

# Homework3 For Machine Learning

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1. Consider the soda can game introduced in the class. Now suppose instead of a single circular table, there are two tables of identical size. A move consists of placing the can on any table (assuming there is a spot left on that table). Once placed, a can cannot move. The first one who cannot put a can on either table loses. In this game would you rather go first or second? Describe the winning strategy

I would like to be the second.

I can use mirroring strategy, place the can in a symmetrical position on another table

2. In the take-chips-away game (with normal play rules):

if the number of chips on the table is 15, does this represent a P-position or N-position?

Describe the winning strategy.

N-position

Remove 3 and give 12 to the other player

Then next player will give me either 11, 10, 9 and I give 8

Then 4 and eventually 0, the next player wins

if the number of chips on the table is 8, does this represent a P-position or N-position?

Describe the winning strategy

P-position

Give either 7, 6, 5 to the next player

then previous player gives 4 and eventually 0, the previous player wins

3. In the take-chips-away game (with Misère play rules):

if the number of chips on the table is 15, does this represent a P-position or N-position?

Describe the winning strategy.

N-position

Remove 2 and give 13 to the other player

Then next player will give me either 12, 11, 10 and I give 9

Then 5 and eventually 1, the next player wins

if the number of chips on the table is 8, does this represent a P-position or N-position?

Describe the winning strategy

N-position

Remove 3 and give 5 to the other player

Then next player will give me either 4, 3, 2 and I give 1, the next player wins

4. In the modified take-chips-away game (with normal play rules), we only allow for a player to take out either 1 or 2 chips (rather than up to 3). For this game:

**if the number of chips on the table is 15, does this represent a P-position or N-position?  
Describe the winning strategy.**

P-position

Give either 14, 13 to the next player

then previous player gives 12, 9, 6, 3 and eventually 0, the previous player wins

**if the number of chips on the table is 8, does this represent a P-position or N-position?  
Describe the winning strategy**

N-position

Remove 2 and give 6 to the other player

Then next player will give me either 5, 4 and I give 3

Then eventually 0, the next player wins

**5. Consider the game of Nim (with normal play rules):**

**Consider piles position (3, 7) (i.e., two piles with the first pile having 3 and the second having 7 chips). Does this represent a P-position or N-position? Describe the winning strategy.**

N-position

$3 \text{ xor } 7$

$= 011 \text{ xor } 111$

$= 100$

the next player takes 4 from 7 (3,3), keep the xor result be 000 and eventually  $000 \text{ xor } 000 = 000$ , the next player wins

**Consider piles position (5, 0, 3, 2). Does this represent a P-position or N-position and why? You don't need to describe the winning strategy**

N-position

$5 \text{ xor } 0 \text{ xor } 3 \text{ xor } 2$

$= 101 \text{ xor } 000 \text{ xor } 011 \text{ xor } 010$

$= 101 \text{ xor } 011 \text{ xor } 010$

$= 110 \text{ xor } 010$

$= 100$

the next player takes 4 from 5 (1,0,3,2), keep the xor result be 000 and eventually  $000 \text{ xor } 000 \text{ xor } 000 \text{ xor } 000 = 000$ , the next player wins