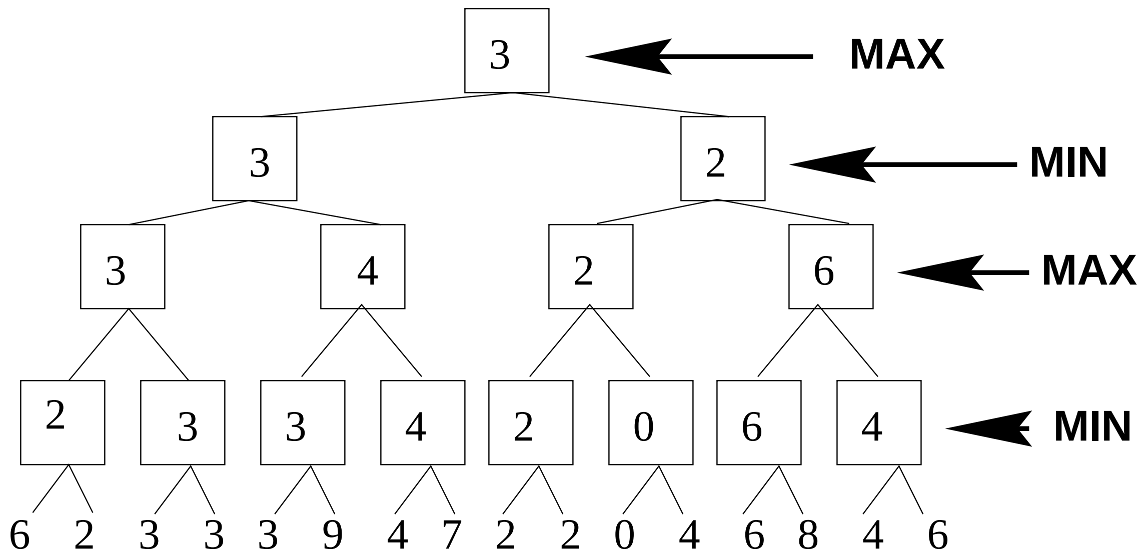
ICS 171 — Quiz #3 — FIFTEEN (15) minutes

1. (5 pts) NAME AND EMAIL ADDRESS:____

YOUR ID:__________ ID TO RIGHT:__________ ROW:______ NO. FROM RIGHT:______

2. (35 pts max, -10 for each error, but not negative) The following problem asks about MINIMAX search in game trees. The game tree below illustrates one position reached in the game. It is MAX's turn to move. Below the leaf nodes are the estimated score of each resulting position returned by the heuristic static evaluator.

WRITE IN EACH OPEN BOX THE VALUE OF THAT NODE FROM MINIMAX SEARCH.



3. (3 pts each, 30 pts total) Label the following as T (= True) or F (= False).

3.a. ___**T**___ An admissable heuristic NEVER OVER-ESTIMATES the remaining cost (or distance) to the goal.

3.b. ___**T**___ Best-first search (sort queue by $g(n) + h'(n)$) is both complete and optimal when the heuristic is admissable and the total cost estimate is monotonic increasing.

3.c. ___**F**___ Most search effort is expended while examining the interior branch nodes of a search tree.

3.d. ___**T**___ Uniform-cost search (sort queue by $g(n)$) is both complete and optimal when the path cost never decreases.

3.e. ___**F**___ Greedy search (sort queue by $h'(n)$) is both complete and optimal when the heuristic is admissable and the path cost never decreases.

3.f. ___**F**___ Beam search uses $\mathcal{O}(b^d)$ space and $\mathcal{O}(b^d)$ time.

3.g. ___**T**___ Simulated annealing uses $\mathcal{O}(constant)$ space and can escape from local optima.

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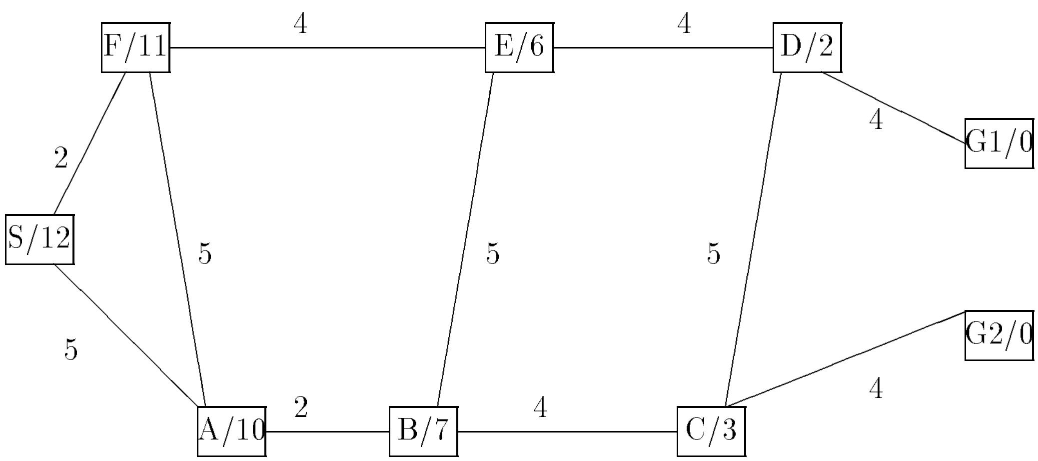
3.h. **F** If the search space contains only a single local maximum (i.e., the global maximum = the only local maximum), then hill-climbing is guaranteed to climb that single hill and will always find the global maximum.

3.i. **T** If the search space is small enough for Mini-Max search to go all the way down to the leaves (e.g., in tic-tac-toe), then it will play a perfect game.

3.j. **F** Mini-Max search assumes that the opponent plays optimally, so the opponent can defeat it by playing otherwise.

Problem 4 asks about this graph. Assume that ALL children of a node are returned in alphabetical order whenever the node is expanded. IN THIS PROBLEM, NODES *ARE* ALLOWED TO BE EXPANDED TWICE OR MORE IF NECESSARY. "S" is the start node, and either "G1" or "G2" are goal nodes. The number inside each node is an estimate of the remaining distance to any goal from that node. The number next to each arc is the operator cost for that arc. The goal node is recognized when the goal node would have been expanded.



4. (30 pts max -10 for each error, but not negative) Provide a trace of the search using HILL-CLIMBING. The heuristic value for each node is the sum of path cost so far plus estimated remaining distance to a goal. At each step, indicate which node is expanded and what its children are. The goal node is recognized when it is expanded (it has no children).

Write nodes as N X/Y where N is the node name (A, B, C, etc.), X is the path cost so far, and Y is the sum of path cost so far plus estimated remaining distance to a goal.

a. Expand **S 0/12** Children = A 5/15, F 2/13

b. Expand **F 2/13** Children = A 7/17, E 6/12, S 4/16

c. Expand **E 6/12** Children = B 11/18, D 10/12, F 10/21

d. Expand **D 10/12** Children = C 15/18, E 14/20, G1 14/14

e. Expand **G1 14/14** and recognize goal node