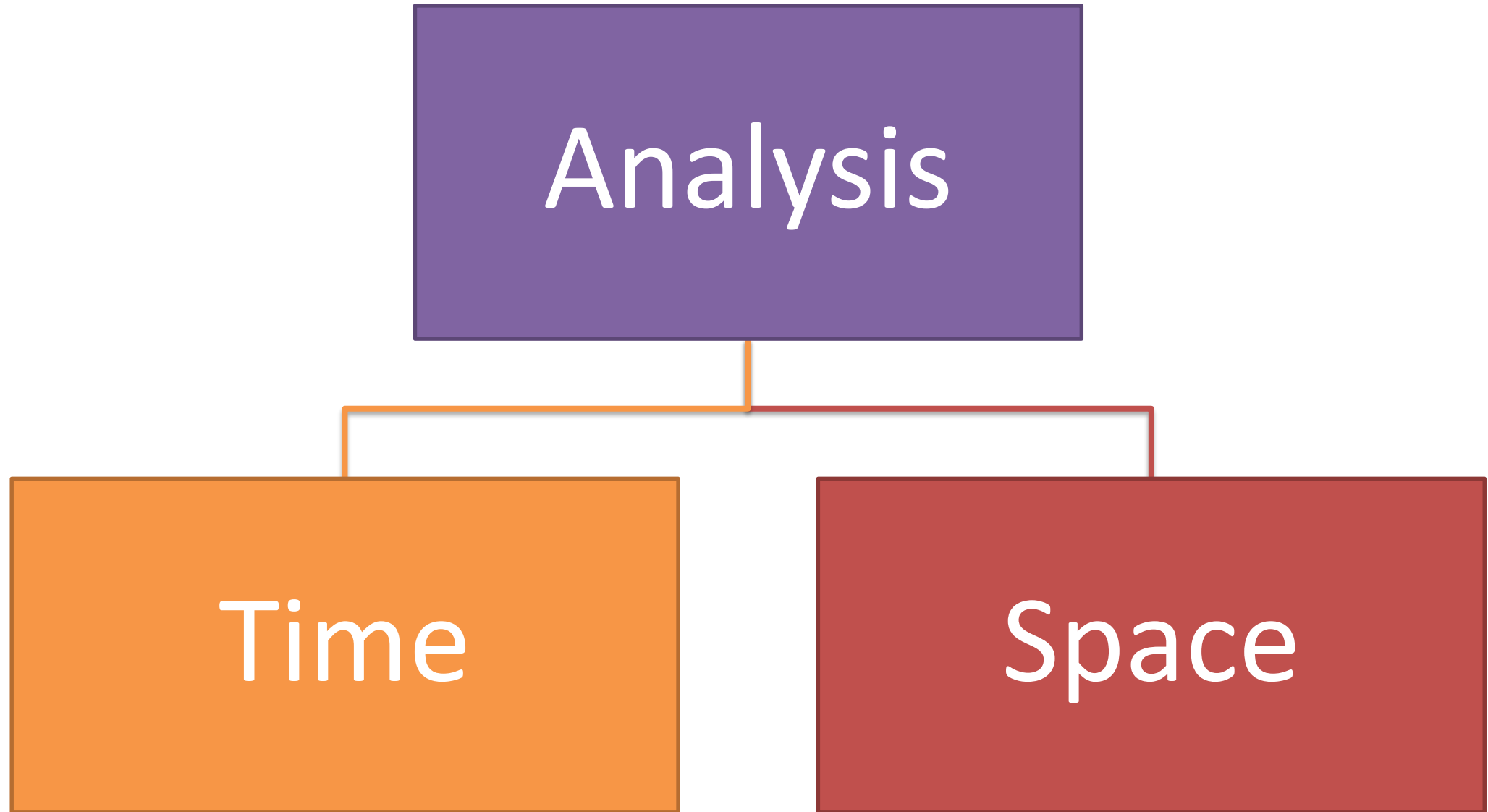
Algorithms

- ❑ An algorithm is a set of steps of operations to solve a problem performing calculation, data processing, and automated reasoning tasks.
- ❑ An algorithm is the best way to represent the solution of a particular problem in a very simple and efficient way.



Algorithms

- ❑ Analysis: predict the cost of an algorithm in terms of resources and performance
- ❑ Design: creating an efficient algorithm to solve a problem in an efficient way using minimum time and space.



Time Complexity & Space Complexity

- ❑ Time Complexity is a function describing the amount of time required to run an algorithm in terms of the size of the input.
- ❑ Space Complexity is a function describing the amount of memory an algorithm takes in terms of the size of input to the algorithm.

Time Complexity & Space Complexity

□ Time Complexity

What make algorithm “fast”?

□ Space Complexity

How much **memory** is used?

Algorithms

- ❑ Input: sequence $\langle a_1, a_2, \dots, a_n \rangle$ of numbers.
- ❑ Output: permutation $\langle a'_1, a'_2, \dots, a'_n \rangle$ such that
$$a'_1 \leq a'_2 \leq \dots \leq a'_n .$$

Example:

Input	8	12	5	9	2
Output	2	5	8	9	12

Algorithm vs Pseudocode

- ❑ An algorithm is a formal definition with some specific characteristics that describes a process. Generally, the word "algorithm" can be used to describe any high level task in computer science.
- ❑ Pseudocode is an informal and human readable description of an algorithm leaving many details of it. Writing a pseudocode has no restriction of styles and its only objective is to describe the high level steps of algorithm.

Algorithm vs Pseudocode

❑ Algorithm: Selection Sort

Input: A list L of integers of length n

Output: A sorted list L_1 containing those integers present in L

Step1: Find the minimum value in the list L

Step2: Swap it with the value in the current position

Step3: Repeat this process for all the elements until the entire list is sorted

Step 4: Return the sorted list L_1

Step 5: Stop

Algorithm vs Pseudocode

□ Pseudocode : Selection Sort

for $j \leftarrow 1$ to $n-1$

$\text{smallest} \leftarrow j$

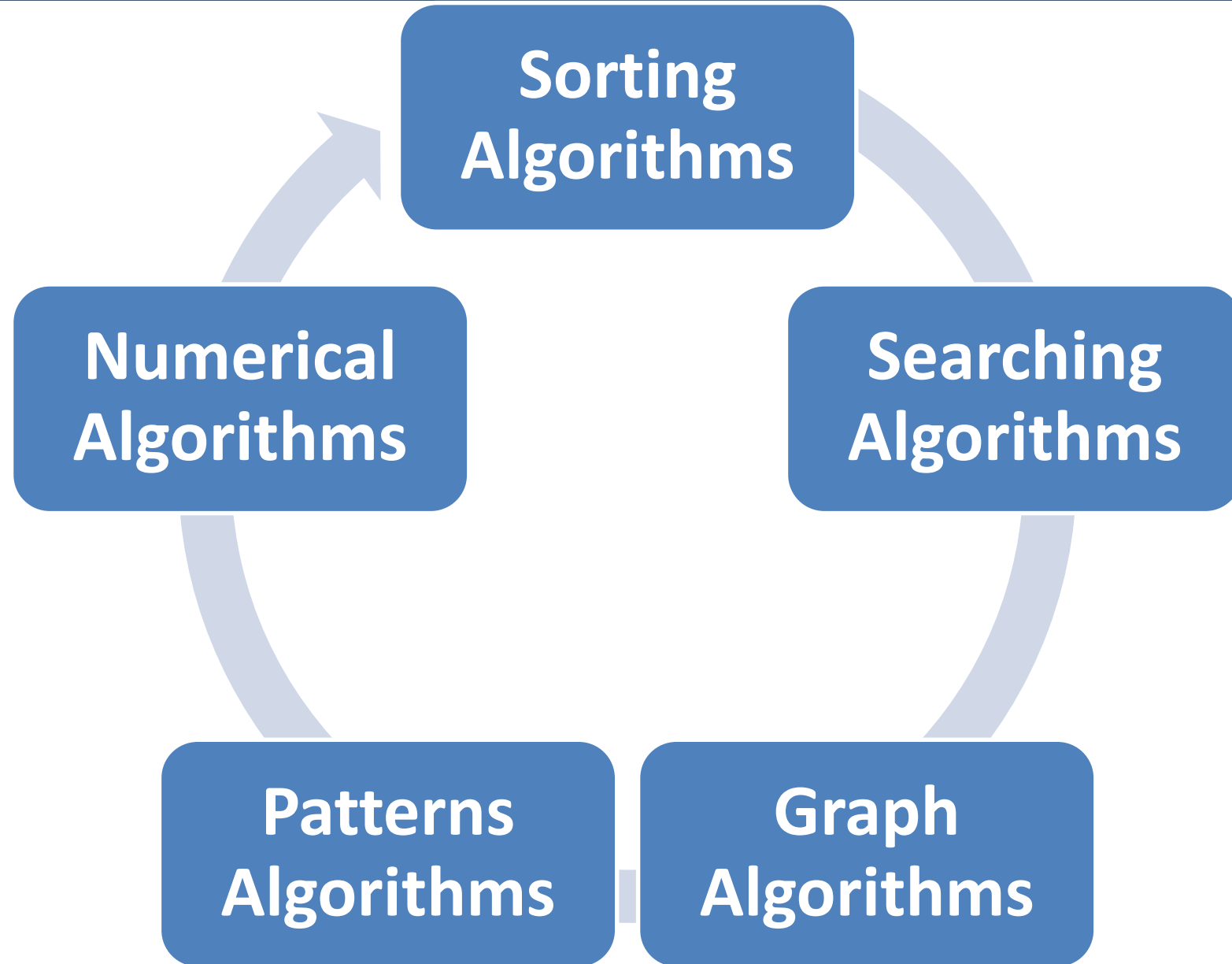
 for $i \leftarrow j + 1$ to n

 if $A[i] < A[\text{smallest}]$

$\text{smallest} \leftarrow i$

 Exchange $A[j] \leftrightarrow A[\text{smallest}]$

Some Algorithm Types



Some Algorithm Types

- ❑ **Sorting Algorithms** are to rearrange the items of a given list in non decreasing order.
- ❑ **Searching Algorithms** deal with finding a given value, called a search key, in a given set.

Some Algorithm Types

- ❑ **Pattern (String) Algorithms** deal with string which comprise letters, numbers, and special characters; bit strings, which comprise zeros and ones; and gene sequences
- ❑ **Numerical Algorithms** deal with mathematical problems that solving equations and systems of equations, computing definite integrals ,evaluating functions, and so on.

Some Algorithm Types

- ❑ **Graph Algorithms** deal with graphs. Graph can be thought of as a collection of points called vertices, some of which are connected by line segments called edges. Graphs can be used for modeling a wide variety of applications, including transportation, communication, social and economic networks, project scheduling, and games.