Albert-Ludwigs-Universität Freiburg
Institut für Informatik
Lecture: Introduction to Mobile Robotics
Summer term 2007
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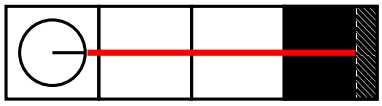
Sheet 9

Topic: Grip Mapping With Known Poses

Submission deadline: Fri 29.06.2007, 11:00 a.m. (before class)

Exercise 1: Occupancy Mapping

A robot has to build an occupancy grid map (cells $c_0, \dots c_n$) of a simple one-dimensional environment using a sequence of measurements from a range sensor.



Assume a very simple sensor model: every grid cell with a distance (based on its coordinate) smaller than the measured distance is assumed to be occupied with $p = 0.4$. Every cell behind the measured distance is occupied with $p = 0.6$. Every cell located more than $20cm$ behind the measured distance should not be updated. Calculate the resulting occupancy grid map using the inverse sensor model (see updated mapping lecture PDF, slide 10).

Please consider using Octave. Use one array `m=0.5*ones(1,21)` for the belief values, and one array `c=[0:10:200]` for the cell coordinates. Use `plot(c,m)` to visualize the belief. If you choose to do it by hand, just integrate the first 5 measurements and only compute the cells between 50 and 150 cm.

grid resolution	$10cm$
map length (1d only!)	$2m$
robot's position	c_0
orientation (of the sensor)	heading to c_n (see figure)
measurements (in cm)	$101, 82, 91, 112, 99, 151, 96, 85, 99, 105$
prior	0.5

Exercise 2: Counting Model

A map of the cells $c_0, \dots, c_3$ of a 1D environment has been built using the "simple counting" approach (see updated mapping lecture PDF, slide 21). The belief values b_i of the cells c_i are $b_0 = 0$, $b_1 = \frac{1}{4}$, $b_2 = \frac{2}{3}$, $b_3 = 1$. The robot was standing in cell c_0. Four measurements $z_0, \dots, z_3$ have been integrated. Here a measurement is defined by the *cell number* where the measuring beam has ended. If $z_0 = 1$, $z_1 = 2$, $z_2 = 3$, what is the value of the last measurement z_3?