Foundations of Artificial Intelligence

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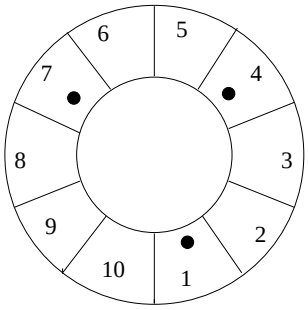
Exercise Sheet 12

Due: Friday, July 25, 2008

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 70%. If there is no landmark within the grid cell, the robot's sensors will detect one with a probability of 15%.



(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:

(i) The robot detects a landmark.
(ii) The robot moves 3 grid cells forward.
(iii) The robot detects again a landmark.
(iv) The robot moves 4 grid cells forward.
(v) 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 70% of the cases. In 20%, it moves an additional cell forwards, in 10% of the cases, it moves one cell less than intended.

The exercise sheets may and should be worked on in groups of three (3) students. Please fill the cover sheet[1] and attach it to your solution.

[1] `http://www.informatik.uni-freiburg.de/~ki/teaching/ss08/gki/coverSheet-english.pdf`