

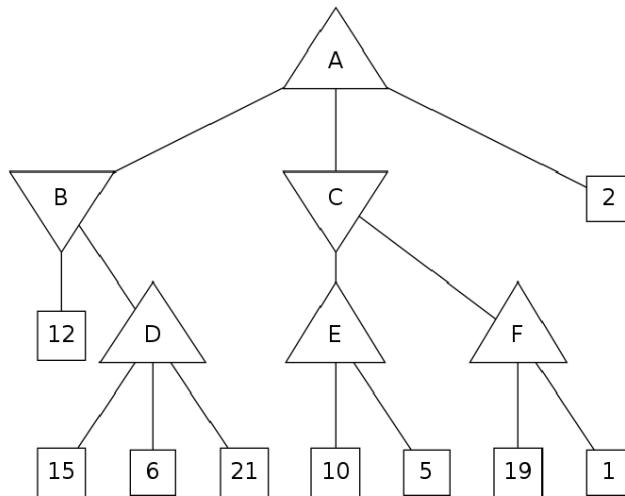
CS 4470: Artificial Intelligence

HW1

Points: Please see the points for each problem.

Instruction: Please submit on canvas

1. Consider the minimax tree shown below for questions a and b.



- a. What value will root node A have? (3pts)
- b. Cross off the nodes that are pruned by $\alpha\beta$ pruning. Assume the standard left-to-right traversal of the tree. If a non-terminal state (A, B, C, D, E, or F) is pruned, cross off the entire subtree. (2pts)

Ans:

a. $A = 12$

$D \max \{15, 6, 21\} = 21, B \min \{12, D\} = 12$

$E \max \{5, 10\} = 10, F \max \{1, 19\} = 19, C \min \{E, F\} = 10$

$A \max \{B, C, 2\} = 12$

b. Cross off 6, 21 and F entire subtree

2.

Pacman is using MDPs to maximize his expected utility. In each environment:

- Pacman has the standard actions {North, East, South, West} unless blocked by an outer wall
- There is a reward of 1 point when eating the dot (for example, in the grid below, $R(C, South, F) = 1$)
- The game ends when the dot is eaten

- (a) Consider a the following grid where there is a single food pellet in the bottom right corner (F). The **discount** factor is 0.5. There is no living reward. The states are simply the grid locations.

A	B	C
D	E	F ○

- (i) [2 pts] What is the optimal policy for each state?

State	$\pi(state)$
A	East or South
B	East or South
C	South
D	East
E	East

- (ii) [2 pts] What is the optimal value for the state of being in the upper left corner (A)? Reminder: the discount factor is 0.5.

$$V^*(A) = \textcolor{red}{0.375}$$

k	V(A)	V(B)	V(C)	V(D)	V(E)	V(F)
0	0	0	0	0	0	0
1	0	0	1	0	1	1
2	0	0.5	1.5	0.5	1.5	1
3	0.25	0.75	1.5	0.75	1.5	1
4	0.375	0.75	1.5	0.75	1.5	1

Iteration 5 is the same as 4.

- (iii) [2 pts] Using value iteration with the value of all states equal to zero at $k=0$, for which iteration k will $V_k(A) = V^*(A)$?

$$k = \textcolor{red}{4} \text{ (see above)}$$