Foundations of Artificial Intelligence

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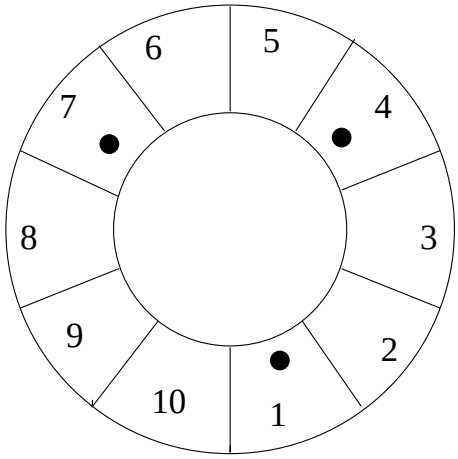
Exercise Sheet 12

Due: Friday, July 20, 2007

Exercise 12.1 (Bayesian Filtering)

Consider the world shown below. A robot moves counter-clockwise (in a deterministic way) in a circular corridor containing 10 grid cells. There are landmarks installed in some grid cells. If the robot is in a cell with a landmark it will detect it with a probability of 60%. If there is no landmark within the grid cell, the robot's sensors will detect one with a probability of 10%.



(a) Given no prior information about the location of the robot, compute for each grid cell the probability that the robot is in that particular cell after the following sequence of movements and measurements:

   (a) The robot detects a landmark.
   (b) The robot moves 3 grid cells forward.
   (c) The robot detects again a landmark.
   (d) The robot moves 4 grid cells forward.
   (e) The robot detects no landmark.

(b) How does your belief about the posterior pose of the robot change when a trustful person tells you that it is three times more likely that the robot started in a cell with an odd index number compared to an even one?

(c) How does your belief change when we additionally assume that the robot performs the perfect motion only in 60% of the cases. In 30%, it moves an additional cell forwards, in 10% of the cases, it moves one cell less than intended.

Exercise 12.2 (Natural language processing)

Give the full parse trees for the following sentences using the grammar defined in the lecture. Construct the first parse tree intuitively. For the second one, apply the top down parsing algorithm and use the bottom up approach for the third one. Give the intermediate steps and illustrate where the two algorithms might run into difficulties.

(a) it is a wumpus

(b) the wumpus is near Mary

(c) the wumpus is in 0 or 5

The exercise sheets may and should be worked on in groups of three (3) students. Please write all your names and the number of your exercise group on your solution.