Assignment-5 Part-1

Guidelines

- The assignment is due on April 27th, 11:55am (Noon).
- `x = 1 - (((LastThreeDigitsOfRollNum)%40 + 1) / 100)`
  - `Ex: For the Roll Number 20161033, x = 0.66`
- `y = (LastTwoDigitsOfRollNum) % 3`

Problem

Consider a rectangular grid of dimensions 1 X 5 and each cell in this grid is a state. Hence, there are 5 states namely S1, S2, S3, S4, S5 as shown in the figure 1. An agent when in any of these states has two possible actions to take, *Left* or *Right*.

Fig. 1 : State Space

When the agent decides to take the action *Left*, it goes to the left state with a probability x and goes to the right state with a probability 1-x. Similarly when the action *Right* is chosen, the agent goes to the right state with a probability x and goes to the left state with a probability 1-x.

Note that when the agent is in one of the extreme states (S1 or S5) and decides to go in the direction of the wall, it remains in the same state. For example, if the agent is in state S1 and takes the action *Right*, it goes to the right state(S2) with probability x and remains in the same state(S1) with a probability 1-x as unfortunately, it cannot pierce through the wall.

The sensors of the agent can detect whether it is in a red state (S1, S2, S5) or in a green state (S3, S4). However, there are uncertainties in the observations made due to some technical glitches and the observation probabilities are given in **Table : y**. Note that the agent can make two and only two observations i.e Red or Green.

P(Observation = Red | State = Red)	0.9
P(Observation = Green | State = Green)	0.85

Table : 0

P(Observation = Red | State = Red)	0.8
P(Observation = Green | State = Green)	0.95

Table : 1

P(Observation = Red | State = Red)	0.85
P(Observation = Green | State = Green)	0.9

Table : 2

Initially, the agent knows that it is in one of the red states i.e S1, S2 or S5.

The agent has taken 3 actions consecutively and the corresponding action-observation pairs are as follows.

   i.   Agent took the action *Right* and observed **Red**.
   ii.   Agent took the action *Left* and observed **Green**.
  iii.   Agent took the action **Left** and observed **Green**.

Please derive the beliefs after **each** of the above actions has been taken.

For the sake of automated evaluations, you are required to submit a text file named *<RollNumber>.txt* and the format is as follows:

- The 1st line contains your Roll Number.
- The 2nd line contains 2 values, x and y separated by a space.
- The next 3 lines contain 5 values each, the beliefs after each step is taken.

A sample file is as follows:

```
20161033
0.66 0
0.1 0.3 0.3 0.1 0.2
0.4 0.1 0.1 0.1 0.3
0.2 0.1 0.3 0.2 0.2
```

An evaluation script named 'parse.py' is uploaded for your reference. Please make sure the '.txt' file you submit is parsed successfully with the script. Failure of doing so will give you a straight 0 in this assignment.

You can run the script by running the following command in your terminal:

```
python3 parse.py <RollNumber>.txt
```

Submission Guidelines

- You are required to do all the computations manually and provide all the steps involved for arriving at the final answer. On account of missing steps, you will be appropriately penalized.
- A typed report is strongly recommended. However, if you're submitting a handwritten report, make sure the handwriting is decent enough and the scanned document is of high resolution. Failure of doing so would lead to a straight zero.
- While we also look at the steps involved, make sure you get your final answer right.
- You are required to submit a zip file named <RollNumber>.zip. On unzipping, the following should be the directory structure.
    - <RollNumber>
        - <RollNumber>.txt
        - partA-Report.pdf