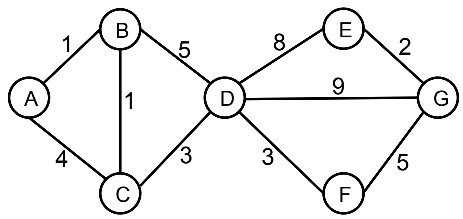
CS188: Exam Practice Session 1

Q1. Heuristics (Fall 2013)



Consider the state space graph shown above. A is the start state and G is the goal state. The costs for each edge are shown on the graph. Each edge can be traversed in both directions.

Suppose you are completing the new heuristic function h shown below. All the values are fixed except $h(B)$.

State	A	B	C	D	E	F	G
h	10	?	9	7	1.5	4.5	0

For each of the following conditions, write the set of values that are possible for $h(B)$. For example, to denote all non-negative numbers, write $[0, \infty]$, to denote the empty set, write $\varnothing$, and so on.

(a) What values of $h(B)$ make h admissible?

(b) What values of $h(B)$ make h consistent?

(c) What values of $h(B)$ will cause A* graph search to expand node A, then node C, then node B, then node D in order?

Q2. All Searches Lead to the Same Destination (Spring 2014)

For all the questions below assume :

- All search algorithms are *graph* search (as opposed to tree search).
- $c_{ij} > 0$ is the cost to go from node i to node j.
- There is only one goal state (as opposed to a set of goal states).
- All ties are broken alphabetically.
- Assume heuristics are consistent.

Definition: Two search algorithms are defined to be ***equivalent*** if and only if they expand the same states in the same order and return the same path.

In this question we study what happens if we run uniform cost search with action costs d_{ij} that are potentially different from the search problem's actual action costs c_{ij}. Concretely, we will study how these new action costs might make uniform cost search equivalent to another search algorithm.

(a) Mark *all* choices for costs d_{ij} that make running **Uniform Cost Search** algorithm with these costs d_{ij} *equivalent* to running **Breadth-First Search**.

- ◯ $d_{ij} = 0$
- ◯ $d_{ij} = \alpha$, $\alpha > 0$
- ◯ $d_{ij} = \alpha$, $\alpha < 0$
- ◯ $d_{ij} = 1$
- ◯ $d_{ij} = -1$
- ◯ None of the above

(b) Mark *all* choices for costs d_{ij} that make running **Uniform Cost Search** algorithm with these costs d_{ij} *equivalent* to running **Depth-First Search**.

- ◯ $d_{ij} = 0$
- ◯ $d_{ij} = \alpha$, $\alpha > 0$
- ◯ $d_{ij} = \alpha$, $\alpha < 0$
- ◯ $d_{ij} = 1$
- ◯ $d_{ij} = -1$
- ◯ None of the above

(c) Mark *all* choices for costs d_{ij} that make running **Uniform Cost Search** algorithm with these costs d_{ij} *equivalent* to running **Uniform Cost Search** with the original costs c_{ij}.

- ◯ $d_{ij} = c_{ij}^2$
- ◯ $d_{ij} = 1/c_{ij}$
- ◯ $d_{ij} = \alpha\ c_{ij}, \quad \alpha > 0$
- ◯ $d_{ij} = c_{ij} + \alpha, \quad \alpha > 0$
- ◯ $d_{ij} = \alpha\ c_{ij} + \beta, \quad \alpha > 0,\ \beta > 0$
- ◯ None of the above

(d) Let $h(n)$ be the value of the heuristic function at node n.

(i) Mark *all* choices for costs d_{ij} that make running **Uniform Cost Search** algorithm with these costs d_{ij} *equivalent* to running **Greedy Search** with the original costs c_{ij} and heuristic function h.

- ◯ $d_{ij} = h(i) - h(j)$
- ◯ $d_{ij} = h(j) - h(i)$
- ◯ $d_{ij} = \alpha\ h(i), \quad \alpha > 0$
- ◯ $d_{ij} = \alpha\ h(j), \quad \alpha > 0$
- ◯ $d_{ij} = c_{ij} + h(j) + h(i)$
- ◯ None of the above

(ii) Mark *all* choices for costs d_{ij} that make running **Uniform Cost Search** algorithm with these costs d_{ij} *equivalent* to running **A* Search** with the original costs c_{ij} and heuristic function h.

- ◯ $d_{ij} = \alpha\ h(i), \quad \alpha > 0$
- ◯ $d_{ij} = \alpha\ h(j), \quad \alpha > 0$
- ◯ $d_{ij} = c_{ij} + h(i)$
- ◯ $d_{ij} = c_{ij} + h(j)$
- ◯ $d_{ij} = c_{ij} + h(i) - h(j)$
- ◯ $d_{ij} = c_{ij} + h(j) - h(i)$
- ◯ None of the above