first try to model by a graph

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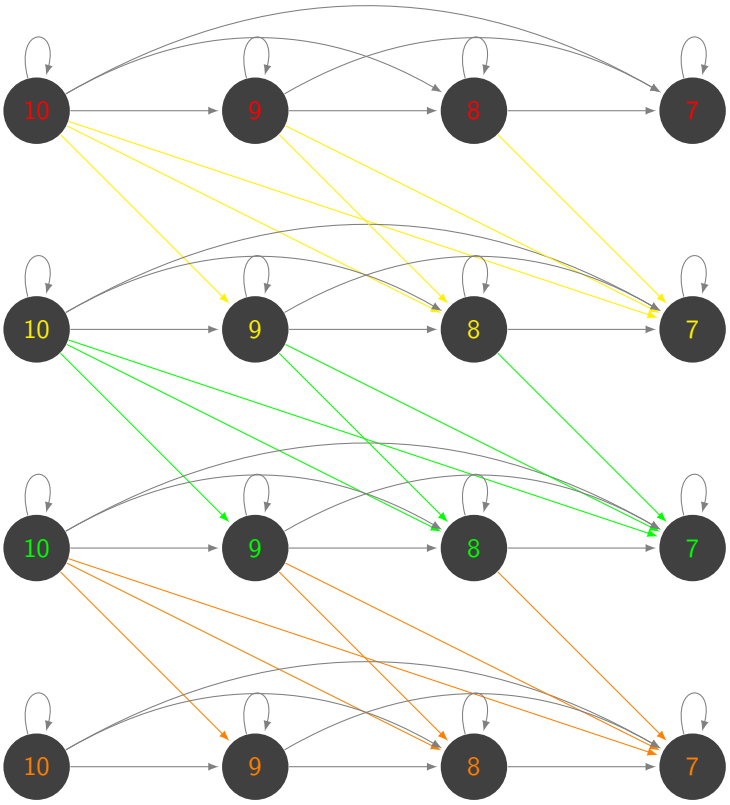

[1]

[1] I didn't put arrows between two states 10 of different color since the change in the color of the traffic light follows an exponential distribution and hence at a precise instant the probability of changing color is 0.

simply a first idea :

- the state with a number represent how far away the robot is from the traffic light (unit of distance are to be defined as explained later)
- the color of the number represents the color of the traffic light : yellow is for orange-red
- the arrows represents how the robot can go from a state from another :
    1. the robot can stay where he is : it's the grey arrows looping back into each state
    2. he can either go one unit of distance or more depending on the speed he decides to take when he leaves the state (cf later) : it's the other grey arrows
    3. the traffic light can change while he is going from one distance to another : let's say it begins in 10 with a red light and goes to 8 if while he was arriving the traffic light changed he will go to the corresponding state [2]. It's represented by the arrows of different colors

Now about the distance and velocity units, I was thinking that we could use a discretization[3] of the different velocities we got (let's say $n+2$) : $\{v_0 = 0, v_1, \ldots, v_n, v_{max}\}$, with v_{max} being the maximum speed the robot can achieve.

Let's assume our robot processes 24 images per sec. Then to define a new unit of distance, let's call it d_g we can take the distance travelled in $1/24$ sec while going at v_0, so that each time we process an image to follow the line, we are actually in a new state, not between two.

But now the question is, how do we measure the length of our movement in $1/24$ sec while going at v_0. It depends on how the robot perceives its distance to the traffic light, there is surely a way to link both explicitly.

[2] there are arrows from the orange light to the red but I didn't put them in hope it would be more readable. One can uncomment in the Latex code the arrows corresponding

[3] thanks Joachim for this idea