Pins

Rules of the Game:

The game starts with a single pile of 21 pins. Two players compete against each other, taking it in turns to pick up their choice of 1, 2 or 3 pins. The aim is to force the other player to pick up the final pin.

Example:

Player 1 goes first. Takes 1 pin. Pins remaining: 20.

Player 2 takes 2 pins. Pins remaining: 18.

Player 1 takes 2 pins. Pins remaining: 16.

Player 2 takes 3 pins. Pins remaining: 13.

Player 1 takes 1 pin. Pins remaining: 12.

Player 2 takes 2 pins. Pins remaining: 10.

Player 1 takes 3 pins. Pins remaining: 7.

Player 2 takes 3 pins. Pins remaining: 4.

Player 1 takes 3 pins. Pins remaining: 1.

Player 2 takes final pin. Player 1 wins.

Your tasks:

5 points: Write an algorithm to win every single game of Pins. You may choose whether you are player 1 or player 2 (the computer will be the other player).

3 points: Draw a model (of your choice) that either: 1) clearly demonstrates why your strategy works or 2) represents the problem in such a way that it helps find a solution to the problem.

2 points: Generalise your algorithm so that it could be used to solve a game of Pins with any number of pins in the starting pile.

Hint available: Deduct 2 points if requested.