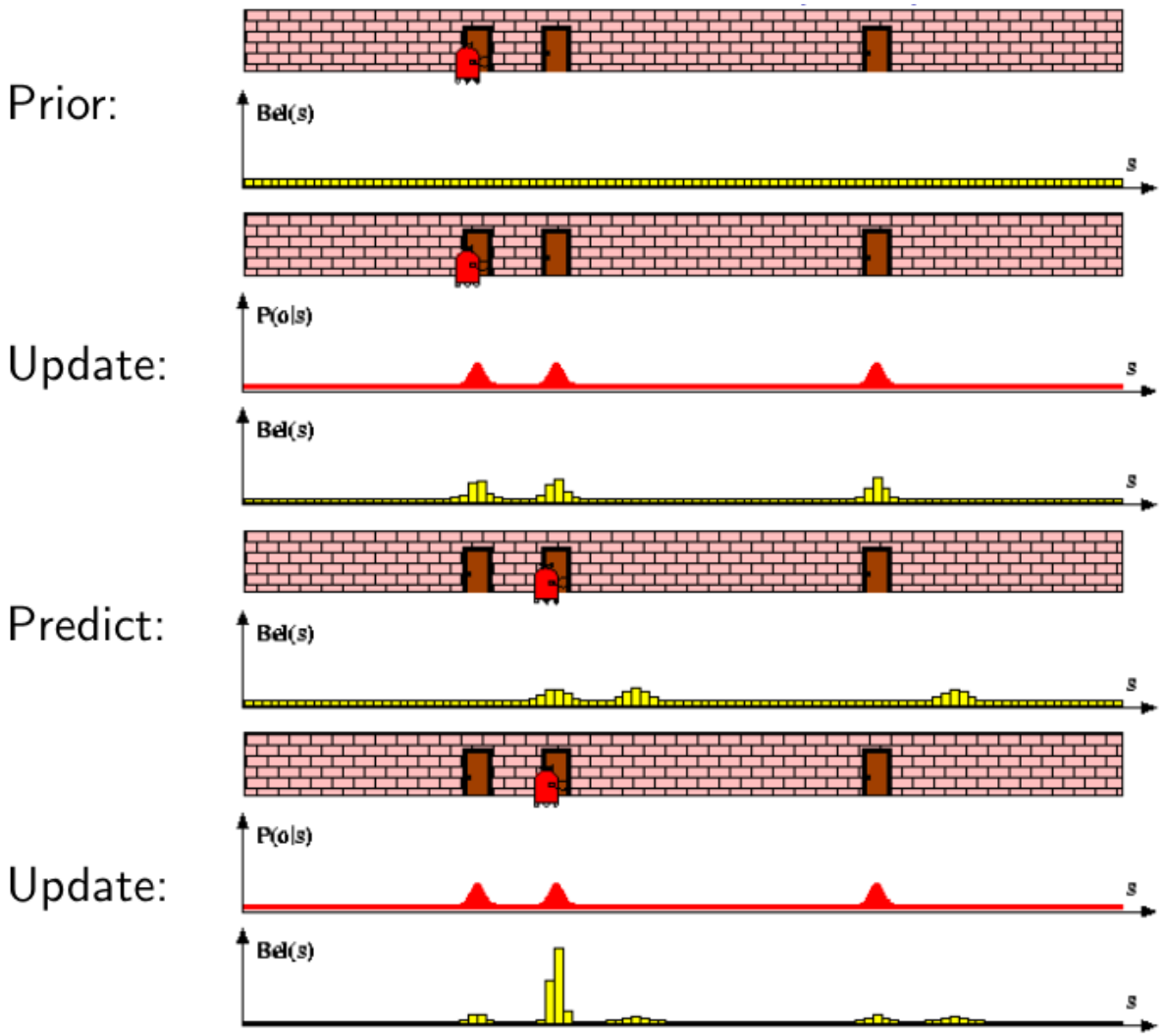
Bayes filter on 1D localization (Homework)

Bayes filter on 1D localization



PR book Figure 8.1

You can implement a discrete bayes filter for the 1D robot localization.

1: **Algorithm Discrete_Bayes_filter**($\{p_{k,t-1}\}, u_t, z_t$)**:**
2: *for all* k *do*
3: $\bar{p}_{k,t} = \sum_i p(X_t = x_k \mid u_t, X_{t-1} = x_i)\ p_{i,t-1}$
4: $p_{k,t} = \eta\ p(z_t \mid X_t = x_k)\ \bar{p}_{k,t}$
5: *endfor*
6: *return* $\{p_{k,t}\}$

Table 4.1 The discrete Bayes filter. Here x_i, x_k denote individual states.

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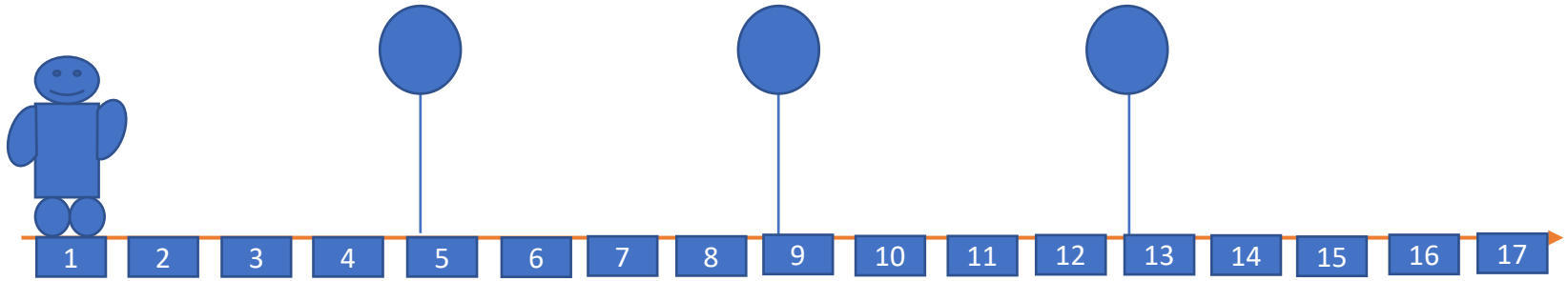
Bayes filter on simplified 1D localization (Homework)



We further simplify the scenario as follows:

- world: discrete grids denoted as spots #1 ~ #40
- control command: move forward one grid
- landmarks: three poles with known locations
- sensor observations: pole detected/not detected in front of the robot

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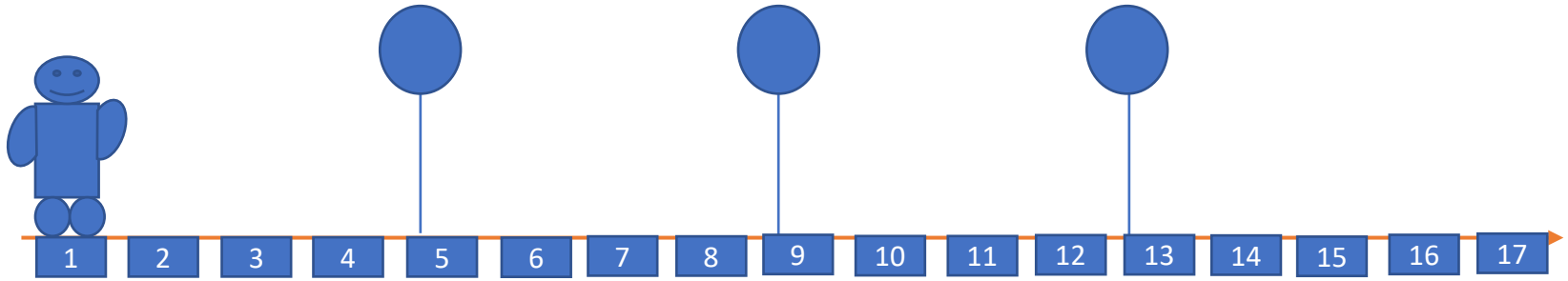
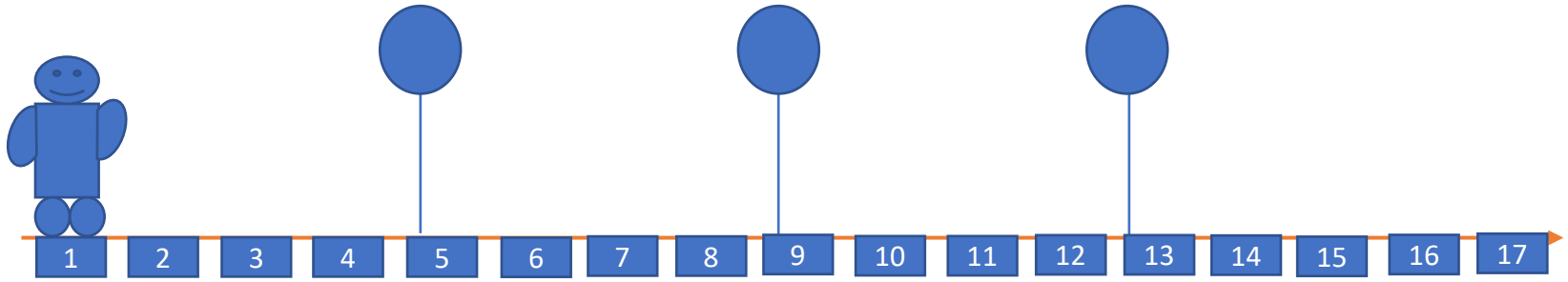


Notations:
P(Li) = The probability the robot is located in location i
P(D) = The probability that a pole is detected
P(!D) = The probability that a pole is not detected
P(D | Li) = The probability of a pole being detected, given the robot is located at the location i
P(Li | D) = ?
P(Li | !D) = ?

Bayes filter on simplified 1D localization (Homework)



What happens when the robot moves?

1. Shift the P(Li) think: what is P(Li) now? e.g., P(L5) <-- P(L4|D)
2. Do Bayes rule for all P(Li | D) again

Complete the assignment 2-1

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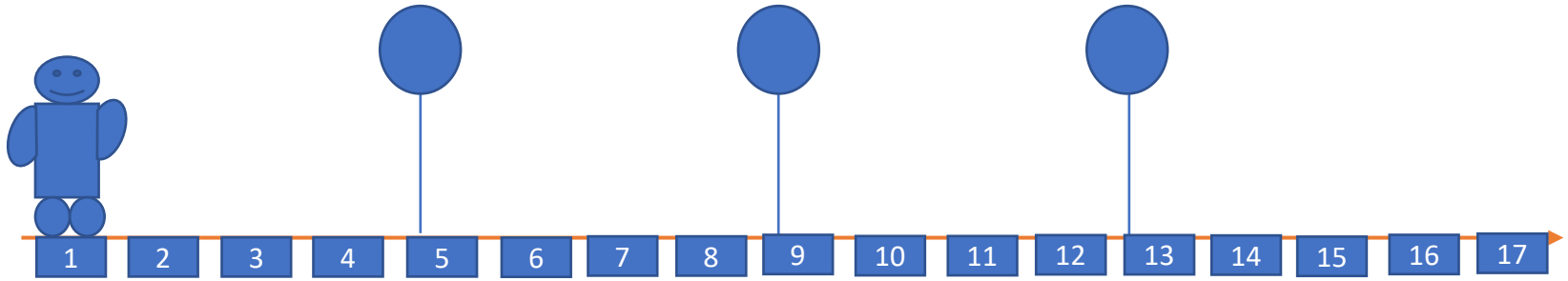

What if robot moves with uncertainties:
- sometimes, the control command asks the robot to move one unit ahead, but the robot can accidently moves two unit ahead with the probability 10%.

Complete the assignment 2-2