Alpha-Beta Prunning

Tuesday, April 7, 2020 5:44 PM

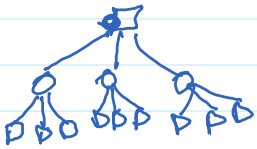
Minimax

alpha-beta prunning :- technique to speed up minimax by cutting branches of the game tree

MAX

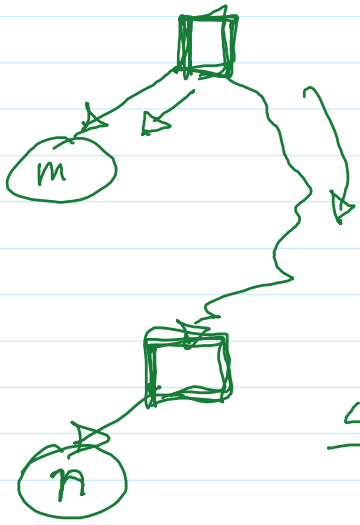
minimax(n) = max(min(3,4,8), min(2,?,?), min(7,3,?))

(3 , ≤2 , ≤3)



= 3

Intuition



≤ n ≤ m

parameter α : The value of the best choice (High value) along the path for MAX.

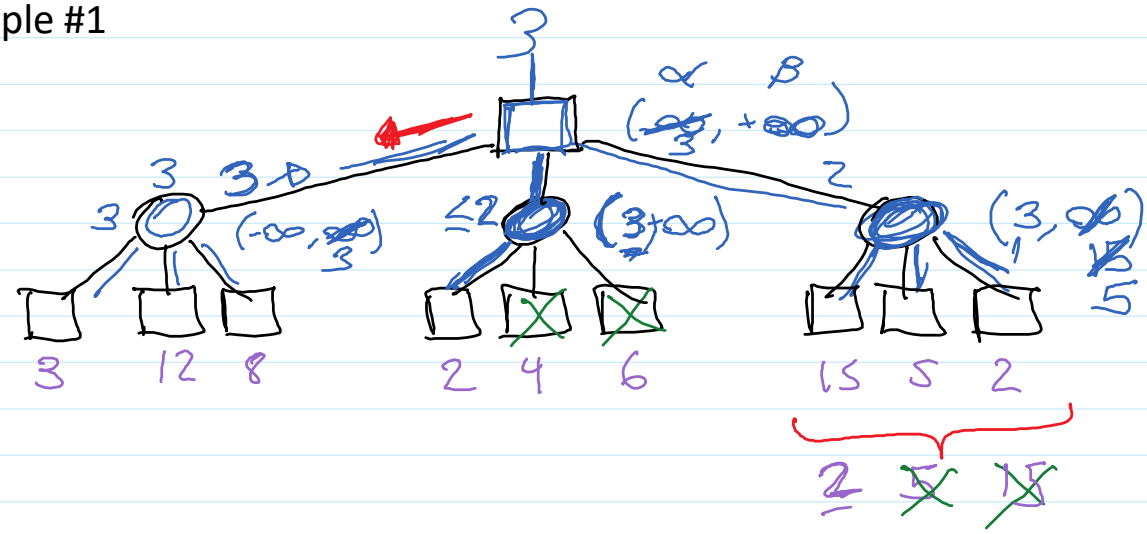
β :- The value of the best choice (low value) along the path for MIN.

- The Alpha Beta Prunning Algorithm

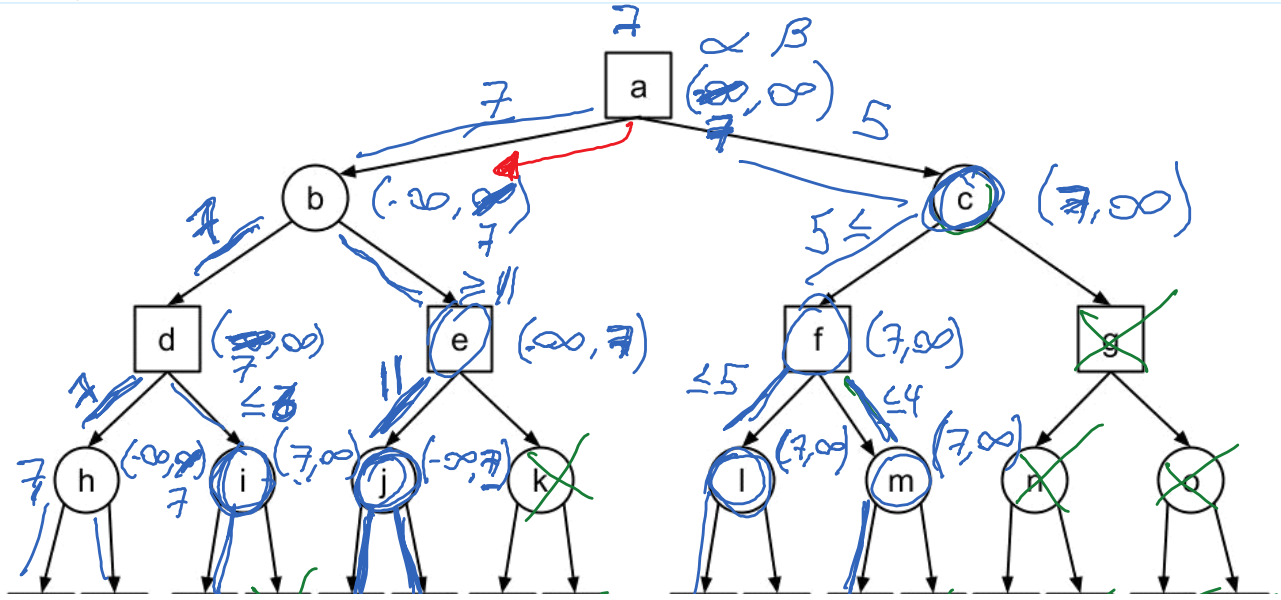
```
PROCEDURE AlphaBetaSearch( s0 : state )
  v := maxValue( s0, -∞, +∞ )
  besta := action for which minimax value of result( s0, a ) equals v
RETURN besta;
```

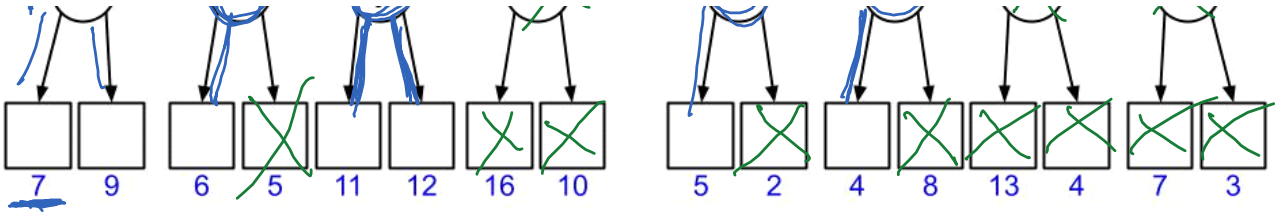
```
PROCEDURE maxValue( s : state, α , β )
  IF term( s ) THEN RETURN utility( s )
  v := -∞
  FOREACH a in actions( s ) DO
    v := MAX( v, minValue( result( s, a), α , β ) )
    if v >= β THEN RETURN v
    α := MAX(α,v)
  RETURN v

PROCEDURE minValue( s : state,  α , β )
  IF term( s ) THEN RETURN utility( s )
  v := ∞
  FOREACH a in actions( s ) DO
    v := MIN( v, maxValue( result( s, a), α , β ) )
    if v <= α THEN RETURN v
    β := MIN(β,v)
  RETURN v
```

- Example #1



- Example #2





- Move Ordering:

α-β - is sensitive to order of Moves.-

chess
- captures
- threats
- take position
- backwards.

Minimax $O(b^m)$

m { branching factor b

α-β $O(b^{m/2})$

$\sqrt{b}$ best theoretical branching factor of α-β.

Chess $b = 35$ $\sqrt{b} = 6$