CSE 4308 / CSE 5360 - *Artificial Intelligence I*

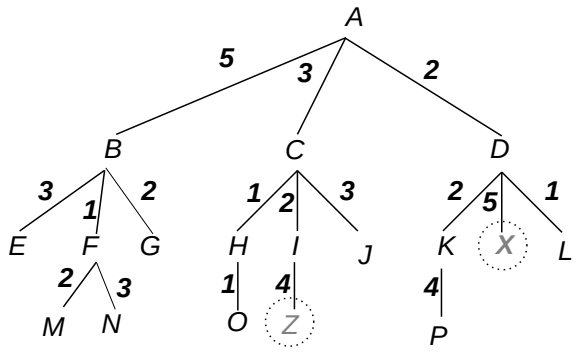
Homework 1- Fall 2013

Due Date: Sep. 13 2013, 5:00 pm

Problems marked with a * are required only for students in the graduate section (CSE 5360). They will be graded for extra credit for students of CSE 4308.

Uninformed Search

1. For the following tree, show the lists of *open* and *visited* nodes (i.e. nodes to which the goat test and the successor function have been applied) for each cycle of the listed search algorithms. The goal nodes are X and Z, and the numbers next to the edges indicate the associated cost.



a) Breadth-first search

b) Depth-first search

c) Uniform cost search (ties (i.e. identical costs) should be broken alphabetically)
For each node in the *open* and *visited* lists also indicate the associated cost.

Informed Search

2. Consider the following problem: In You are given two pitchers, one holding $7L$ and one holding $3L$ and an empty tub into which you are to fill exactly $18L$. You can either fill a pitcher all the way and add that water to the tub or you can fill a pitcher from the tub and pour the content down the drain (in other words you can add one pitcher full to the tub or you can remove one pitcher full from the tub). The cost of every move is proportional to the amount of water used (i.e. the capacity of the pitcher used).

a) Formulate the problem as an informed search problem by designing a state space, a successor function, a goal test, and an admissible heuristic for this problem.

b) Show the operation of Best-first search on this problem by listing the open list and the visited list (including the cost value used) for each iteration of the search.

c) Show the operation of A^* search on this problem by listing the open list and the visited list (including the cost value used) for each iteration of the search.

d)* Show the operation of IDA^* search on this problem by listing the open list and the visited list (including the cost value used) for each iteration of the search.

Problem Solving Using Search

3. Consider an extension of the problem in part 2 except for the case where you have up to 4 pitchers, i, with different capacities, c_i and two tubs, j, where the goal is to put exactly $x_j L$ of water into each of the two tubs (which can hold an unlimited amount of water). There are now 3 potential moves with each pitcher: i) add water from the faucet to one of the two tubs, ii) take water out of one of the tubs and pour it into the drain, or iii) take water out of one of the tubs and pour it into the other tub. The cost of each move is 1 for each L of water taken from the drain plus 0.5 for each L of water carried (i.e. taking $1L$ from the faucet As previously, the cost of each move is equal to the amount of water used (i.e. the capacity of the pitcher used).

   a) Write a program which solves this problem using A^* search (make sure that the number of pitchers, their capacities, and the goal amount are easy to change in the code). Your search should return the correct sequence of water additions and subtractions to reach the solution, including the total cost. In addition, it should output the sequence in which nodes were added to the open list and how they can were visited.

   b)* Write a program which solves the problem using IDA^* search (make sure that the number of pitchers, their capacities, and the goal amount are easy to change in the code). Your search should return the correct sequence of water additions and subtractions to reach the solution, including the total cost. In addition, it should output the sequence in which nodes were added to the open list and how they can were visited.