



Universitat de Lleida

# Formal Specification of Algorithms

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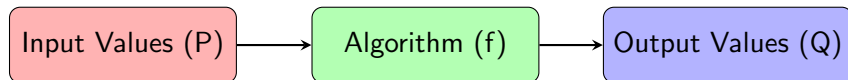
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- Definition of formal specification
- Methodology to specify the algorithms
- Exercises

# Definition

**Formal specification of an algorithm** is defined as the mechanism to describe the algorithm behavior (Specify what the algorithm does).



## Methodology to specify the algorithms

The most used technique is the one based on pre-conditions (input values) and post-conditions (return values). As the methodology is formal, the used language has to be **Predicate Logic**

### Methodology

- **Precondition (P)** = { Initial state of the input parameters (x) }
- **Function (f)** *function\_name* (input x: input type) return y: return type
- **Post-condition (Q)** = { Final State of the output variables (y) based on the input parameters (x) }

# Methodology to specify the algorithms

Use Formal specification in order to represent the maxim of three values.

- **Precondition (P)** =  $\{ x \in \mathbb{N}, y \in \mathbb{N}, z \in \mathbb{N} \}$
- **Function (f)**
- **Post-condition (Q)**

# Methodology to specify the algorithms

Use Formal specification in order to represent the maxim of three values.

- **Precondition (P)** =  $\{ x \in \mathbb{N}, y \in \mathbb{N}, z \in \mathbb{N} \}$
- **Function (f)**  $\max(\text{input}:z,y,z = \text{int})$  return  $m:\text{int}$
- **Post-condition (Q)**

## Methodology to specify the algorithms

Use Formal specification in order to represent the maxim of three values.

- **Precondition (P)** =  $\{ x \in \mathbb{N}, y \in \mathbb{N}, z \in \mathbb{N} \}$
- **Function (f)**  $\text{max}(\text{input}:z,y,z = \text{int})$  return  $m:\text{int}$
- **Post-condition (Q)** =  $\{ m \geq x \wedge m \geq y \wedge m \geq z \}$

**Is this definition correct?**

Use Formal specification in order to represent the maxim of three values.

- **Precondition (P)** =  $\{ x \in \mathbb{N}, y \in \mathbb{N}, z \in \mathbb{N} \}$
- **Function (f)** max (input:z,y,z = int) return m:int
- **Post-condition (Q)** =  $\{ (m \geq x \wedge m \geq y \wedge m \geq z) \wedge (m = x \vee m = y \vee m = z) \}$



# Exercises

- 1 Define the maximum of a value List of integers.
- 2 Define the mean of a value list of floats.
- 3 Define the function count negative value in a list of integers
- 4 Determine if a List of integers is sorted (ascendant sorted)

**For the exercises we assume that the List is not empty. Then,**  
 **$\text{len}(\text{List}) > 0$**