



UNIVERSITÀ
DEGLI STUDI
DI PADOVA

raceup

Assignment Driverless

Formula Student-RaceUP Team

Electric Division





“Remember, the assignment is something in support of the interview and will NOT be evaluated on its own.”

You can complete either one of the two exercises:

Exercise 1:

You are tasked with writing a program to solve a maze that is represented as a grid of characters. Your goal is to create an algorithm that finds a path from the starting point 'S' to the exit 'E', avoiding walls represented by '#' and walking through open spaces represented by '.'. The maze will be provided as a text-based input. The program should print on screen the sequence of moves that lead to the exit, or indicate that no solution exists. You can use any preferred programming language. It is recommended to follow good code practices. Provide also a short description of the program as a README file, explaining your solution code and the process you followed to solve the task, **INCLUDE ALSO A GUIDE ON HOW TO EXECUTE YOUR CODE.**

Copy the example mazes down below in a .txt file to check if your code works.

Input Format:

- The maze is given as a list of strings, where each string represents a row in the maze.
- 'S' is the starting point.
- 'E' is the exit.
- '#' represents a wall that cannot be crossed.
- '.' represents an open passage.
- The maze is guaranteed to contain one 'S' and one 'E'.

Output:

- Print on screen a list of moves that solves the maze (e.g., ['UP', 'DOWN', 'LEFT', 'RIGHT']).

How to hand in your code: Upload it on a (public) GitHub repository, then reply to our email with the link to the github containing your project.

EXAMPLE MAZES:

1.

```
S....  
  .###.  
  ..E..  
  .#.#.  
  .....  
  .....
```

2.

```
S.....#####  
  .##.#.....  
  .##.#.####  
  ...#.E.....  
  ###.#####.  
  ...#.....  
  .#####  
  .....#.....  
  #####.####  
  .....  
  .....
```

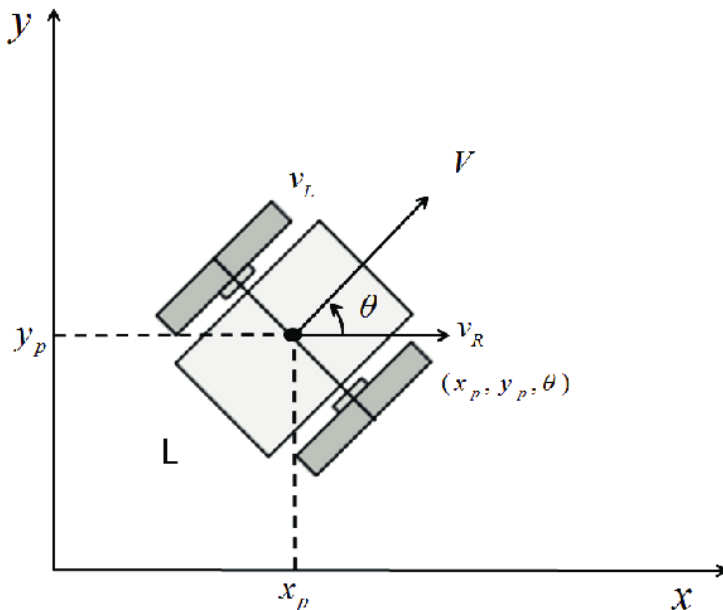
3.

```
S.....#####  
  .##.#.....  
  .##.#.####  
  ...#.E.....  
  .##.#####.  
  ...#.....  
  .###.####.  
  .....#.....  
  #####.###.  
  .....  
  .....
```



Exercise 2:

Imagine you need to design the system of a household cleaning robot. The robot must move autonomously through the space, avoiding obstacles like furniture, pets, or objects, while also ensuring that the entire house is cleaned efficiently and in the shortest time. The robot is a differential drive robot as the one in the picture:



It has a sensor that gives you the distance from the objects 180° in front, and encoders positioned on the two wheels which measure the rotation of the wheels.

How would you estimate the position of the robot with the wheel encoders starting from a position (0,0). (introduce some mathematical solution but focus on a clear explanation, highlighting how the process would work)

If you had the possibility would you use any additional sensors to the encoders? Why?

How would you handle a situation where the robot has to choose between avoiding an obstacle and completing a particularly dirty part of the room?

Consider that the robot got lost in the room, which strategy would you use to recover the position?

What kind of solutions would you propose for managing uncertainty, considering that sensors might not accurately detect all obstacles?

Could you provide a block scheme describing how you would manage the behavior of the robot and the different sensors? Add a short description for each block and provide an image of the block scheme.

How to deliver: Write your answer on a file save it as a .PDF with the following naming NAME_SURNAME.pdf, then reply to email you received from us with the PDF file attached.



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