SAMPLE CLASS TEST

CS4618 Topics in Artificial Intelligence I

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Time allowed: Forty-five minutes
1. (10 marks) Suppose we have an admissible heuristic function $h$ for a state space. Also, $h(n) \geq 0$ for all states $n$ in the state space, and all action costs are positive.

Hence, state whether each of the following is true or false. In each case explain your answer in detail.

i) If $n$ is a goal state, then $h(n) = 0$.
ii) If $h(n) = 0$, then $n$ is a goal state.
iii) If $n$ is a ‘dead-end’ (i.e. it is a non-goal state from which a goal state cannot be reached), then $h(n) = \infty$.
iv) If $h(n) = \infty$, then $n$ is a ‘dead-end’.
v) If $n'$ is a successor of $n$, then $h(n) \geq h(n')$.

2. (10 marks) Two (indistinguishable) humans, one big monkey and one small monkey are to cross from the left bank to the right bank of a river. There is a boat but it can hold only up to two creatures at a time (whether they be monkeys or humans), and only the humans and the big monkey are capable of rowing it. At all times, the number of humans on either side of the river (if any) must be greater than or equal to the number of monkeys on that side of the river.

i) (2 marks) Give a representation for the states of this puzzle.
ii) (0.5 marks) Give the initial state.
iii) (0.5 marks) Give the goal state.
iv) (7 marks) Suppose that the cost of each river crossing equals the total weight of the creatures in the boat. (Assume all weights are greater than one.)

Hence, state whether the following are admissible heuristic functions. In each case, explain your answer in detail.

a. the total number of creatures on the left bank;
b. the total weight of the creatures on the left bank;
c. the total weight of the creatures on the left bank but, if the only creature on the left bank is the small monkey, add on 2 times the minimum weight of the creatures on the right bank;
d. the total weight of the creatures on the left bank plus 2 times either the weight of one of the humans or the weight of the large monkey, whichever is lighter.