Foundations of Artificial Intelligence
Summer term 2002

University of Freiburg
De Raedt / Kersting

Exercise Sheet No 4

May 08, 2002
Deadline: May 15, 2002, before the lecture
1 bonus point

Exercise 4.1 (6 points)

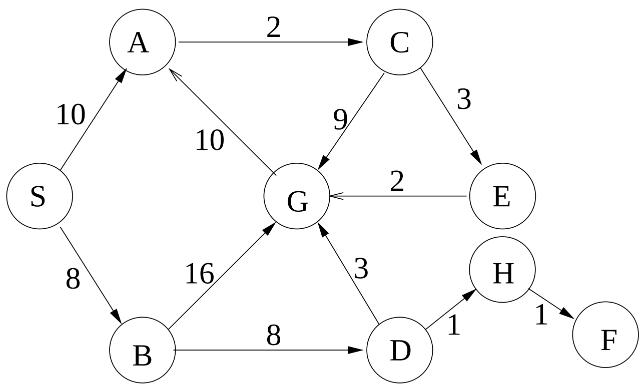
In the lecture, we have noticed that an admissible heuristic (when combined with path-max) leads to monotonically nondecreasing f values along any path, i.e. $f(succ(n)) \geq f(n)$. Does the implication also hold the other way, i.e. does monotonicity in f imply admissibility? Prove your answer.

Exercise 4.2 (7 points)

Perform *SMA** using

	S	A	B	C	D	E	F	H	G
h-value	12	5	5	5	2	2	1	1	0

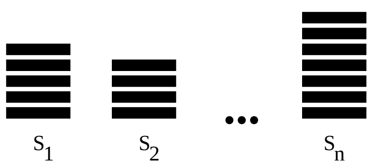
as heuristic on the following graph:



Assume that you have enough memory to hold 4 nodes.The node S is the starting state and G is the only goal state.

Exercise 4.3 (7 points)

In this exercise, you will run through the Minimax search strategy on the game *Nim*. The rules of *Nim* are as follows. There are stacks $s_1, \ldots, s_n$ $(n > 0)$ of coins in front of two players *Min* and *Max*:



Each stack s_i consists of $c_{ij} > 0$ many coins. Each player has a complete and perfect model of the environment and of the possible actions and their effects. The players *Max* and *Min* move alternately, and *Max* moves first. The action a player can perform is to take $1 \leq l \leq c_{ij}$ many coins away from a single stack s_i. The player who removes the last (overall) coin wins.
Starting from the initial state (two stacks consisting of 3 and 2 coins), draw the whole game tree. Evaluate the leaf nodes of the tree using the utility function which assigns 1 to win and 0 to loss. Then use Minimax to find the value for the root node. Circle the action that *Max* should take.