

**ECE 479/579**

Principles of Artificial Intelligence

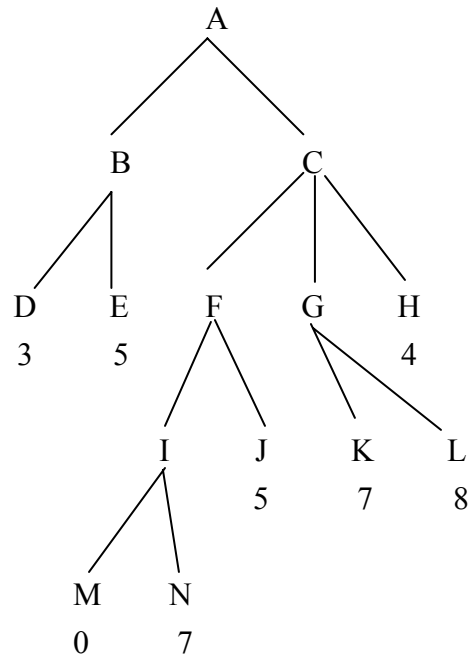
**Dr. M. Marefat**

**Assignment # 4**

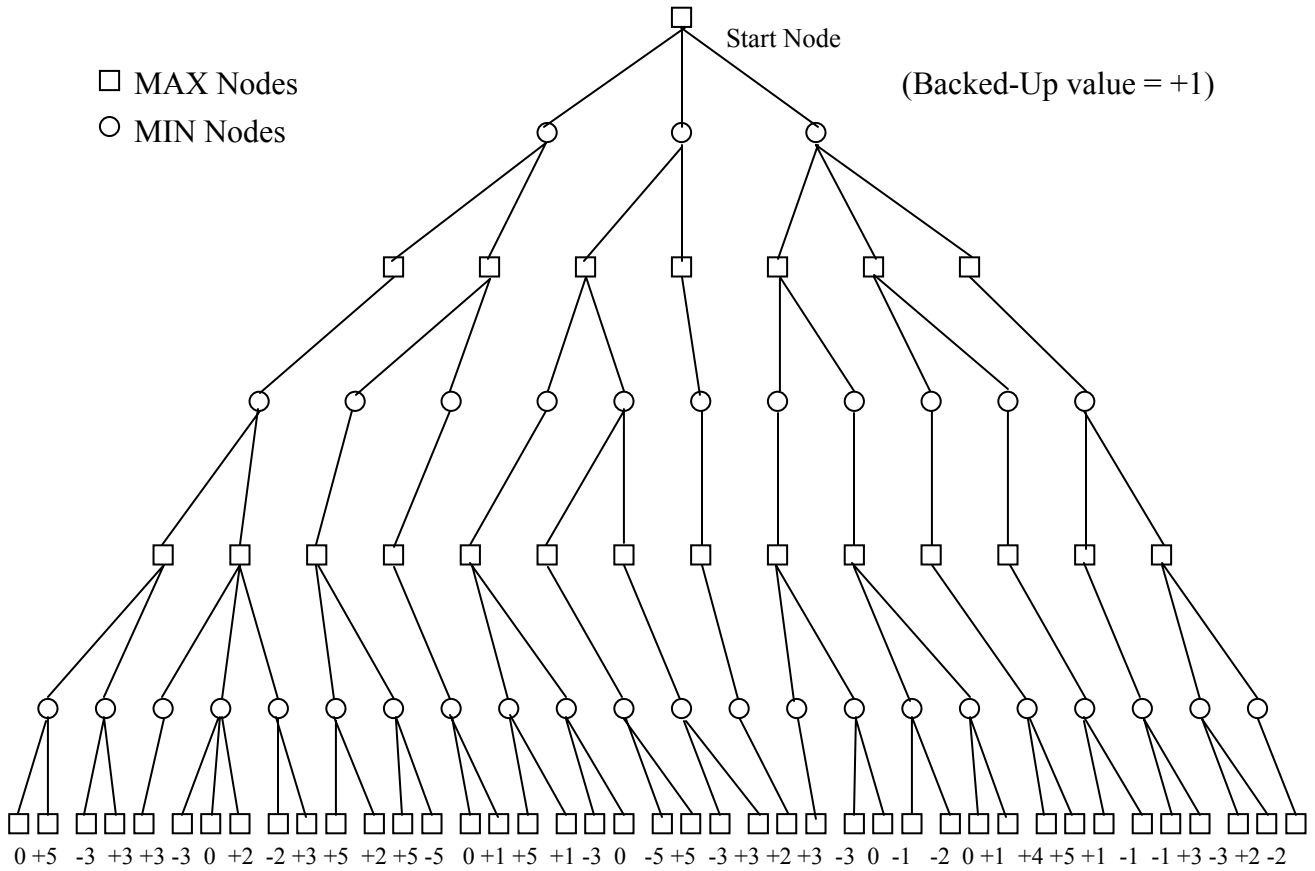
**Search**

1. The game nim is played as follows: two players alternate in removing one, two, or three pennies from a stack initially containing five pennies. The player who picks up the last penny loses. Show by drawing the state space and a strategy depicted in this state-space that the player who has the second move can always win. Characterize the winning strategy.

2. Perform minimax search on the tree shown below.



3. Conduct an alpha-beta search for the tree shown in the attached figure by generating (visiting) the right-most node first. Indicate where cutoffs occur. Compare this with the given figure in which the cutoffs are the lighter arcs.



#### 4. Performance Evaluation

Show a performance analysis for finding the **shortest path** between two nodes. Assume the nodes are on a lattice as shown with the *start node*  $s = (0, 0)$  and the *goal node*  $\gamma = (m, n)$ .

At any node in the lattice the available moves are one unit to the right, to the left, one step up, or one step down. All moves are of equal cost.

How does the heuristic graph search perform using the following:

1.  $f = g$ ;

2.  $f = g + h$ ;

where  $h(x, y) = \max\{|m-x|, |n-y|\}$ .

