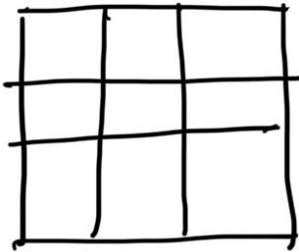# AIS - T1

Static Evaluation function

(Evaluate the "goodness" of a configuration of the game)

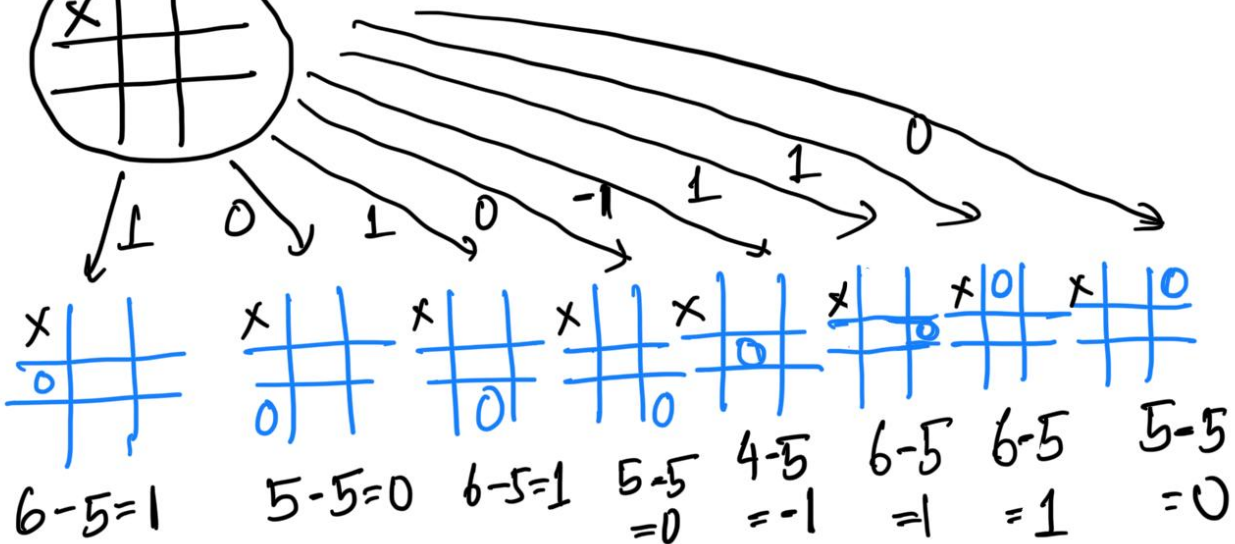MAX

Initial Board

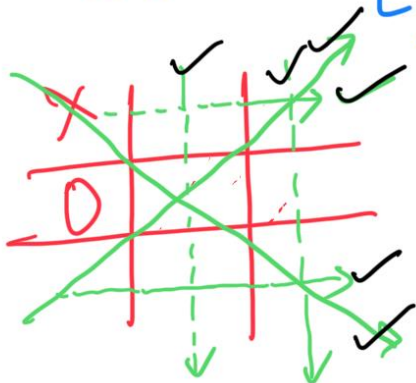Player 1 : X

Player 2 : O

Player X

MIN

X

$6-5=1$ $5-5=0$ $6-5=1$ $5-5 \atop =0$ $4-5 \atop =-1$ $6-5 \atop =1$ $6-5 \atop =1$ $5-5 \atop =0$

SEF = [number of 3-lengths open for me
− number of 3-lengths open for you]

for X ⟶ number of 3-lengths
OPEN ⟶ 6

A IS T2

Max

MIN

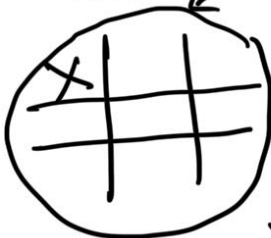$\beta = -1$

Now $\alpha \geq -1$ Only look values higher than '-1'
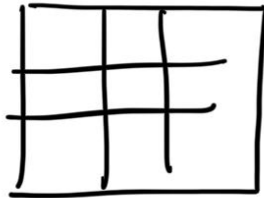
Once β value is passed to root from left branch. α value will be changed.

$\alpha = -1$
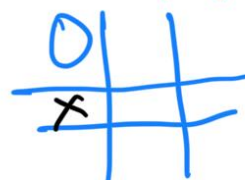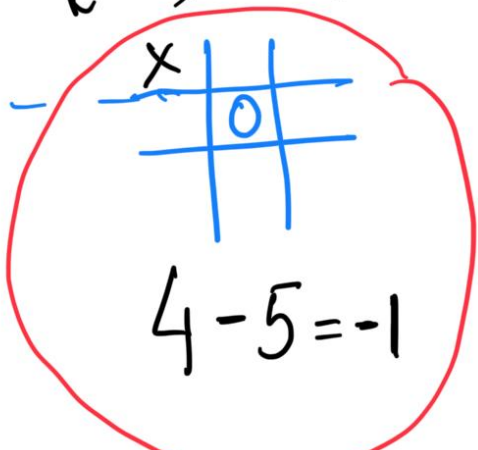
$\beta = \cancel{+\infty}$ -1

then $\beta \leq 1$
but $\alpha \geq \beta$

Pruning

$4 - 5 = -1$
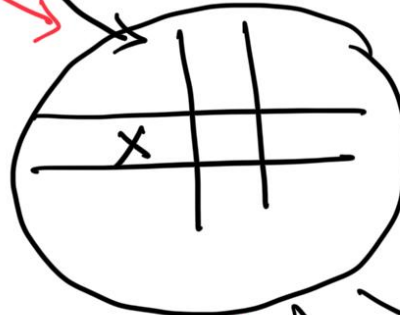
It will be Selected.

$5 - 6 = -1$

β node is no Longer Promising to α nodes

$\Downarrow$

This is Called α - cut·off

Max

$\alpha \geq -1$

$\boxed{\alpha \geq 1}$

$\beta = 1$

Min

X

O X

$5 - 4 = 1$

X O

$6 - 4 = 2$

O X

$5 - 4 = 1$

O X

$6 - 4 = 2$

O X

$6 - 4 = 2$

O X O

$5 - 4 = 1$

X O

$6 - 4 = 2$

X O
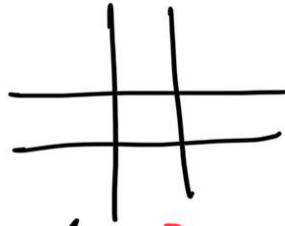
$5 - 4 = 1$
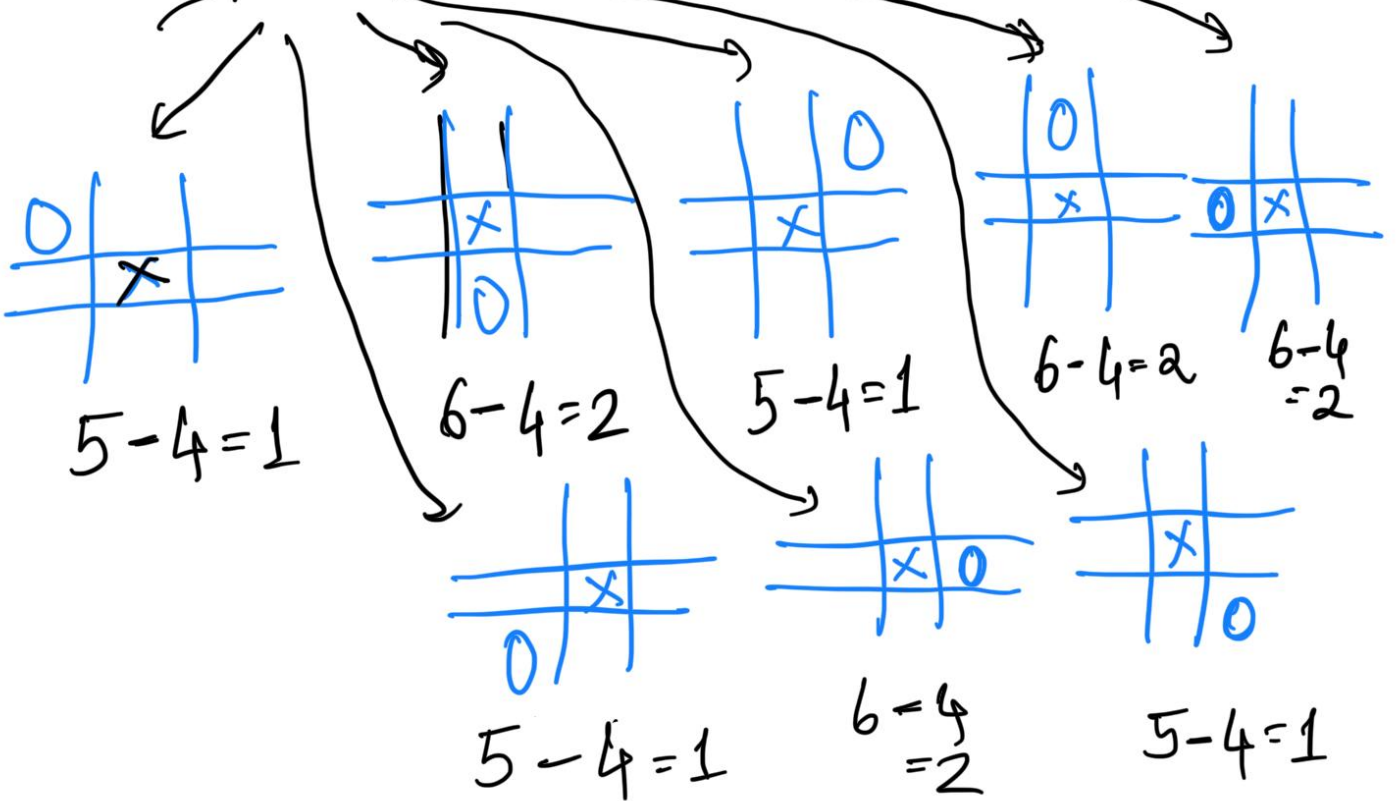
In the similar way, we can draw the complete game tree.

AIS - T4

⟨α-β pruning⟩

Practice Problem

MAX ① A $[\alpha = -\infty, \beta = +\infty]$ **3**

$\alpha \geq 3$

MIN ② B $-\infty, +\infty$ **3**

β value

③ ≤ 3

④ $3 < 12$, NO change

≤ 3

⑤ $3 < 8$, NO change $= 3$

3   12   8

③   ④   ⑤

⑥ **2** 3, +α

C

⑦ $\beta \leq 2$

α ≥ β pruning

2   4   6

⑦

D 14 = 8 3, +α

⑧ ⑨ $\beta \leq 14$

⑩ $\beta \leq 5$

⑪ $\beta \leq 2$

14   5   2

⑨   ⑩   ⑪
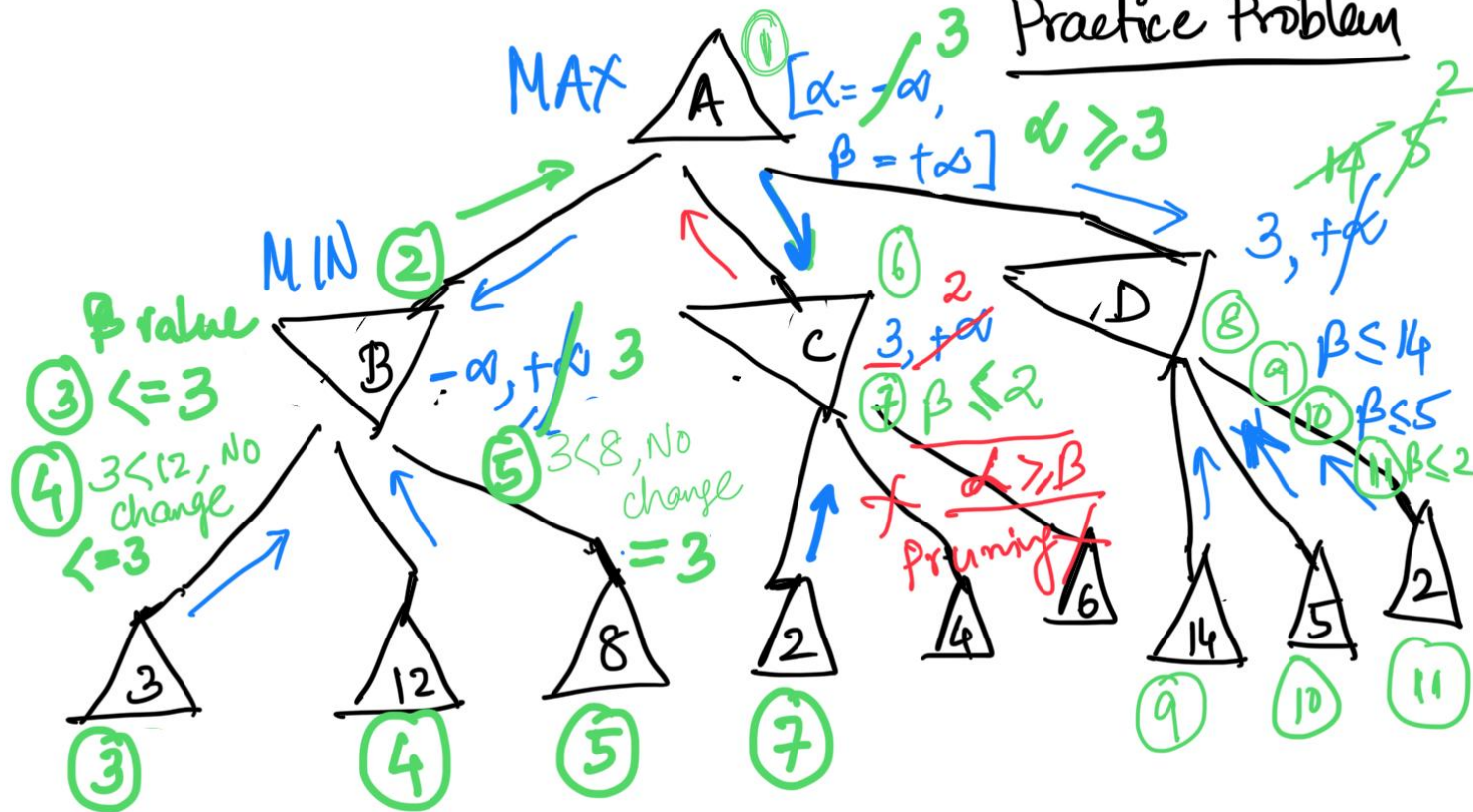
Final value at root = 3
Path: A → B → 3

MAX Node — Only "α" value changes

MIN Node — Only "β" value changes

AIS-T5

Practice Problem
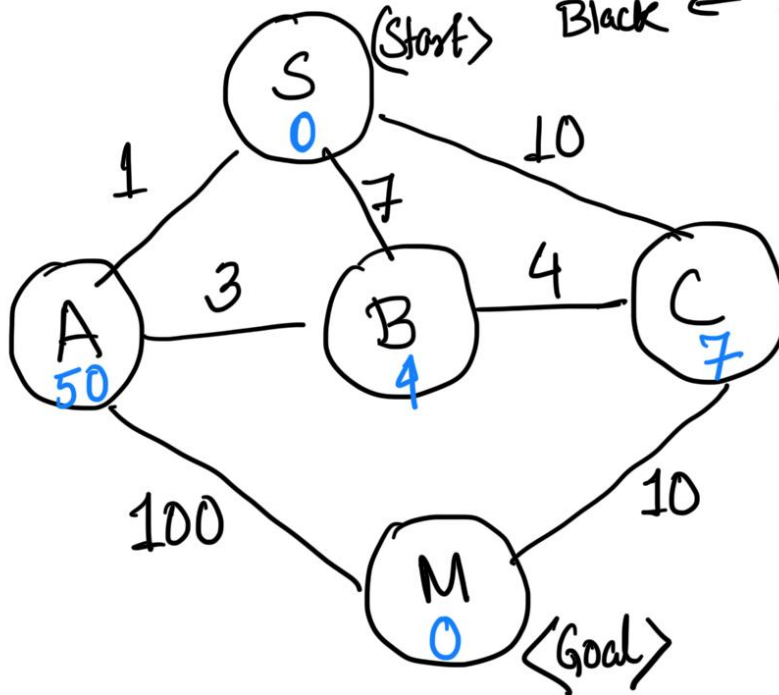
(Draw search
tree for A*
Algorithm)

CLOSED

S

OPEN

A_S^{51} B_S^{11} C_S^{17}

$g = 1$ $= 7$ $= 10$
$h = 50$ $= 4$ $= 7$
$f = 51$ $= 11$ $= 17$

A_S^{51} A_{SB}^{60} C_{SB}^{18} C_S^{17}

         $= 10$ $= 11$
         $= 50$ $= 7$
         $= 60$ $= 18$

C_{17} A_S^{51} A_{SB}^{60} C_{SB}^{18} M_{SC}^{20}

                        $= 20$
                        $= 0$
                        $= 20$

C^{18} A_S^{51} A_{SB}^{10} M_{SC}^{20}

goal → Terminate

CLOSED   OPEN

M

AIS - T6

A* algorithm returned Path

$S \rightarrow C \rightarrow M$

Total Cost : 10+10 = 20

Is this optimal Path?

No, we have better
cost $S \xrightarrow{1} A \xrightarrow{3} B \xrightarrow{4} C \xrightarrow{10} M$

Total cost 1+3+4+10 = 18

Find out whether heuristic Score of 'A' is consistent or Not?

No, we know $h(n) \leq h(n') + cost(n, n')$ for all child n' of n is maintained for node n

n's heuristic will be consistent if ↗ is maintained for node n

Here, $h(A) \leq cost(A, B) + h(B)$

$50 \leq 3+4$ ⟵ Not True

So, A's heuristic is not consistent.

AIS - T(7)

(Cond.)

How to make A's heuristic consistent?

Soln.

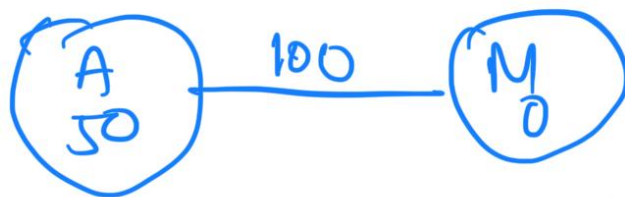$$A_{50} \xrightarrow{3} B_4$$

$$h(A) \le 3 + 4$$
$$\le 7$$

$$A_{50} \xrightarrow{1} S_0$$

$$h(A) \le 1 + 0$$
$$\le 1 \quad \checkmark$$

$$A_{50} \xrightarrow{100} M_0$$

$$50. \le 100 + 0$$
$$\le 100$$

if $\underline{h(A) = 1}$ then it will be
Consistent.