CSE 4309/5361 - *Artificial Intelligence II*

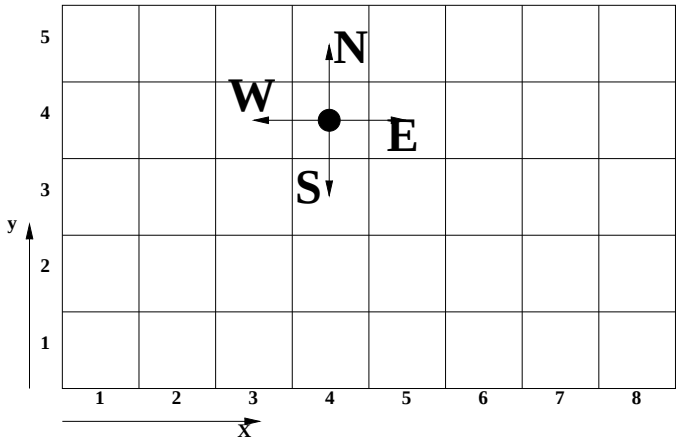
Homework 1- Spring 2013

Due Date: Feb. 14, 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.

Uninformed Search

1. An agent moves in a grid world where locations are marked by x and y indices and wants to find its way from a start location (x_s, y_s) to a goal location (x_g, y_g) using search. At each point in time the agent can either move $North$, $South$, $East$ or $West$, each of which moves it one cell in the given direction as shown in the figure below.



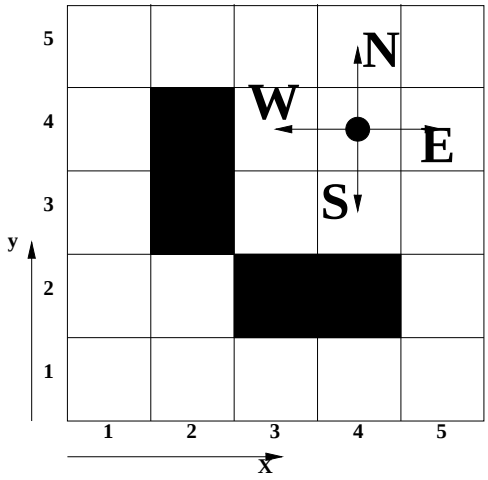
   a) Considering a start state for the agent in location $(1, 1)$ and a goal state at $(3, 3)$, show the sequence in which breadth first search would expand the location nodes (i.e. the order in which it would evaluate them whether they are the goal state). If there are too many, you only have to show the first 20 nodes that are being expanded.

   b) For the same start and goal location as in part $a)$, show the sequence of expanded nodes for depth-first search. Again, if there are too many, you only need to show the first 20 nodes.

   c) GIven the characteristics of the uninformed searches covered in class (depth-first, breadth-first, and iterative deepening), for each of them indicate if it would or would not be appropriate for this problem and why. In particular consider whether they would find the goal and what their complexity in terms of memory and time would be to find a solution for this problem.

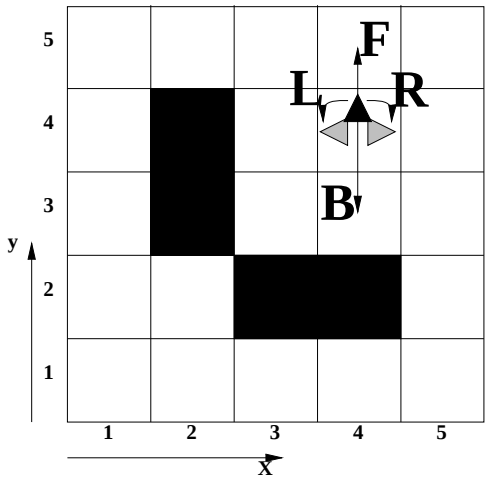
2. Consider again the navigation problem above but in this case with a number of cells being marked as obstacles, i.e. as cells that can not be traversed by the agent. Assuming the start location, the goal location, and the locations of all the obstacles are known beforehand (e.g. in an array which marks for

every grid cell whether it is an obstacle, the start, or the goal), implement a search-based agent using an uninformed search method to find its way to the goal - if it exists - in a general 5x5 world (i.e. a world with arbitrary start, goal, and obstacle locations).



Informed Search

3. Again, consider the grid world navigation problem from problem 2 but with a larger world and a changed actions set where the agent can move $Forward$ and $Backward$ and can turn $Left$ and $Right$ (each of which will turn the agent by 90 degrees in the indicated direction while staying in the same location). Assuming that in this world the two move actions ($Forward$ and $Backward$) have a cost of 2 and the two turn actions ($Left$ and $Right$) have a cost of 1, the agent is interested in finding a shortest path to the goal.



a) Develop a heuristic function for this problem that estimates the distance to the goal.

b) For a general 5x5 world implement a an agent that uses A^* search to find its way to the goal.

c) * Expand the search-based agent from part b) to use IDA^* and to work with $20x20$ worlds. (Note that this search could take a long time to run.)