CS360 Homework 13

Search

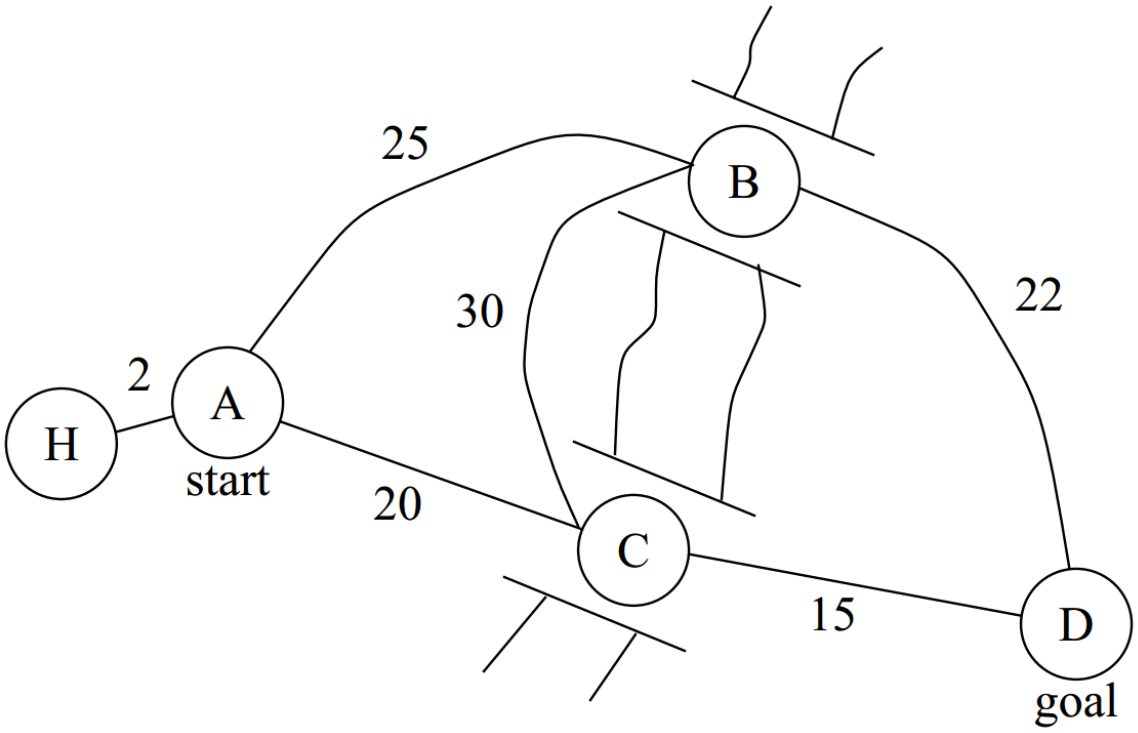
1) Develop an iterative-deepening variant of A* (call Iterative Deepening A*), that is, a version of A* that finds cost-minimal paths for consistent heuristics and uses a series of depth-first searches to keep its memory consumption small. (Hint: If you are stuck, look at the lecture slides on heuristic search.) Solve Problem 3 from Homework 12 for this version of A* with the (consistent) Manhattan distance heuristic.

Search-Based Planning

2) Consider the formulation of the Tower of Hanoi puzzle as a planning problem (solution of Homework 12, problem 2). Using the delete relaxation, calculate the length of the action sequence for achieving each predicate that appears in the goal state from the start state, then calculate the heuristic value of the start state as the maximum of these values.

Value of Information

3) A mobile robot is trying to get from his current position A to a destination D as quickly as possible. There is a river separating A from D and there are two bridges, B and C, spanning the river. The robot must design a strategy to move from A to D via one of the bridges.



Though the robot knows that one (and only one) of the bridges is inoperable, it is uncertain regarding which one of the two bridges is out. From its start position, position A, the robot can climb a hill to position H and use sensors to obtain information regarding which bridge is out. Collecting this information will take time, since it must go to H and return back to A, and the information gained is uncertain because the sensors will not be able to tell precisely which bridge is out.

The numbers in the above graph give the distance between locations in miles. In similar situations in the past, the robot experienced that 4 out of 5 times bridge C was out and only 1 out of 5 times bridge B was out. The robot has a short-range sensor that tells it with 100 percent reliability whether a bridge is out. The sensor can only be used when the robot is directly in front of the bridge. The long-range sensor of the robot is unreliable. It errs with a probability of 10 percent, that is, suggests that the broken bridge is operable and the other bridge is broken.

Design a strategy for the robot that minimizes the expected execution time.

Markov Decision Processes

4) Assume that you are trying to pick up a block from the table. You drop it accidentally with probability 0.7 while trying to pick it up. If this happens, you try again to pick it up. How many attempts does it take on average before you pick up the block successfully?