Assignment 1

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Section: 4

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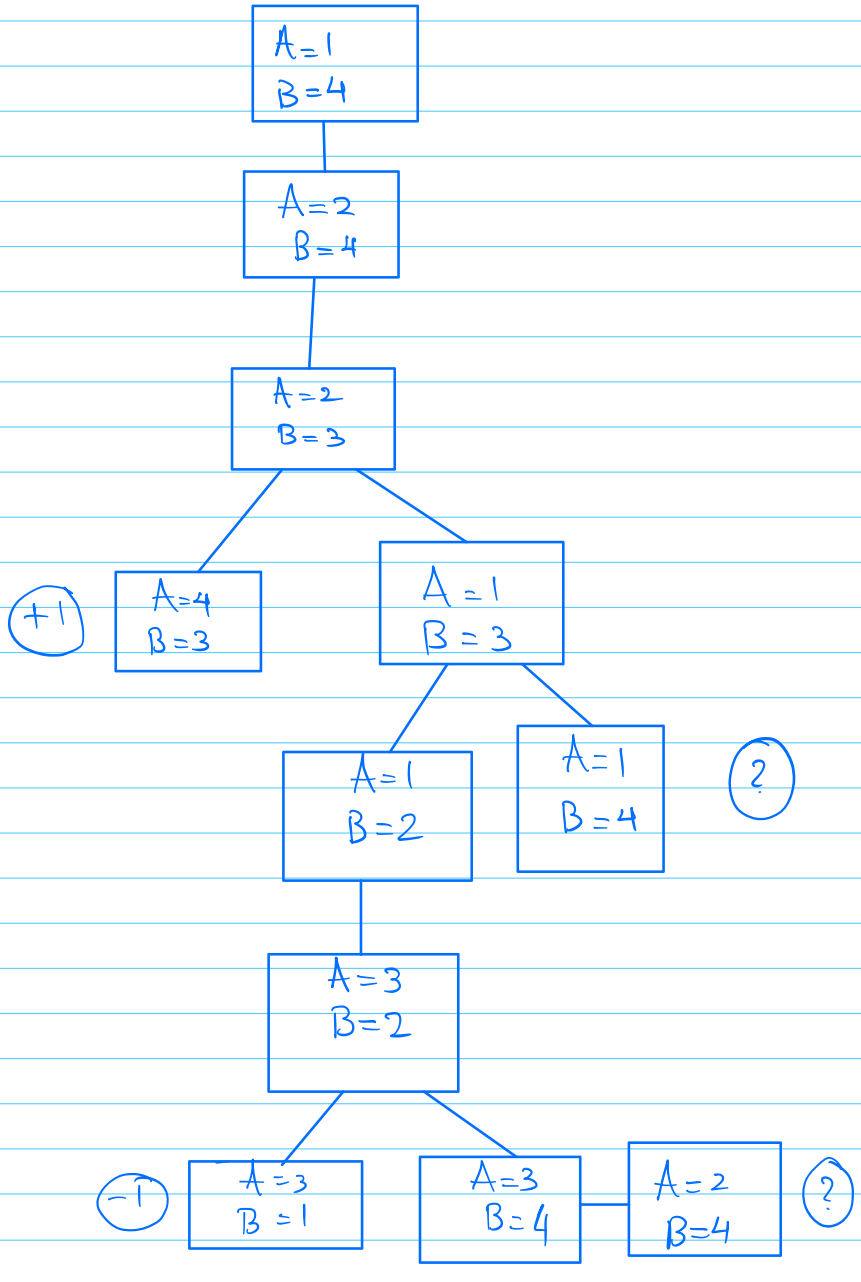
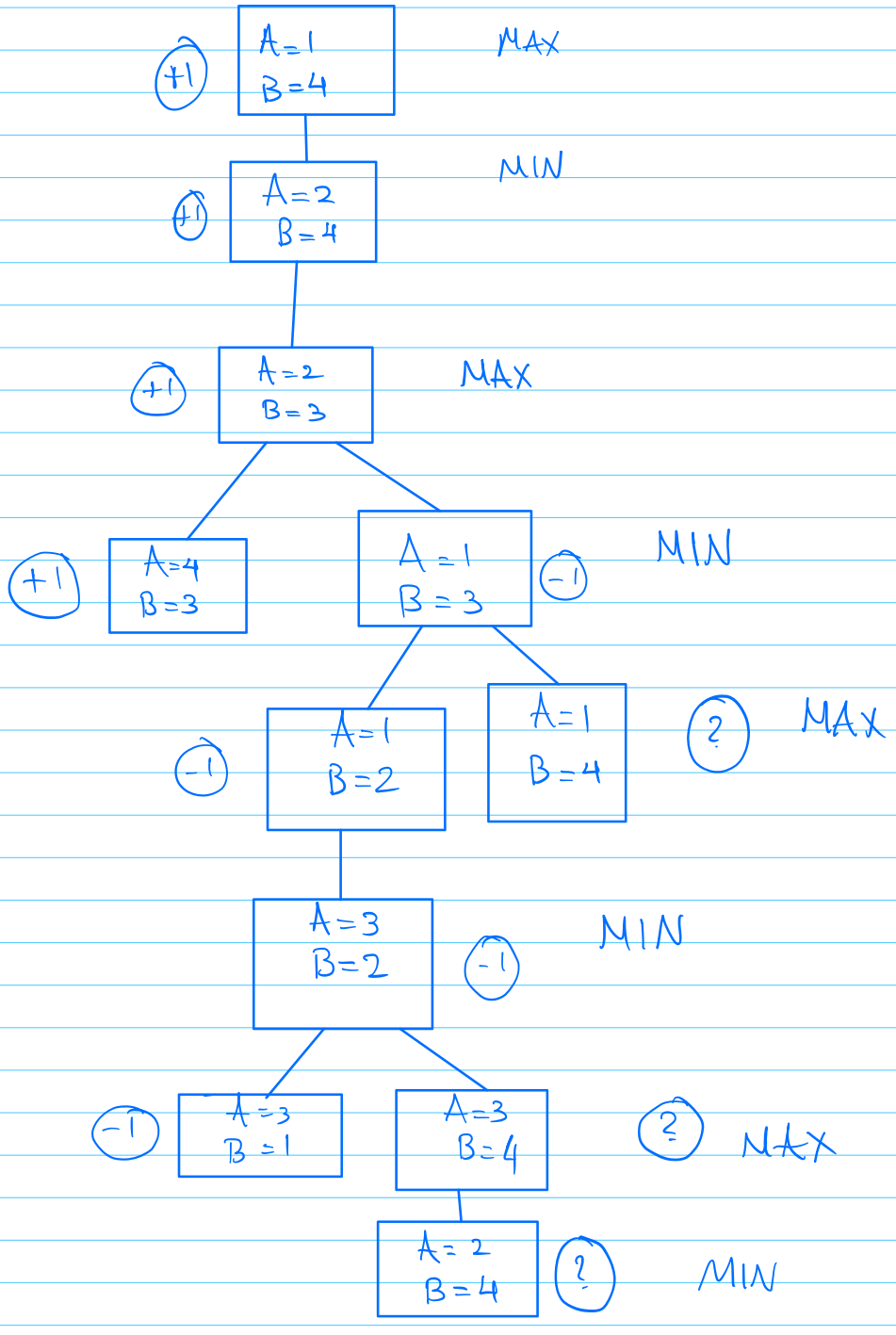
a)



b)

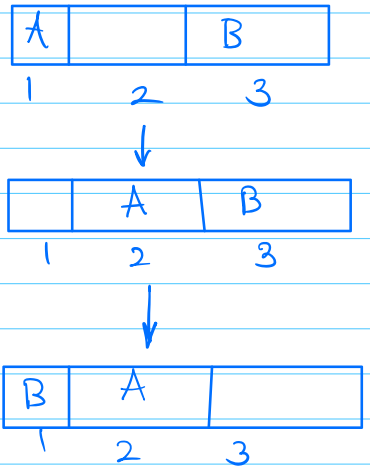


The "?" values are handled by assuming that an agent will always choose "+1" state or "-1" whenever he has two choices between "+1" and "?", and "-1" and "?", and this is to avoid infinite looping in states

c) Proof by induction :-

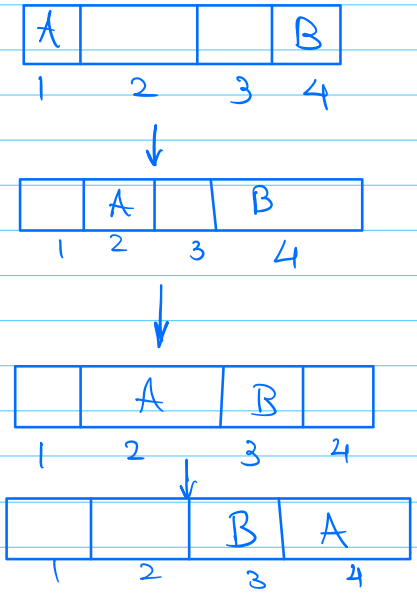
if n is even and $n > 2$, then A wins.
else if n is odd and $n > 2$, then B wins.

Base case : 1) $n = 3$ (odd)



It is clear that B wins, as it reaches position 1 before A reaches position n

2) $n = 4$ (even)



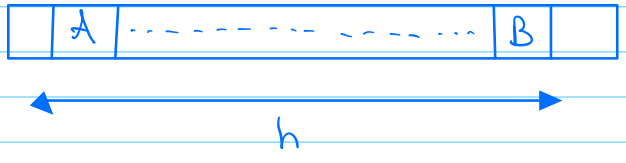
It is also clear that A wins, since it reaches position n before B reaches 1

2) Inductive Step:-

if is true for $n = k$, then it is true for $n = k+1$

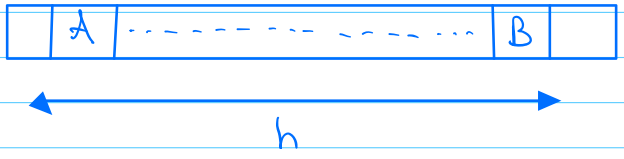
Consider two cases; a) K is even and $K > 4$
b) K is odd and $K > 3$

a) The initial steps for each n is always the same, that is, A moves one step to right and then B moves one step to the left, see the figure below.



where $h = K - 2$, please note that the problem size decreases by 2, and since K is even and $K > 4$, therefore, $h = K - 2$ is also even, and if player A keep moving his token to the right in his turn, and player B keep moving his token to the left in his turn, then it is guaranteed that we will reach a subproblem of size $h = 4$, which is considered winning for A

b) The initial steps for each n is always the same, that is, A moves one step to right and then B moves one step to the left, see the figure below.



where $h = K - 2$, please note that the problem size decreases by 2, and since K is odd and $K > 3$, therefore, $h = K - 2$ is also odd, and if player A keep moving his token to the right in his turn, and player B keep moving his token to the left in his turn, then it is guaranteed that we will reach a subproblem of size $h = 3$, which is considered winning for B