



**POLITECNICO**  
MILANO 1863

**MPI**

Alessandro Margara

[alessandro.margara@polimi.it](mailto:alessandro.margara@polimi.it)

<https://margara.faculty.polimi.it>

# Rules

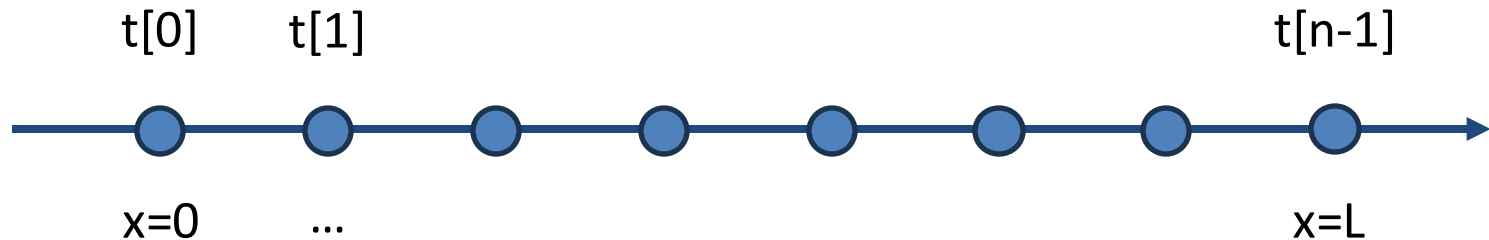
---

- Rename the temp\_simulation\_XX.c file replacing XX with the number of your group
- Write in the comment on top of the file your group number and the name of all group members
- Submit only a single c file with your solution
  - Submitted from the contact email provided in the group registration document

# Requirements

---

- You are to implement a simple simulator of temperature dynamics using MPI
  - Consider a one-dimensional domain of length  $L$
  - Consider the value of temperature at  $n$  discrete points within the domain



# Requirements

---

- The simulation evolves in discrete rounds, each containing multiple iterations
  - `iterations_per_round` in the template file
- Before the first round, the initial temperature value of each point needs to be initialized
  - You can use the `initial_condition` function
  - It takes in input the position of the point ( $x$ ) and the length of the domain ( $L$ )

# Requirements

---

- Let us call  $t[p]^i$  the value of temperature  $t$  measured at point  $p$  during iteration  $i$
- The temperature  $t[p]^{i+1}$  at iteration  $i+1$  is computed as the average of the temperature of point  $p$ , its predecessor  $p-1$  and its successor  $p+1$  at iteration  $i$

$$t[p]^{i+1} = (t[p-1]^i + t[p]^i + t[p+1]^i) / 3$$

# Requirements

---

- Boundary conditions
  - For the first point  $t[0]$  and for the last point  $t[n-1]$ , consider the average of the temperature of the point and its only neighbor point

$$t[0]^{i+1} = (t[0]^i + t[1]^i) / 2$$

$$t[n-1]^{i+1} = (t[n-1]^i + t[n-1]^i) / 2$$

# Requirements

---

- At each round, you have to compute and print the minimum and maximum values of temperature over all points, and the difference between the minimum and the maximum
  - The code for printing is already in the template
- The simulation should stop when the difference between the maximum and the minimum is below a given threshold
  - Variable `allowed_diff` in the template
- Run the simulation in parallel on multiple processes, minimizing synchronization and communication as much as possible
  - You may assume the number of points to be a multiple of the number of processes involved in the computation