

THE GAME OF NIM

NIM is a game played with piles of stones (or pennies). You will need a partner to play this game. Here are the rules:

- (1) On your turn, you can take as many stones you want from one pile.
- (2) You must take at least one stone on each turn.
- (3) Players alternate taking turns.
- (4) The player who takes the last stone from the last pile wins.

Try playing NIM with your partner. Keep track of who goes first in each game. There is always one player who is guaranteed to win if he/she plays according to a certain strategy. It is your job to figure out what this strategy is. Decide if Player 1 (the first to pick) or Player 2 (the second to pick) has a winning strategy for each game.

Game 1: Pile 1 has four stones.

Who has the winning strategy: Player 1 or Player 2

Strategy:

Game 2: Pile 1 has one stone. Pile 2 has two stones.

Who has the winning strategy: Player 1 or Player 2

Strategy:

Game 3: Pile 1 has three stones. Pile 2 has three stones.

Who has the winning strategy: Player 1 or Player 2

Strategy:

Game 4: Pile 1 has eight stones. Pile 2 has five stones.

Who has the winning strategy: Player 1 or Player 2

Strategy:

Game 5: Pile 1 has seven stones. Pile 2 has seven stones. Who has the winning strategy:

Player 1 or Player 2

Strategy:

Question 1: If there is only one pile of stones, which player wins? Why?

Question 2: If there are two piles of stones, when does Player 1 win? When does Player 2 win? Why?

Game 6: Pile 1 has one stone. Pile 2 has two stones. Pile 3 has three stones.
Who has the winning strategy: Player 1 or Player 2
Strategy:

Game 7: Pile 1 has one stone. Pile 2 has two stones. Pile 3 has two stones.
Who has the winning strategy: Player 1 or Player 2
Strategy:

Game 8: Pile 1 has one stone. Pile 2 has four stones. Pile 3 has six stones.
Who has the winning strategy: Player 1 or Player 2
Strategy:

Game 9: Pile 1 has two stones. Pile 2 has four stones. Pile 3 has six stones.
Who has the winning strategy: Player 1 or Player 2
Strategy:

Game 10: Pile 1 has three stones. Pile 2 has four stones. Pile 3 has eight stones.
Who has the winning strategy: Player 1 or Player 2
Strategy:

Think about situation when the largest pile has either six, seven or eight stones.

Question 3: If there are three piles of stones, when does Player 1 win? When does Player 2 win? (This is not an easy question, but any good ideas may be valuable.)