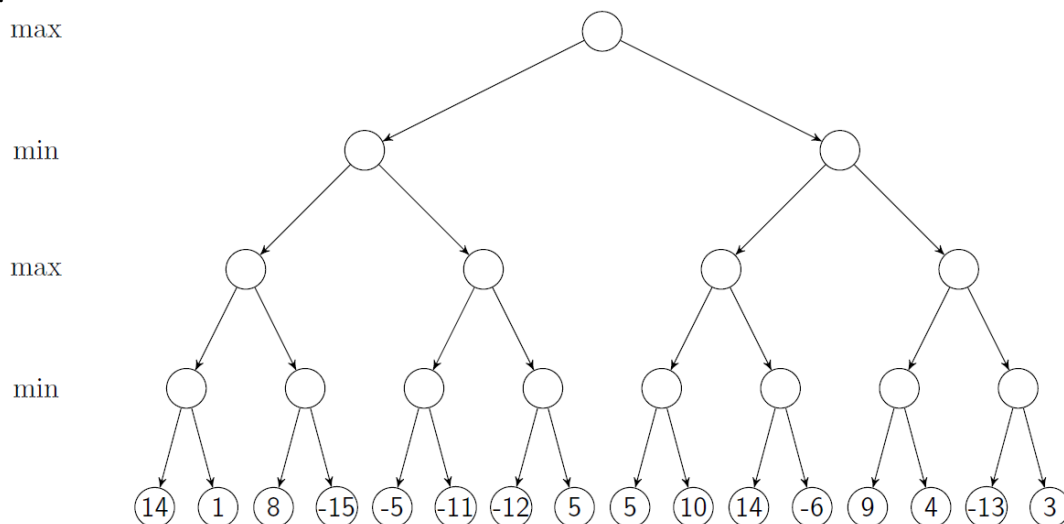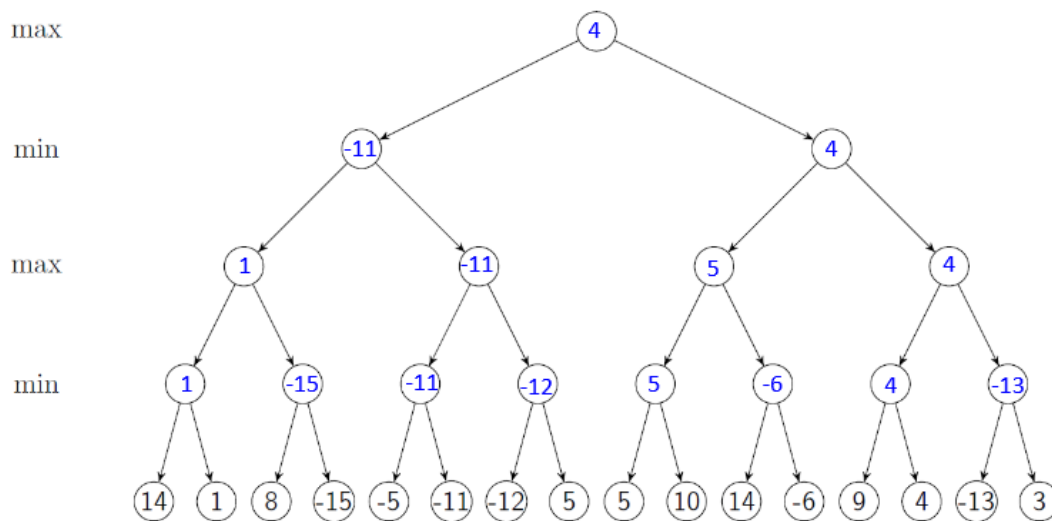# CS 540-1 Homework assignment #6

Due Dec 12, Jianyi Liu
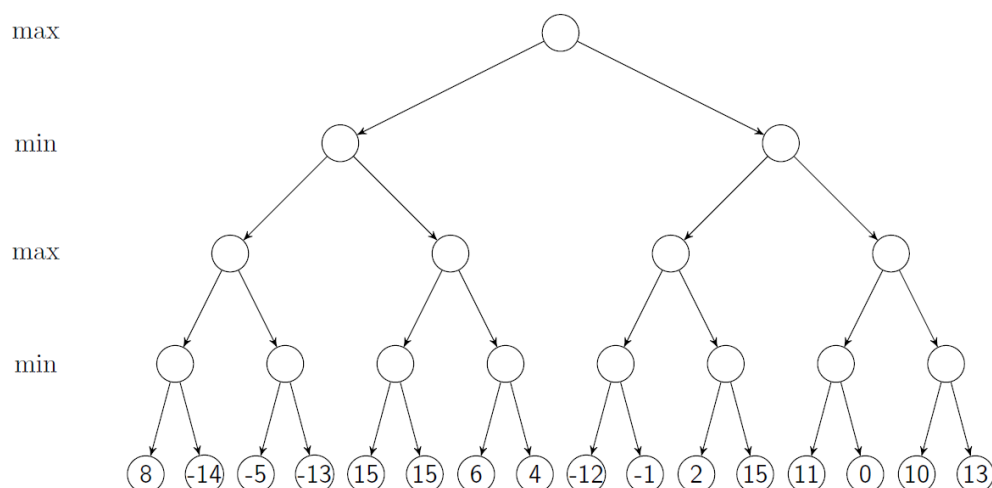Jianyi.liu@wisc.edu

Question 1: Game Playing [25]

a) [10] Use the Minimax algorithm to compute the minimax value at each node for the game tree below.
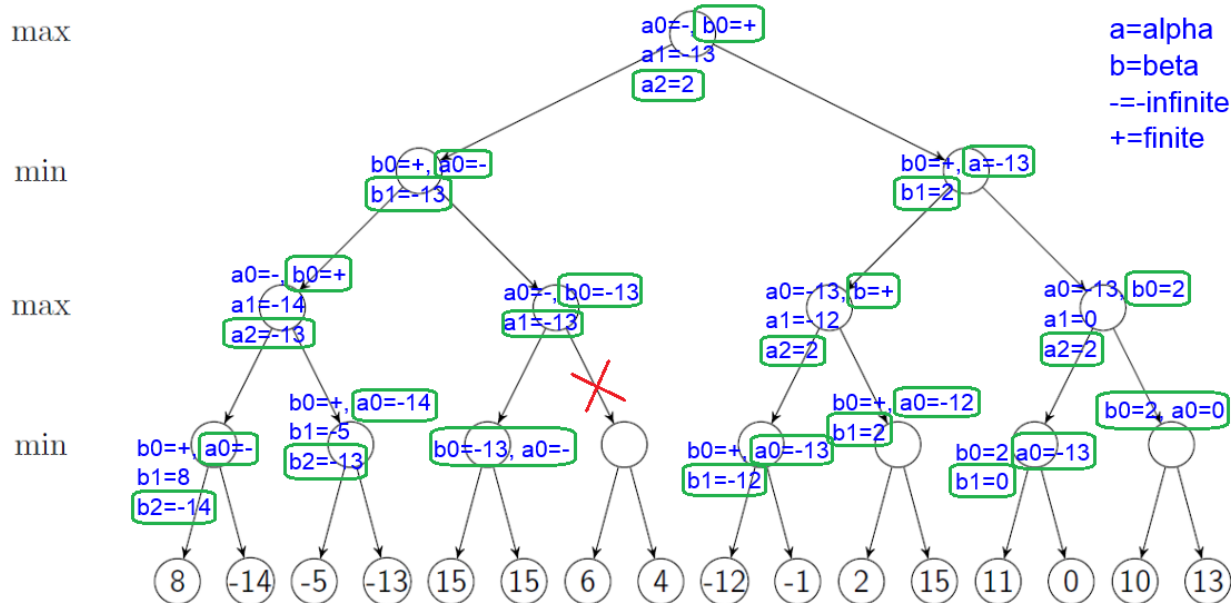

Sol:

b) [15] Use Alpha-Beta Pruning to compute the minimax value at each node for the game tree below, assuming children are visited left to right. You are asked to:

max

min

max

min

8 -14 -5 -13 15 15 6 4 -12 -1 2 15 11 0 10 13

(a) [10] Show the alpha and beta values at each node.
(b) [5] Show which branches will be pruned.
Sol:

max

min

max

min

a=alpha
b=beta
-=-infinite
+=finite

a0=- b0=+
a1=-13
a2=2

b0=+, a0=-
b1=-13

b0=+, a=-13
b1=2

a0=-, b0=+
a1=-14
a2=-13

a0=-, b0=-13
a1=-13

a0=-13, b=+
a1=-12
a2=2

a0=-13, b0=2
a1=0
a2=2

b0=+, a0=-14
b1=-5
b2=-13

b0=+, a0=-12
b1=2

b0=2, a0=0

b0=+ a0=-
b1=8
b2=-14

b0=-13, a0=-

b0=+, a0=-13
b1=-12

b0=2 a0=-13
b1=0

8 -14 -5 -13 15 15 6 4 -12 -1 2 15 11 0 10 13

Question 2: Game Theory [25]
a) [10] Consider the following zero-sum game. You are asked to:
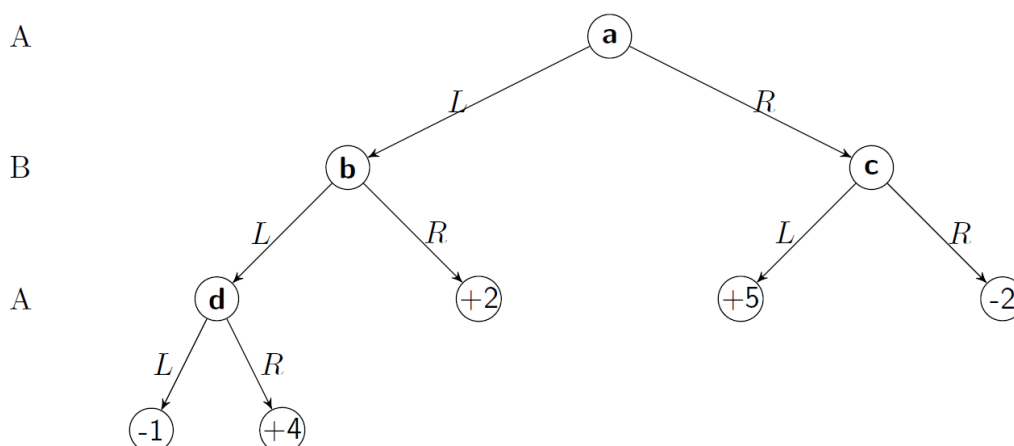
(a) [5] Write down the pure strategies for player A and B (by denoting the choice for internal states a to d).

Sol: Player A has 4 pure strategies:

A's strategy I: (a→L, d→L)

A's strategy II: (a→L, d→R)

A's strategy III: (a→R, d→L)

A's strategy IV: (a→R, d→R)

   Player B has 4 pure strategies:

B's strategy I: (b→L, c→L)

B's strategy II: (b→L, c→R)

B's strategy III: (b→R, c→L)

B's strategy IV: (b→R, c→R)

(b) [5] Write down the matrix normal form of this game.

	B-I	B-II	B-III	B-IV
A-I	-1	-1	2	2
A-II	4	4	2	2
A-III	5	-2	5	-2
A-IV	5	-2	5	-2

b) [15] The table below shows a matrix normal form of a non-zero game. The two numbers in each entry represent the gains for player A and B respectively. You are asked to:

	B			
	I	II	III	IV
I	3,5	1,3	3,2	8,3
A II	6,5	1,4	4,8	1,3
III	7,9	9,5	2,6	3,2
IV	3,9	6,2	3,6	5,4

(a) [10] Apply iterative elimination of strictly dominated strategies to this matrix normal form.
Sol:
If we start from Player A, the strictly dominates doesn't apply. So, start from Player B.
For Player B, B-I strictly dominates B-II and B-IV.

		B			
		I	II	III	IV
	I	3,5	1,3	3,2	8,3
A	II	6,5	1,4	4,8	1,3
	III	7,9	9,5	2,6	3,2
	IV	3,9	6,2	3,6	5,4

For Player A, A-II strictly dominates A-I and A-IV.

		B	
		I	III
	~~I~~	~~3,5~~	~~3,2~~
A	II	6,5	4,8
	III	7,9	2,6
	~~IV~~	~~3,9~~	~~3,6~~

		B	
		I	III
A	II	6,5	4,8
	III	7,9	2,6

(b) [5] Show what strategies will player A and B choose in the end and explain the reason.
Sol: By Nash Equilibrium, we have two choice, A-III & B-I, and A-II & B-III. And A-III & B-I is strictly better than A-II & B-III, so we choice A-III & B-I.