

Midterm Exam

ARTIFICIAL INTELLIGENCE

Class: CS Honor 2010

Questions: 3 – Total mark: 10 – Time: 60 minutes

Open book

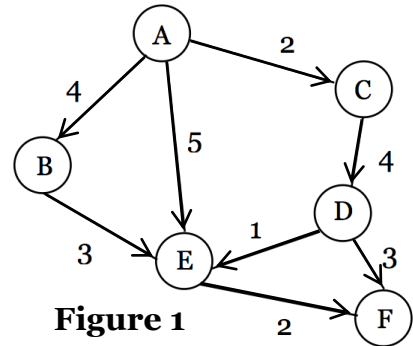
Question 1 (3 marks):

Consider the weighted graph in Figure 1, where A is the start node and F is the goal node, and the two following cost functions:

- $g(n)$ = minimal sum of the weights of the edges of a path from the start node to node n .
- $h(n)$ = minimal number of the edges of a path from node n to the goal node.

In which order are the nodes visited using each of the following heuristic searching algorithms?

- Uniform Cost Search.
- Greedy Search.
- A^* Search.



(1 mark)

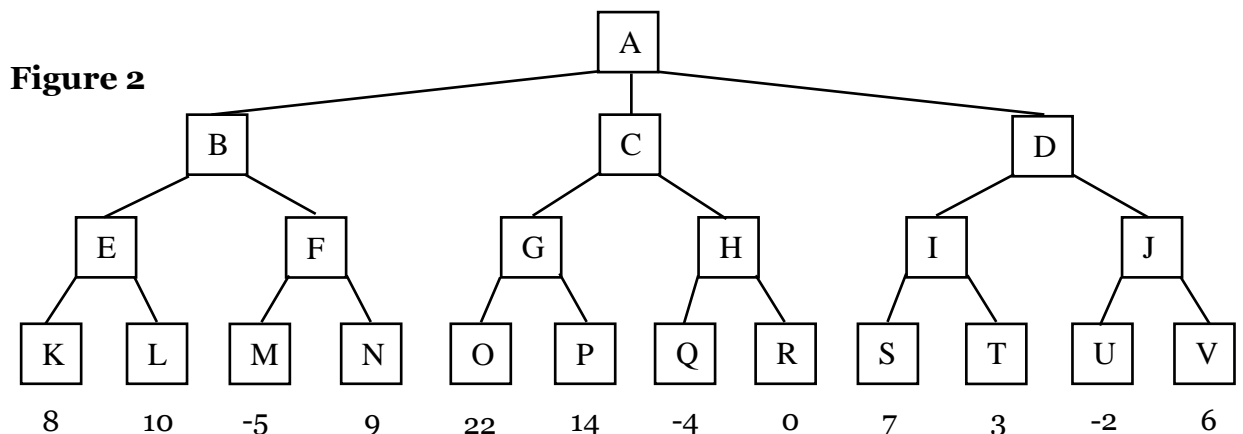
(1 mark)

(1 mark)

Question 2 (3 marks):

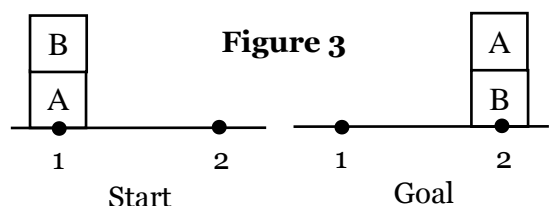
Consider the 2-player game search tree of states with static heuristic values of the leaf nodes as shown in Figure 2. Suppose that, the smaller a heuristic value is, the better it is for the player who is going to make a move from the root node.

- According to the Minimax algorithm, which next state that player will choose? (1.5 marks)
- Using alpha-beta cut-off, which branches will be pruned in the search, assuming that the nodes are examined from left to right? (1.5 marks)



Question 3 (4 marks):

Consider a Blocks World that takes into account the block and robot arm positions. Assume that there are 2 positions on the table where a block can be placed, and the Start and Goal conditions are as in Figure 3. Initially, the robot arm is at position 1.



----- Continued next page -----

The robot can do one of the following actions in each step:

- Un-stacking a block *A* from another block *B*; the robot arm must be currently at the same position as that of the two blocks.
- Stacking a block *A* on another block *B*; the robot arm must be currently holding *A* and at the same position as *B*'s one.
- Picking up a block from a position on the table; the robot arm must be currently at that position.
- Putting down a block to a position on the table; the robot arm must be currently at that position.
- Moving the empty robot arm from its current position to another position.
- Moving the robot arm holding a block from its current position to another position.

- (a) Specify the Start and Goal conditions using predicate logic. (1 mark)
- (b) Give specifications of the six actions described above with the precondition, add-list, and delete-list for each of them. (1.5 marks)
- (c) Apply Goal Stack Planning, trace the steps followed to make a plan for the given Block World, showing the stack contents in each step. For not drawing too many stack images, you can group consecutive steps of obvious sub-goal satisfaction into one step. (1.5 marks)

----- End -----