

# Lindenmayer Systems

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- Characterized by three parameters:
  1. **Alphabet  $\Sigma$**  - the allowed symbols
  2. **Production  $P$**  - how to replace each symbol
  3. **Initial word  $s$**  - the word to start with

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## Example

1.  $\Sigma := \{F, +, -\}$

2.  $P := \begin{cases} F \mapsto F + F + \\ + \mapsto + \\ - \mapsto - \end{cases}$

3.  $s := F$

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How does it look after 3 rounds?

$s:$        $F$

$w_1:$

$w_2:$

$w_3:$

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# Draw Lindenmayer Systems

# Two Step Procedure

Goal: Draw n-th step of Lindenmayer system

Done in 2 steps:

1. Obtain n-th step
2. Draw it



# Step 1 – Obtain n-th Word

Write and use the following two functions

- `std::string production (const char c)`
  - In: symbol e.g.  $\mathbb{F}$
  - Out: its production e.g.  $\mathbb{F}+\mathbb{F}+$

# Step 1 – Obtain n-th Word

Write and use the following two functions

- `std::string production (const char c)`
  - In: symbol e.g. F
  - Out: its production e.g. F+F+
  
- `std::string next_word (const std::string word)`
  - In:  $w_n$  (Word of step n) e.g. FF
  - Out:  $w_{n+1}$  (Word of step n+1) e.g. F+F+F+F+
  - Applies `production` to each character in  $w_n$  and concatenates the results.

# Step 2 – Draw It

Idea: view alphabet as turtle commands

Example:

Alphabet:  $\Sigma := \{ F, +, - \}$

*F*: `turtle::forward()`

*+*: `turtle::left(90)`

*-*: `turtle::right(90)`