

# Universidade da Beira Interior

## Departamento de Informática

### Artificial Intelligence

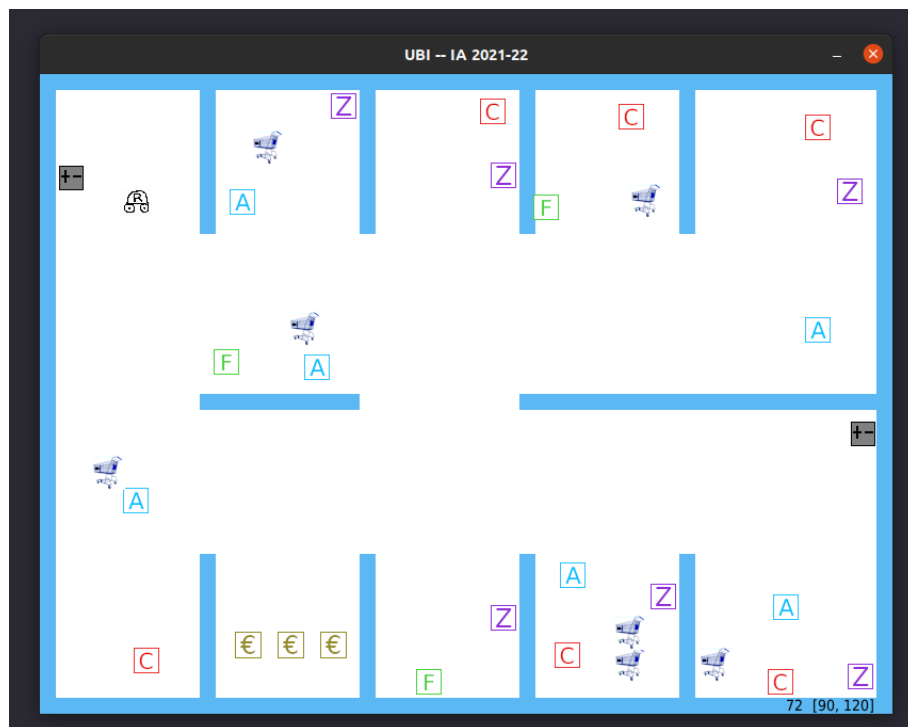
Practical Project

2021-22

## Introduction

In this project we will create the AI for a robot that moves under our control in a virtual world, that corresponds to a supermarket.

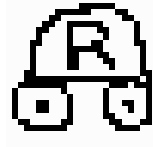
The world is similar to the following:



At the top left corner we have the supermarket entrance. Immediately below we see a battery charger that can be used by the robot, when necessary.

On the bottom right corner we see the battery status (currently is 72) and the coordinates of the robot position ( $x = 90$  and  $y = 120$ ).

This is the robot:



## Project

### Setup

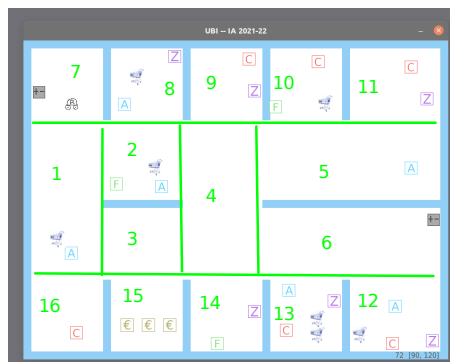
To run the code we just need to write `python3 ia.py` in a terminal. To control the robot you use the following keys: W=up, S=down, A=left, D=right, ESC=end.

While moving around, the robot is going to find several objects, and when it comes close enough to them, their names and category (see below) is given to the function `work()` that receives information regarding the robot's localization, its battery status and the list of nearby objects.

### How the world works

The robot always starts in the same location (zone 7 of the supermarket). The battery is discharging as time goes by, and when it reaches zero charge the simulation finishes. The battery can be recharged by touching the chargers that exist in the supermarket.

At any moment, the number of the zone where the robot is can be obtained using the coordinates of its position and the information from the following figure:



The A represents Adults, the C represents Child, the Z represents a Zone and the F represents a supermarket worker (Funcionário in Portuguese). Note that the numbers from 1 to 6 are assigned to corridors. In this figure the corridor limits are marked with green lines.

The supermarket clients may or may not bring with them a cart. Some adults (clients) bring children with them. The next table shows the probabilities relating these elements, that can be used to answer some questions:

Adult	Cart	P(Child   Adult, Cart)
V	V	0.8
V	F	0.5
F	V	0.1
F	F	0.05

Example: the probability of finding a child in a supermarket zone, given that there is a cart there but no adult, is 0.1.

When the robot receives information about a nearby object, it always receives first the object category followed by the object's name. Example: `adult_jonh`, `zone_fruit_shop`, `worker_anna`. You will see these messages in Portuguese, like: `adulto_joão`, `zona_frutaria`, `funcionário_ana`.

There are different zones in the supermarket, such as:

- zone 7 is fixed and is always the supermarket entrance;
- butchery, stationery shop, fruit shop, hygiene, drinks, bakery, fishmonger. In Portuguese these are called: `talho`, `papelaria`, `frutaria`, `higiene`, `bebidas`, `padaria`, `peixaria`;
- the exit is in the supermarket cashier that must be detected by the robot when he detects the cashiers (`caixas`, in Portuguese).

Note that your code will be tested with different versions of the world where everything can change. The only thing that remains is the walls and the robot always starts in the same position.

## Questions

Your robot must be able to answer these questions, at any point in time:

1. What was the last person of the feminine sex that you saw?
2. In what type of zone are you in now?
3. What is the path to the stationary zone?
4. What is the distance to the butcher?
5. How long do you think it will take to go to the cashier?
6. How much time do you think it will take to have half of the battery that you have now?
7. What is the probability that the next person you see is a child?
8. What is the probability of finding an adult in a zone if there is a child there but no cart?

And here is the Portuguese version of the questions (these are the ones you see in the terminal when you press the question keys):

1. Qual foi a penúltima pessoa do sexo feminino que viste?
2. Em que tipo de zona estás agora?
3. Qual o caminho para a papelaria?
4. Qual a distância até ao talho?
5. Quanto tempo achas que demoras a ir de onde estás até à caixa?
6. Quanto tempo achas que falta até ficares com metade da bateria que tens agora?
7. Qual é a probabilidade da próxima pessoa a encontrares ser uma criança?
8. Qual é a probabilidade de encontrar um adulto numa zona se estiver lá uma criança mas não estiver lá um carrinho?

These questions are asked by the user when he presses the numeric key that corresponds to the question number. The answers will be printed in the terminal. The code that answers the questions must be written in the file `agente.py`.

The virtual machine already has installed several libraries that might be useful to you: `networkx`, `numpy`, `scipy`, `scikit-learn` and `pyAgrum`.

## Presentation

Your group will make a presentation of your work with 8 minutes duration. Do not spend this time talking about things that are already in this description: focus on what you implemented and how it works. Also talk about what were the difficulties you had and how you were able to solve them. Both group members have to talk: ideally each will use half of the presenting time to explain the 4 questions that he solved. After the presentation there is a period for questions.

## Deliverables

You have to deliver the following:

- a PDF report explaining your work. The report must explain clearly which part of the work was done by which group member. It is not acceptable for you to write something like “this part of the work was done together”.
- the PDF slides of your presentation (not PPT, not online).

- the file `agente.py` with your code in it. It must run in a virtual machine identical to the one you received with this text. It must be well documented (code comments).

The deliverables must be submitted in a single zip file with both your student numbers in the file name, by email to `luis.alexandre@ubi.pt` until 11pm of 2021-12-22. You **must** to submit by this date. If you do not submit whatever you have, even if it is not “finished” yet, you will fail the Project and this course. Do not wait for the final day. We seriously advise you to submit, at most, on the day before the deadline to avoid any possible problem. All submissions will be acknowledged by an email. If you do not receive an email acknowledging the reception of your work then speak with the professor urgently. He has 24 hours to acknowledge the reception.

The final practical classes will be devoted to help you with the Project, but do not wait for them to start working.