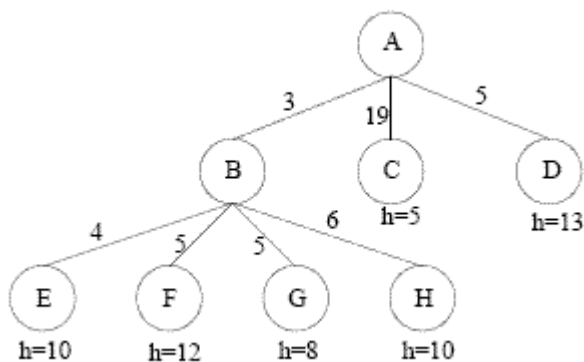


1. What is the main assumption of the declarative approach in AI (compared to the procedural approach)? (5p)
2. Using three nodes, give an example for an inconsistent, but admissible heuristic function! (5p)
3. Which node will be selected from the queue containing the leaf nodes of the tree in Fig. 1 (assuming that equivalent nodes are selected from left to right) in case of
 - depth-first-search:
 - breadth-first-search
 - uniform cost search:
 - iterative deepening search:
 - greedy search:
 - A*:
 (10p)

Fig.1. Search tree with costs on edges and heuristic values indicated by h .

4. Apply the MINIMAX algorithm for the tree in Fig.2., propagate the values and indicate the MINIMAX moves! (10p)

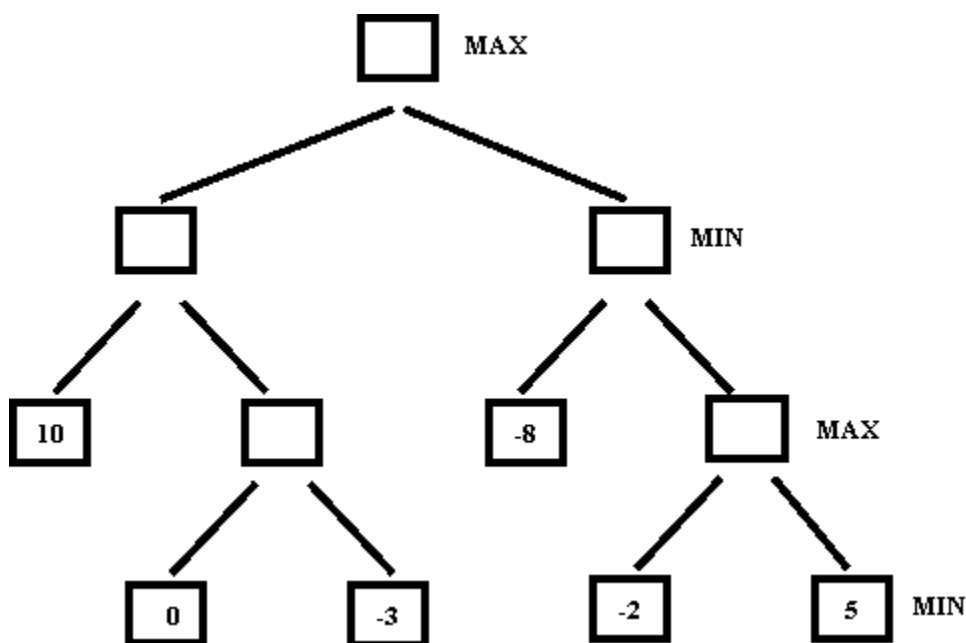


Fig.2. MINIMAX tree.

5. Estimate the effective branching factor for the search tree in Fig.3. (the goal state is the node 12, in bold)! (10p)

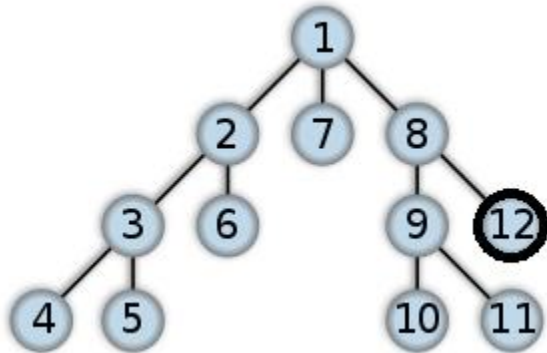


Fig.3. Search tree with found goal (in bold).

6. There is a contest with three players, Adam (A), Betty (B) and Chris (C), in which the result is a single complete ordering/ranking of the players (a permutation of A, B,C). We assume that there are no ties/draws, ranking is complete and transitivity holds, which constraints are formalized in a knowledge base KB. Let the propositions P_{AB} , P_{AC} , P_{BC} denote the following relations of the result $A < B$, $A < C$, $B < C$ ($X < Y$ denotes that X precedes/has a better position than Y in the result of the contest). We do not know the complete order of the three players, but we have the following statements also in the knowledge base KB:

- A claims (SA): C is not the first.
- B claims (SB): I'm not the last.
- C claims (SC): A is not the second.

- a) Define the statements SA, SB, SC using the propositions P_{AB} , P_{AC} , P_{BC} .
- b) Convert them to conjunctive normal form (CNF).
- c) Indicate the models of the knowledge base (assuming that the knowledge base includes assumptions about completeness and transitivity of the ordering).
- d) Prove with truth-table that the knowledge base KB entails P_{BC} , ($KB \models P_{BC}$), that is that B has a better position than C („ $B < C$ ”).
- e) Using a first-order logic semantics, the world corresponding to this KB, are permutations of A,B and C. Illustrate the entailment relation $KB \models P_{BC}$ using this representation (that is indicate the models of the knowledge base KB and the models of the proposition P_{BC}).

(20p)

++: Assuming that nodes are evaluated from left to right, what alpha-beta cuts are possible in Fig.2.?