Albert-Ludwigs-Universität Freiburg
Lecture: Introduction to Mobile Robotics
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Autonomous Intelligent Systems
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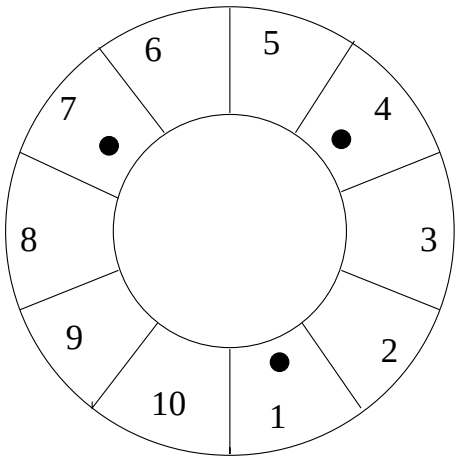
Sheet 5

Submission deadline: Wed 31.05.2006, 09:15 (before class)

Exercise 1: Localization

Consider the world shown below. A robot moves counter-clockwise (in a deterministic way) in a circular corridor containing 10 grid cells. In some grid cells are landmarks installed. If the robot is in a cell with a landmark it will detect it with a probability of 80%. If there is no landmark within the grid cell, the robot's sensors will detect one with a probability of 40%. Compute for each grid cell the probability that the robot is in a particular cell after the following sequence of movements and measurements:

1. The robot detects a landmark.
2. The robot moves 3 grid cells forward.
3. The robot detects again a landmark.
4. The robot moves 4 grid cells forward.
5. The robot detects no landmark.



Exercise 2: Implementation of a simple discrete filter:

Implement a simple discrete filter for the solution of exercises like the one above. Please use the Java template and data files linked on our web page. Input file 1 matches the situation in Exercise 1 and can be used as a test case for your implementation.

(a) Implement the algorithm with a deterministic motion model and the sensor model of Exercise 1. Add a method that interprets the final belief distribution after all inputs have been processed.

(b) Exchange the deterministic motion model for an undeterministic one that approximates a Gaussian distribution: $P(x_t = c + a - 1|x_{t-1} = c, a) = \frac{1}{4}$, $P(x_t = c + a|x_{t-1} = c, a) = \frac{1}{2}$, $P(x_t = c + a + 1|x_{t-1} = c, a) = \frac{1}{4}$.

(x_t: cell index at time t, c: cell index, a: action (number of cells moved)).

Please send your implementation and output files to *omartine@informatik.uni-freiburg.de.*