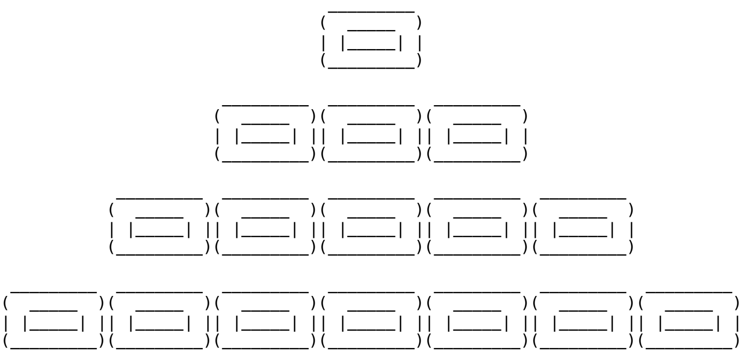
Nim *(from old English Inman “to take”)*

Last Year at Marienbad (*L'année dernière à Marienbad* by Alain Resnais, 1961)

What is it?

A strategic and mathematical game. Much like Chess and Go, the players need to plan their moves ahead in order to “win” the game.



The classic game of Nim can have different structures, always composed of a few “heaps” or “rows” of items, any items. The amount can be of 2, 3 or 4 heaps. The one above is 4 heaps: 1, 3, 5 and 7. A peculiarity of the Nim game is that, even if can be played in a normal setting (the player that picks-up the last item wins) it is mostly played as a ***Misère game***, meaning one has to lose the last item to its opponent in order to win.

```
   O                       O                       O
  OOX                     OOX                     OOO
 OOOOX                   OOOOO                   OOOOX
OOOOOOO   (1, 2, 4, 7)   OOOOOOX. (1, 2, 5, 6)   OOOOOOX. (1, 3, 4, 6)
```

BEWARE: this game is inherently unfair! Unlike other games there is nothing left to chance. The Nim game is intrinsically an ***unfair game***, as depending of the amount of items in each heaps, one can be sure to win or sure to loose. Also if a player knows the safe positions depending of the amount of pieces in front of him, one can be sure to always be in a winning position (some of the allegedly winning combinations below for the 4 heaps version).

What are the rules?

The rules of the Nim game are quite simple. It is a two players' game, each player plays one after the other. One can remove as many items as they want each turn, and needs to remove at least one item, as long as they remain in the same row. The next turn they may remove again as many items as they want in another row, as long as it remains in that same row. The last player to pick up an item loses.

What do you need to play this game?

No physical skills require. You need an adversary and 16 pieces of anything. This game can be done on paper, physically, with placards, glasses, peanuts, cigarette butts, coins. As long as you have 4 rows of 1, 3, 5 and 7 items layed out in front of you, you can be "nimming" your adversary away.

What is a Misère game?

A misère game is a game in which the rules which in a "normal" game would bring one to win actually get one to loose. As such the players have to trick their adversary into a "poor" game, it is thus necessary to spare tricks, in order not to acquire but dismiss. The one who looses territory, gains authority.

Ideologies behind the Nim?

Unlike other strategic games such as Go, Chess or even Ought Crosses, the Nim game is very brief and experienced players can already tell after a few turns which player is gonna win or lose the ongoing game, as its mathematical sequence are very dominant visually and tactically. Also, when in Go and Chess, or other similar boardgames the player is overtaking the territorial space of the game in order to corner its opponent and take over its pawns, the take-over in the Nim game is nowhere to be seen but in the players' mind. In its own way, the Nim "game" is a counter-game as the players are in certain ways with very little to no agency. One player is always ahead of the other, and there are no chance in turning back the table while playing.
The win is reversed, one has to escape the urge of dominating the space in order to trick its opponent into the light, at the moment the one losing is in the spotlight, the game has already been lost. In a way the Nim game illustrated all the micro-actions taken by player in order to win in any other more lengthy tactical games, the difference being that while in other games, a player might be overpowered at any moment, in the Nim game, this power dynamic is set in stone quite quickly.

This game fascinates a lot due to its solvable feature, if one has cracked the code, one will always win (or loose rather…), undoubtedly! In a way it is a puzzle to solve with two people but where only one gain from it, and you need that human factor in order to solve the puzzle.
The Nim game, formula has been studied, solved, programmed as well by thinkers, mathematicians, programmers and puzzle amateurs. Accessible to any person, of any age or background. It can be seen as a party trick as show-off, but contains some kind of magic for the unexperienced player.

It is said to originate from China, but the sources are uncertain. People would allegedly play on the streets with any kind of junk that could be found around them. Therefore, the Nim game is absolutely not site-specific and can be played anywhere with anything as long as there are two players. Of course one can play alone, but then one doesn't gain any kind of puzzling satisfaction.

HOW TO SET UP DR. NIM FOR EACH NEW GAME

1. PUT THE 15 MARBLES IN THE TOP ROW OF THE MACHINE.
2. SET THE FLIP-FLOPS SO THEY LOOK LIKE THIS.
3. FLIP THE EQUALIZER TO THE *START* POSITION, LIKE THIS.

HOW TO PLAY AGAINST DR. NIM

1. If you want to go first, flip the *TURN SWITCH* to player.
2. You may take 1 or 2 or 3 marbles on each turn.
3. The one who takes the *LAST* marble *LOSES*.
4. Next, *PUSH* the *TRIGGER* once for each of the 1 or 2 or 3 marbles you may want to take.
5. After your turn, flip the *TURN SWITCH* to *DR. NIM* . . . Then push the *TRIGGER* only *ONCE* and Dr. Nim will take his turn.
6. When he is finished, Dr. Nim will flip the *TURN SWITCH* back to *PLAYER* for your turn.
7. Repeat steps 4 and 5 until only *ONE MARBLE IS LEFT*.

WHOEVER HAS TO TAKE THAT LAST MARBLE LOSES!

IF YOU SHOULD WANT TO LET DR. NIM GO FIRST, FLIP THE *TURN SWITCH* TO *DR. NIM* AND PLAY AS ABOVE.

If you play correctly, you can beat THE AMAZING DR. NIM, but remember, DR. NIM hates to lose . . . so don't make any mistakes.

> Dr. Nim was a plastic toy invented by John Thomas Godfrey and published by ESR Inc. in 1966. It was the first mass-market consumer product explicitly marketed as a "computer game,"

[ONLINE NIM HERE]

[ANDROID NIM]

See [Nimbers], [Surreal Number]

In Python

```python
import functools

MISERE = 'misere'
NORMAL = 'normal'

def nim(heaps, game_type):
    """Computes next move for Nim, for both game types normal and misere.

    if there is a winning move:
        return tuple(heap_index, amount_to_remove)
    else:
        return "You will lose :("

    - mid-game scenarios are the same for both game types

    >>> print(nim([1, 2, 3], MISERE))
    misere [1, 2, 3] You will lose :(
    >>> print(nim([1, 2, 3], NORMAL))
    normal [1, 2, 3] You will lose :(
    >>> print(nim([1, 2, 4], MISERE))
    misere [1, 2, 4] (2, 1)
    >>> print(nim([1, 2, 4], NORMAL))
    normal [1, 2, 4] (2, 1)

    - endgame scenarios change depending upon game type

    >>> print(nim([1], MISERE))
    misere [1] You will lose :(
    >>> print(nim([1], NORMAL))
    normal [1] (0, 1)
    >>> print(nim([1, 1], MISERE))
    misere [1, 1] (0, 1)
    >>> print(nim([1, 1], NORMAL))
    normal [1, 1] You will lose :(
    >>> print(nim([1, 5], MISERE))
    misere [1, 5] (1, 5)
    >>> print(nim([1, 5], NORMAL))
    normal [1, 5] (1, 4)
    """

    print(game_type, heaps, end=' ')

    is_misere = game_type == MISERE

    is_near_endgame = False
    count_non_0_1 = sum(1 for x in heaps if x > 1)
    is_near_endgame = (count_non_0_1 <= 1)

    # nim sum will give the correct end-game move for normal play but
    # misere requires the last move be forced onto the opponent
    if is_misere and is_near_endgame:
        moves_left = sum(1 for x in heaps if x > 0)
        is_odd = (moves_left % 2 == 1)
        sizeof_max = max(heaps)
        index_of_max = heaps.index(sizeof_max)

        if sizeof_max == 1 and is_odd:
            return "You will lose :("

        # reduce the game to an odd number of 1's
        return index_of_max, sizeof_max - int(is_odd)

    nim_sum = functools.reduce(lambda x, y: x ^ y, heaps)
    if nim_sum == 0:
        return "You will lose :("

    # Calc which move to make
    for index, heap in enumerate(heaps):
        target_size = heap ^ nim_sum
        if target_size < heap:
            amount_to_remove = heap - target_size
            return index, amount_to_remove

if __name__ == "__main__":
    import doctest
    doctest.testmod()
```