# Artificial Intelligence
Fall 2024
Problem Set #1

Assigned: Oct. 4 (F)

Due: Oct. 17 (Th)

Problem #1: (State Space Representation) Consider the problem of transporting N people across a river, where each person has a certain weight. Everyone starts off on the right-hand side of the river and is to be transported to the left-hand side. Suppose also that only one boat exists, which is able to support a maximum weight of WB.

    A. Design a state space representation for this problem. Specify clearly the meaning of each component of the state representation.

    B. Design a complete set of operators in this domain based on the above representation. Note that these operators should also work for transporting any allowed subgroup of people in either direction. That is, they should not be overly specific to the actual problem we want to solve, but instead should allow one to traverse the search space in a general manner.

Problem #2: Given the graph to the right, *write down the order in which the states are visited by the following search algorithms*. If a state is visited more than once, write it each time. Ties (e.g., which child to first explore in depth-first search) should be resolved according to alphabetic order (i.e. prefer A before Z). Remember to include the start and goal states in your answer. Treat the goal state as G when you break ties. Assume that algorithms execute the goal check when nodes are visited, not when their parent is expanded to create them as children.
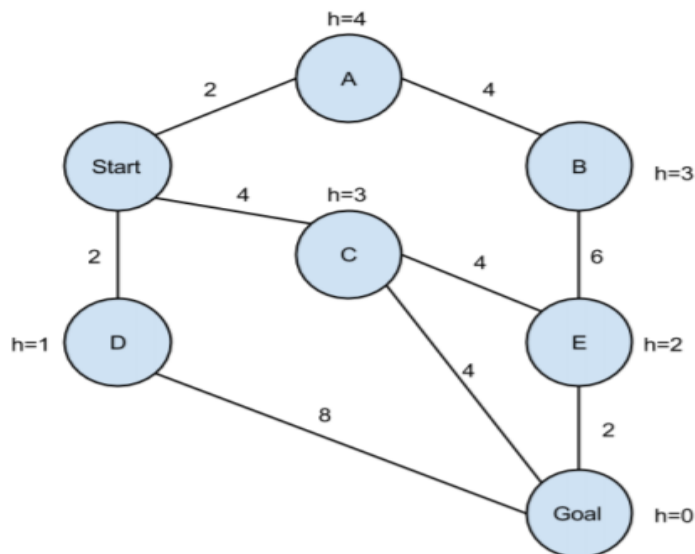
    A. Iterative deepening depth first search (ID)

    B. A* search, where $f(n)=g(n)+h(n)$

Problem #3: The figure below shows a problem-space graph, where A is the initial state and G denotes the goal. Edges are labeled with their true cost. We have a heuristic function, f(), written in the standard form: f(n)=g(n)+h(n) where g(n) is the cost to get from A to n and h(n) is an estimate of the remaining distance to G.

     A. In the graph below, is f() admissible? Why or why not?
     B. Is f() monotonic? Why or why not?