Montlake Math Challenge
September 25, 2008

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. You must take at least one stone on each turn.
2. Players alternate taking turns.
3. 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 wins or Player 2 wins in each game.

Game 1: Pile 1 has four pennies.

Player 1:

Player 2:

Winner:

Game 2: Pile 1 has one penny. Pile 2 has two pennies.

Player 1:

Player 2:

Winner:

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

Player 1:

Player 2:

Winner:

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

Player 1:

Player 2:

Winner:

Game 5: Pile 1 has seven pennies. Pile 2 has seven pennies.

     Player 1:

     Player 2:

     Winner:

Game 6: Pile 1 has one penny. Pile 2 has two pennies. Pile 3 has three pennies.

     Player 1:

     Player 2:

     Winner:

Game 7: Pile 1 has one penny. Pile 2 has two pennies. Pile 3 has two pennies.

     Player 1:

     Player 2:

     Winner:

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

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