

Python Programming #4

Final Program for the TLCW / TLCL Nim Game

Writing a computer program that can play the TLCW / TLCL nim game like a world champion of the Game

Overview: You should enhance your program for **Python Programming #3C** such that the computer program can always make the best moves possible from the beginning of the game. The computer program can easily beat any ordinary user who hasn't thought about the optimal strategies to play the nim game. In the following, we describe the optimal strategies for playing the **TLCW / TLCL** nim game, and you should implement the optimal strategies into your program such that the computer will make moves based on the optimal strategies.

Optimal strategies for the TLCW (**T**aking the **L**ast **C**oin to **W**in) Nim Game

- Let N be the number of coins left at the moment and M be the maximum number of coins allowed to take each time.
- Figure out the value of $N \% (M+1)$, i.e. the remainder of N divided by $(M+1)$.
- **If $N \% (M+1)$ not 0, the optimal move is to take $N \% (M+1)$ coins away.** For example, with 14 coins left with 3 coins taken at most, the optimal move is to take 2 coins away.
- **If $N \% (M+1)$ is 0, there is no good move, just make any valid move you want.** A valid move such as just taking away 1 coin is fine.

For example, with 12 coins left with 3 coins taken at most, there is no good move at all, make any valid move you want.

Optimal strategies for the TLCL (Taking the Last Coin to Lose) Nim Game

- Let N be the number of coins left at the moment and M be the maximum number of coins allowed to take each time.
- Figure out the value of $(N-1) \% (M+1)$, i.e. the remainder of $(N-1)$ divided by $(M+1)$.
- **If $(N-1) \% (M+1)$ not 0, the optimal move is to take $(N-1) \% (M+1)$ coins away.** For example, with 14 coins left with 3 coins taken at most, the optimal move is to take 1 coin away.
- **If $(N-1) \% (M+1)$ is 0, there is no good move, just make any valid move you want.** A valid move such as just taking away 1 coin is fine. For example, with 13 coins left with 3 coins taken at most, there is no good move at all, make any valid move you want.