CSE 4309/5361 - *Artificial Intelligence II*

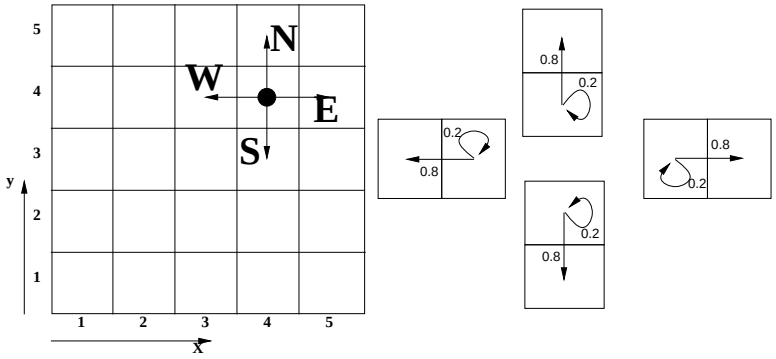
Homework 2- Spring 2013

Due Date: March 21, 2013

Note: Problems marked with * are required only for students enrolled in CSE 5361. They will be graded for students enrolled in CSE 4309 for extra credit.

Bayesian Networks

Consider a similar navigation scenario as in the first assignment where an agent moves in a grid world. However, in this grid world, the initial location of the agent is not known and the agent's actions succeed only probabilistically. In particular, the agent's $North$, $South$, $East$ and $West$ actions each succeed with probability 0.8 and with probability 0.2 the agent lips and as a result stays in the same place (without noticing that it did so. The only sensors that the agent has are one that detects when it bumps into a wall surrounding the grid world (irrespective of orientation), and one that can detect when it reached the goal.



1. Assuming that all sensors are perfect (i.e. a wall causes a bump sensor signal with probability 1 and the goal causes a goal sensation with probability 1) and that the location of the goal is known beforehand, design a Bayesian Network that can keep track of the probability distribution over the agent's location in a 5x5 grid world. You can use any Bayesian Network package (e.g. BNT for Matlab, PNL for C, C++, or JavaBayes for Java - see http://www.cs.ubc.ca/∼murphyk/Software/bnsoft.html for a list of Bayesian Network packages) to represent the network and perform the inference.

    a) Implement an agent that you can move by hand and that uses the Bayesian network to estimate the probability distribution over its location.

    b) For 2 different goal locations and (unknown) start locations show the probability distribution over the agent's location after each step until it reaches the goal location.

Decision Networks

2. Considering the same world as for problem 1 (including 5x5 size), augment your Bayesian network by adding additional nodes, including decision and utility nodes, to make it into a decision network that allows the agent to automatically find its way to the goal.

    a) Build the decision network for this agent.

    b) Design a utility function for the agent and implement it in the decision network.

    c) Integrate the decision network into an agent so that it allows it to navigate to an arbitrary (known) goal.

3.* Extend your agent from problem 2 to the situation where the goal location is initially not known.

    a)* Build the decision network for this agent.

    b)* Design a utility function for the agent and implement it in the decision network.

    c)* Implement the rational agent using this network.

Note: For all problems you should submit your design as well as code for your agents, including instructions how to build and run the code and how to interpret its output.