Theory of Computer Games

Homework # 7

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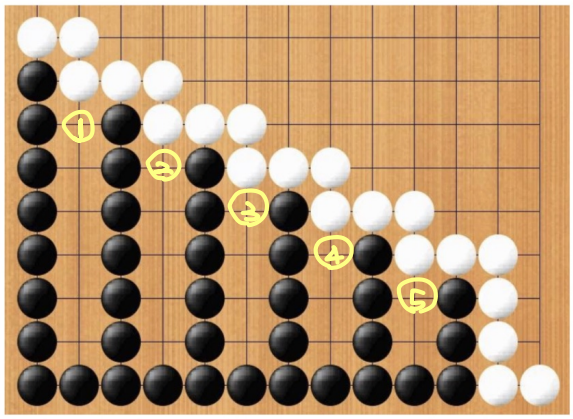
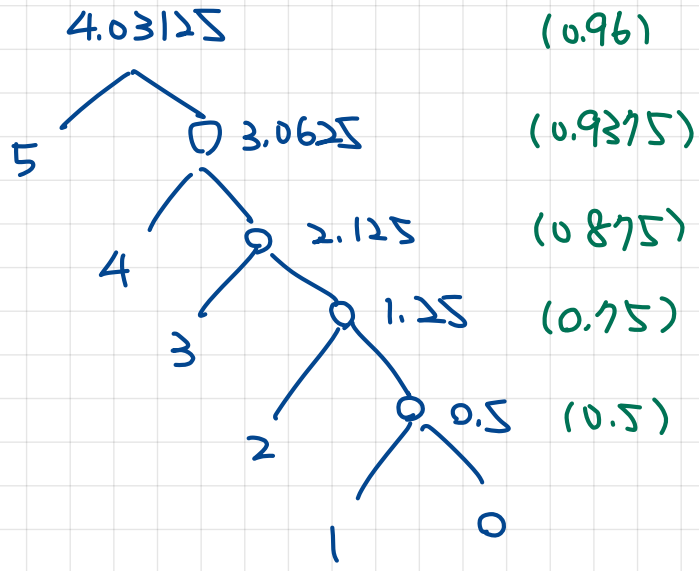
1. For the following Go endgame (also shown in Page 7 of slides), evaluate the expected value of each slot (in terms of Black's territory) in Japanese rule. If White plays first, what is the optimum White strategy to minimize Black's territory value? For this strategy, what is the optimum territory Black can get?

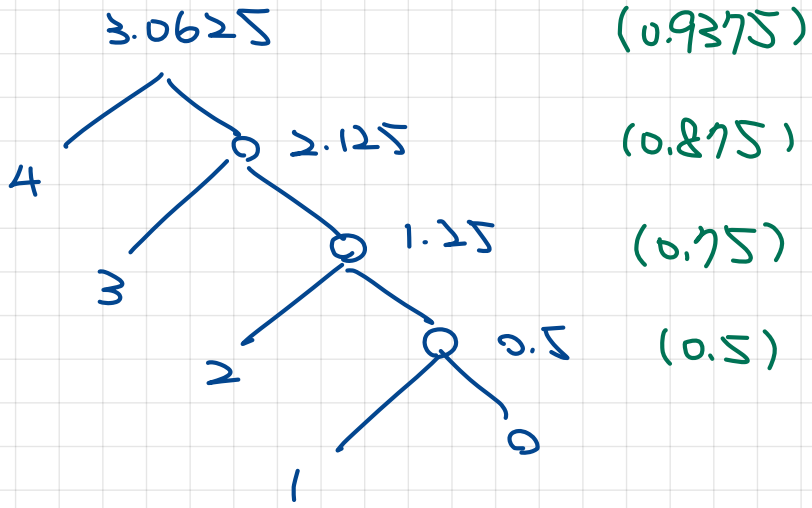


1-1

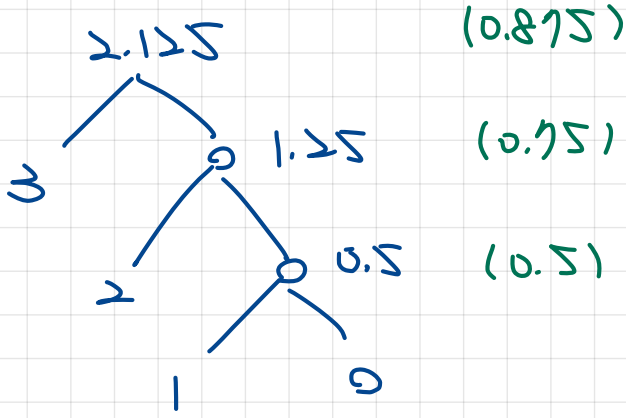
(1)



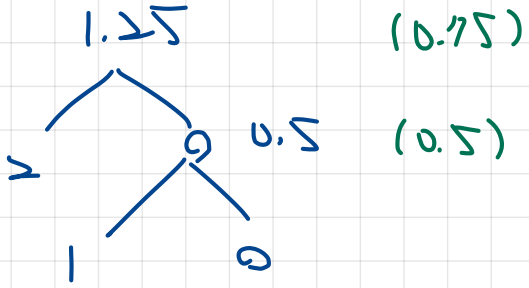
(2)



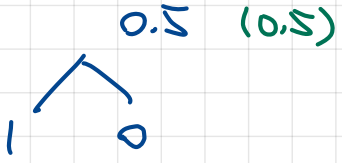
③



④



⑤



Hence ⇒ ① → ② → ③ → ④ → ⑤ #

1-2

$4+3+2+1=10$ #

2. For the following Triangular Nim (Normal play), please calculate its Grundy numbers.

O O

O O O

take 1 : $\overset{\circ\circ}{\circ\circ}^{*2}$, $\circ\overset{\circ\circ}{}^{*1}$, $\circ\overset{\circ}{\circ}\overset{\circ}{}^{*0}$, $\circ\overset{\circ\circ}{\circ}^{*1}$, $\circ\overset{\circ\circ}{}\circ^{*1}$

$\overset{\circ\circ}{\circ\circ} : \{\overset{\circ\circ}{}, *_1, *_0, *_2\} = *3$

$\overset{\circ}{\circ\circ} : \{*_1, *_2\} = *0$

$\circ : \{*_0\} = *1$

$\circ\overset{\circ}{} : \{*_0, *_1\} = *2$

$0^0 : \{*_0, *_2\} = *_1$

take 2 : $\{0_{00}, 0\ 00, 0^0\ 0, 0^{00}\} = [*_0, *_3, *_3, *_0]$

$\Rightarrow$ Grundy Number $= 4$ #

3. For a Nim game (Normal play) with three heaps 19, 37 and 33, plus the above Triangular Nim, what will you take to win?

4 : 0000100

19 : 0010011

33 : 0100001

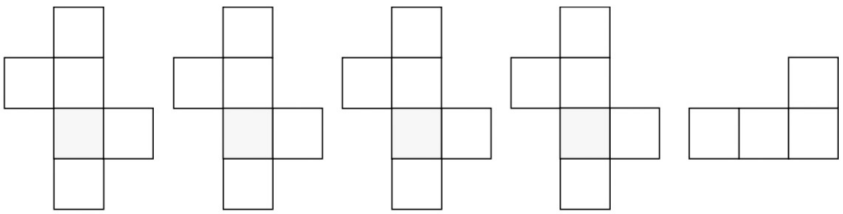
37 : 0100101

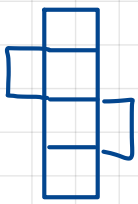
+

0010011 $\Rightarrow$ 19

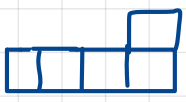
$\Rightarrow$ take heap : 19 #

4. For the game Domineering, assume that the game has the following fragments left. Who wins? Show it.





: V H V H $\Rightarrow \uparrow$



: V H V H $\Rightarrow -\frac{1}{2}$

$\rightarrow \uparrow + \uparrow + \uparrow + \uparrow + (-\frac{1}{2}) < 0$

$\Rightarrow$ □, H will win #

5. For a Nim game with Misère play, describe your winning strategy.

We can apply normal strategy.

Make use of it until a stack of numbers ≥ 2

and the other stack of numbers < 2

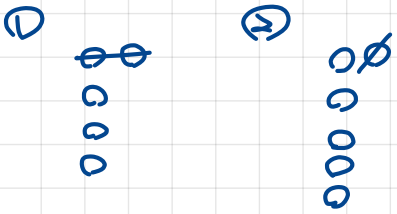
$\Rightarrow$

① if the remain 1 stack of number is odd

, take all the numbers in the stack of ≥3

② if the remain 1 stack of number is even

, take the numbers in the stack of ≥3 until it remains 1 number.

① ② 

$\Rightarrow$ the 2 methods will both make the stack remains 1 number to remain odd numbers.

$\Rightarrow$ Absolutely will win! #