Coding test – cleaning robot

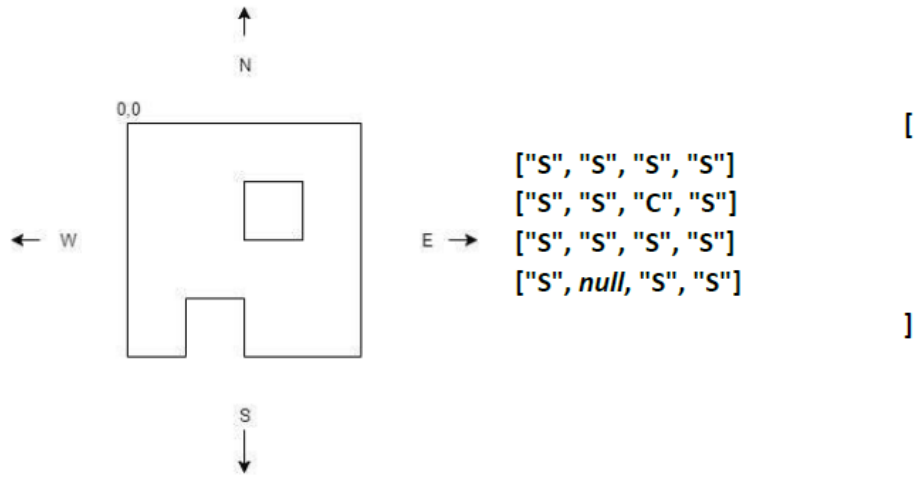
Company XYZ has decided to launch a new automated cleaning robot to the market. The robot shall be able to clean all surfaces in a room, automatically, without manual intervention.
To map the operating space, the robot will receive information about the room as a set of cells. Each cell represents:

• A cleanable space of 1 by 1 that can be occupied and cleaned (S).

• A column of 1 by 1 which can't be occupied or cleaned (C)

• A wall, represented by an empty cell (null) or by being outside the matrix

This map is provided as a matrix of m by n in which each element of the matrix is one of those items or else it is empty (null). For example, the 4x4 map (top left is always 0,0):



The robot also receives a set of basic instructions, each of which drain the battery of the robot by a certain amount and that it must follow.

• Turn Left (TL). Instructs the robot to turn 90 degrees to the left. Consumes 1 unit of battery.

• Turn Right (TR). Instructs the robot to turn 90 degrees to the right. Consumes 1 unit of battery.

• Advance (A). Instructs the robot to advance one cell forward into the next cell. Consumes 2 unit of battery.

• Back (B). Instructs the robot to move back one cell without changing direction. Consumes 3 units of battery.

• Clean (C). Instructs the robot to clean the current cell. Consumes 5 units of battery.

A sequence of valid operations will look like:

• C, TR, A, C, A, C, A, C, TL, A, C, A, A, A, C, TL, C

The robot will process each operation and must obey it unless it hits an obstacle (a column or a wall) or runs out of battery. If a command (possibly only Advance) in the received command set would result in the robot entering an obstacle cell, the robot will ignore it and instead initiate the following algorithm (back off strategy):

1. Turn right, then advance. (TR, A)

2. If that also hits an obstacle: Turn Left, Back, Turn Right, Advance (TL, B, TR, A)

3. If that also hits an obstacle: Turn Left, Turn Left, Advance (TL, TL, A)

4. If that also hits and obstacle: Turn Right, Back, Turn Right, Advance (TR, B, TR, A)

5. If that also hits and obstacle: Turn Left, Turn Left, Advance (TL, TL, A)

6. If an obstacle is hit again the robot will stop and return.

The robot will execute each command in order until no more commands are left, a battery low condition is hit, or all the back off strategies fail. If, for example, the robot has 4 units of battery and a “clean” command (requiring 5 units of battery) is received, the robot will stop at that point and finish the program with 4 units of battery left. If the battery low condition is hit during a back off sequence, the robot does not continue with the next back off strategy, but also finishes the program immediately.

To provide the information to the robot, a JSON file is provided with the following format:

```
{
        "map": [
                ["S", "S", "S", "S"],
                ["S", "S", "C", "S"],
                ["S", "S", "S", "S"],
                ["S", null, "S", "S"]
        ],
        "start": {"X": 3, "Y": 0, "facing": "N"},
        "commands": ["TL","A","C","A","C","TR","A","C"],
        "battery": 80
}
```

In which “map” contains the map; “start” contains the starting point of the robot as X, Y with X being the column and Y being the row, for example, the column obstacle in the example is on position (2,1) and the direction it is facing which can be North (N), East (E), South (S) or West (W); “commands” contains the ordered list of commands to execute, “battery” the initial battery level.
Upon execution, the robot must produce a result json which describes the results of the cleaning containing:

- All cells visited.
- All cells cleaned.
- Final position of the robot.
- Final battery left.

```
{
        “visited”: [ {“X”: 1, “Y”:0}, {“X”: 2, “Y” : 0}, {“X”:3, “Y”: 0}],
        “cleaned”: [{“X”: 1, “Y”:0}, {“X”: 2, “Y” : 1}],
        “final”: { “X” : 2, “Y” : 0, “facing”: “E”},
        “battery”: 54
}
```

Tasks

Create a command line program that will receive a json file as an input with the parameter specified and will run the robot simulation and produce the output as specified:

• Visited will contain all the cells visited by the robot.

• Cleaned will contain all the cells cleaned by the robot.

• Final will contain the final position and facing direction of the robot.

• Battery will contain the final battery left on the robot.

• The program shall be invoked as:

```
cleaning_robot <source.json> <result.json>
```

The program shall take the first parameter as the input and produce the results in the second parameter.

Deliverables

• Your solution may be delivered on any language of your choice.

• Please include instructions on how to build and run your code.

Bonus points

• Bonus point for creating a full REST microservice in addition to the console app.

• Bonus point for usage of source control.

Guidance

• The code and the whole solution should be production quality. Follow good design patterns, reusability and extensibility. **Keep it simple.** Include tests or quality assurance measures you see as appropriate.

• **Focus on the core algorithm**: commands definition, executing the sequence, backing out of obstacles… Only after you have this correct, clean, and nice to look at, spend your time on bonus points.

• In the provided ZIP file, together with the description of this problem, there are two JSON examples for both a sample input and expected output.