# 15 boxes

This is a game for two players.

They need a collection of counters (only one colour).

Players take it in turns to place a counter in an empty box.

The first player to get three consecutive boxes with counters in is the winner.

Here is how one game went (It was a win for A on her fourth move):

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| O | O | O |  |  | O |  |  | O |  |  | O |  |  | O |
| B3 | A4 | A2 |  |  | A1 |  |  | B1 |  |  | B2 |  |  | A3 |

1. Which player should win - the one that goes first, or the one that goes second? Can you find a winning strategy?
2. What happens if you change the number of boxes you start with?
3. What is the strategy if the first to get three consecutive boxes loses?

# Cram

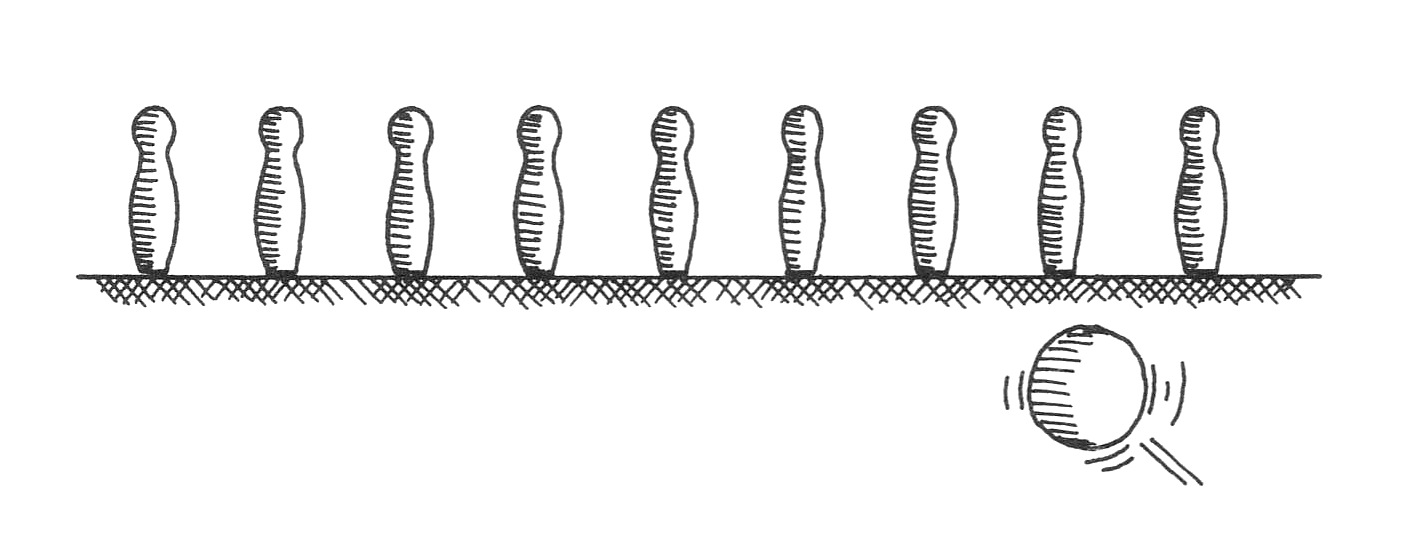
Players take it in turns to place a domino on a 6 x 6 square grid.   
It is assumed that the domino covers two adjacent squares on the grid.   
The player that cannot move loses.



In this game white has had 8 turns and black only 7.   
It is black’s turn and he cannot go. So white wins.

1. Which player should win - the one that goes first, or the one that goes second? Can you find a winning strategy?
2. What about a 7x7 grid? Try other sizes – not necessarily square.
3. What is the strategy if the first person that cannot move *wins*?
4. What happens when you use 3 x 1 rectangles (trominoes) ?

# Kayles



This is an old 14th Century game for two players.   
The ball can knock down either a single pin or two adjacent pins standing next to each other.

Players alternately roll a ball and the player that knocks over the last pin (or pair of pins) wins.

Assuming that you are not allowed to miss (you just roll again).

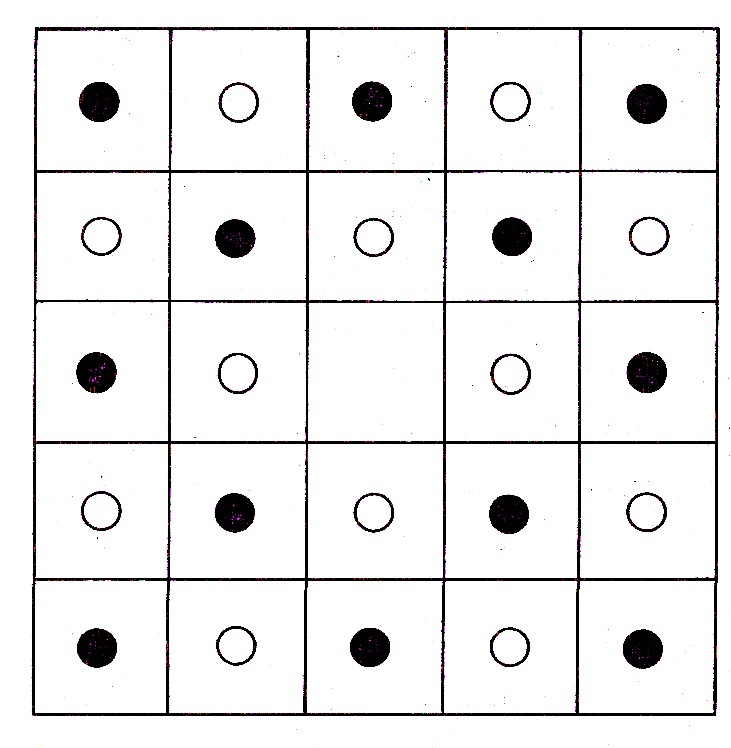
1. What is the first player’s winning strategy?
2. Try different numbers of pins.
3. Suppose the one who knocks over the last pin *loses*?
4. Play the regular game when there is a pin missing at the start ...

# Lewthwaites Game

Place the counters as shown on the board below.

Take turns at moving the counters orthogonally to the vacant square.

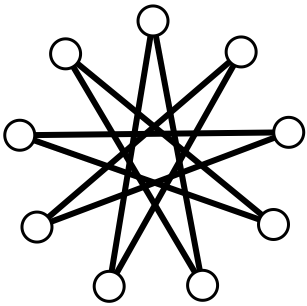
The first player that is unable to move loses.



1. Prove that the game has to end after at most 12 moves.
2. Prove that the second play can always win.
3. Try different size boards.

# Star

Put a counter on each of the star’s nine points.



Players A and B take turns at removing either one counter or two counters joined by a line. The player who takes the last counter wins.

Prove that player B can always win.

# Hip

A game for 2 players

Players alternately place a counter on the board.

The game continues until some counters complete the vertices of a square. The player to complete the square wins.

The square can be in any orientation, for example:

Suppose only one colour of counter is used.

(a) Which player has a winning strategy?

(b) Analyse the game on different sized square boards.

Now suppose each player has a different colour and the goal is to complete a square in your own colour.

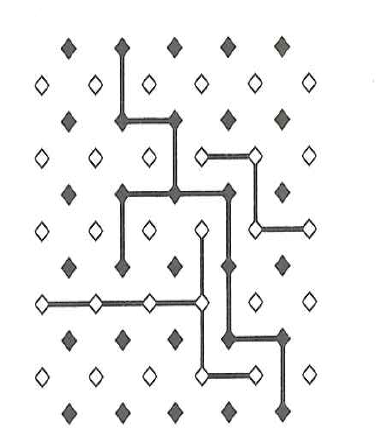
# Bridg-it

A game for two players.

Players alternately draw line segments between two horizontally or vertically adjacent dots.

Player A connects black dots and Player B connects white dots.

Player A tries to draw a path from the top to the bottom of the board.

Player B tries to draw a path from the left to right hand edges.

One player must not draw a segment that crosses a segment drawn by his or her opponent.

So this small diagram shows a game that was won by Player A on a 5 x 6 board.



Analyse the game of bridg-it on some small boards: (2 x 3; 3 x 4; 4 x 5)

Analyse the misère form where the player who completes the path loses.