POLITECNICO
MILANO 1863

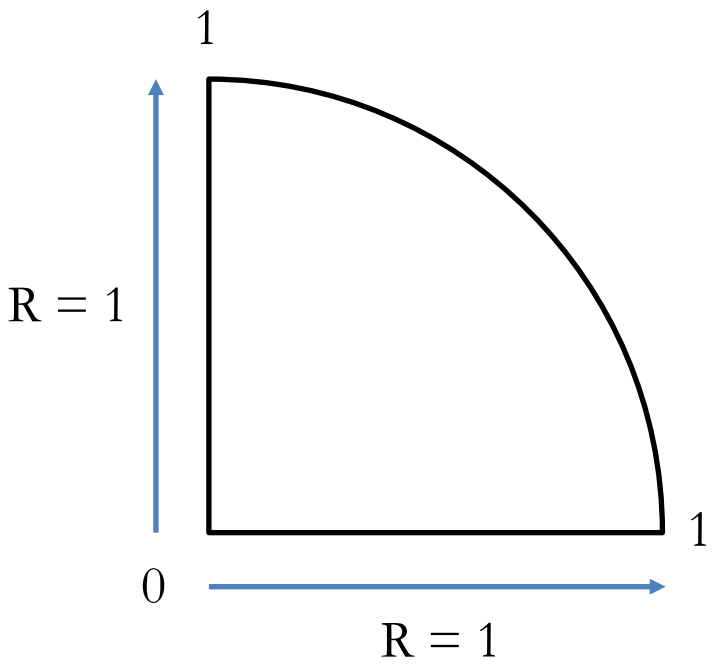
MPI

Alessandro Margara
alessandro.margara@polimi.it
https://margara.faculty.polimi.it

Exercise 1

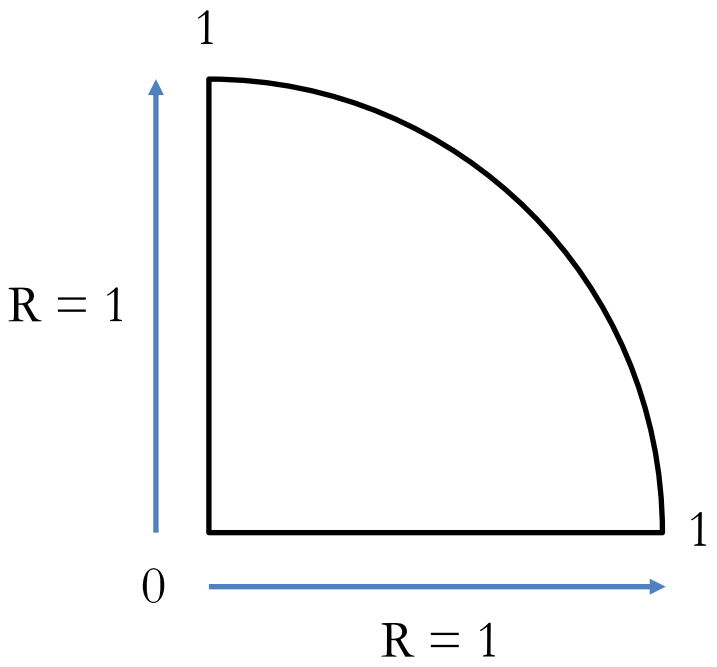
- Use a Monte Carlo simulation to estimate the value of Pi

- Given a circle of radius R=1, its area is A=Pi
  - Let us consider only one forth of the circle
  - Then the area is A=Pi/4



Exercise 1

- Consider the cartesian coordinates as in figure
- Given a point P(x,y) it will be within the circle iff
  - Sqrt(x^2+y^2) <= Sqrt(1)
  - x^2+y^2 <= 1
- We can estimate A by generating many random points and checking how many of them fall within the circle
- We can then compute Pi = 4*A



Exercise 2

- Implement a guess game
  - N rounds
  - One process acts as leader and selects a number X between 1 and 1000 (included)
    - In the first round, the leader is process 0
  - All processes (including the leader) select a random number and send it to the leader
    - The process that selects the number that is closest to X wins the round and becomes the leader for the next round
    - If multiple processes have the same score, no one wins the round, and the leader does not change
  - Process 0 keeps track of the number of rounds won by each process and prints the updated leaderboard at the end of each round

Exercise 3

- You are to implement a simple traffic simulator

- Consider a linear road divided into consecutive segments numbered 0..N as in the figure below
  - N is represented by variable num_segments in the template
  - You may assume the number of segments to be a multiple of the number of processes

Exercise 3

- The simulation evolves in descrete rounds for a given number of iterations
  - num_iterations in the template file

- At each round
  - Some cars enter the road in segment 0
    - Use function create_random_input() to obtain the number of cars
  - Each car either remains in the same segment or moves to the next one
    - Use function move_next_segment() to determine if a car moves or not
    - Cars that move out of the last segment are not part of the simulation anymore

Exercise 3

- Every 10 iterations, you have to compute the total number of cars that are currently within the road
  - Process P0 prints the sum
  - The code for printing is already in the template
- Run the simulation in parallel on multiple processes, minimizing synchronization and communication as much as possible
- You may set DEBUG to 1 to obtain deterministic values and check the correctness of your code
  - At each round a single car enters the road
  - Cars always move to the next segment