ICS 171, Summer 2000: Lecture 3 Homework

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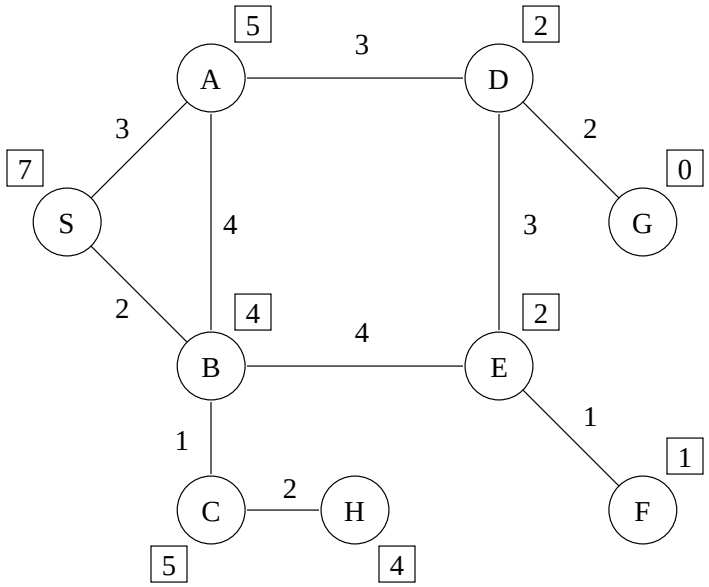
Due: August 22, 2000

(1) Consider the following graph representing the state space and operators of a navigation problem:



The path cost is shown by the number on the links; the heuristic evaluation is shown by the number in the box.

- When placing expanded child nodes on a queue, assume that the child nodes are placed in alphabetical order (i.e. if node S is expanded the queue will be: A B)
- Assume that we never generate child nodes that appear as ancestors of the current node in the search tree.

See the midterm prep handout for detailed examples of how these algorithms work on an alternative problem.

(a) What is the order that best first search will expand the nodes?

(b) What is the order that uniform cost search will expand the nodes?

(c) What is the order that A* search will expand the nodes?

(d) What is the order that IDA* search will expand the nodes?

(e) What is the order that hill-climbing search will expand the nodes?

(2) What will happen in best first search if we set $h(n) = -g(n)$?

Setting $h(n) = -g(n)$ means that the best nodes (the ones with the lowest score) will be those with the longest path (the higher $g(n)$ and thus lower $-g(n)$). Preferring longest paths means depth first search. If we set $h(n) = g(n)$ we get breadth-first search. (from R & N)

(3) Question 4.2, parts b, c, and d in the course text (Russell & Norvig, page 118).

(4) Suppose that h_1 and h_2 are admissible heuristics. Which of the following are admissible?

$$\frac{(h_1 + h_2)}{2}$$

Admissible.

$$2h_1$$

Not Admissible.

$$\max(h_1, h_2)$$

Admissible.

(5) If h_1 and h_2 are admissible heuristics, which is the better method of combining them: $F = \max(h_1, h_2)$ or $G = (h_1 + h_2)/2$? Explain.

$\max(h_1, h_2)$ is the better method of combining h_1 and h_2 because $\max(h_1, h_2) \geq (h_1 + h_2)/2$. Another way of thinking about this is that the maximum of two numbers is always greater than the average.