

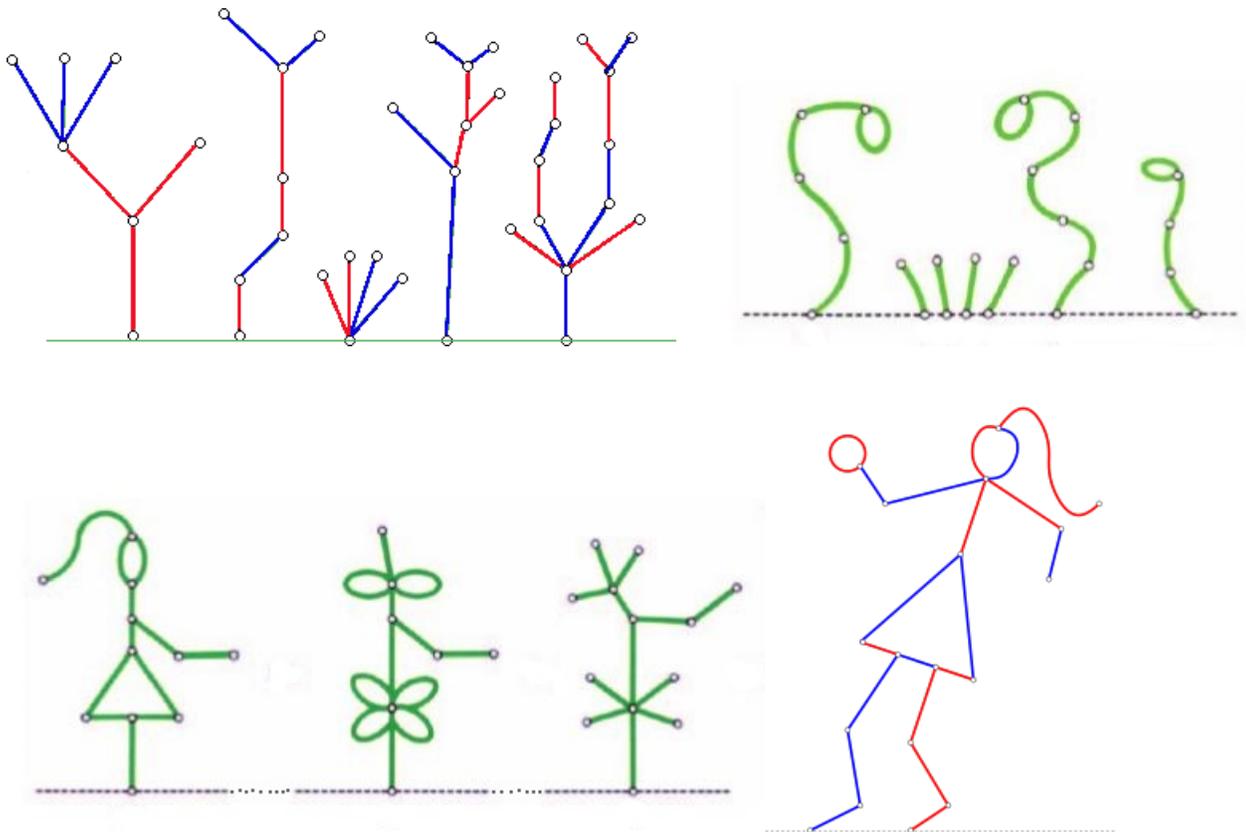
# Hackenbush

## Nim with Lines (and something else)

### Rules:

1. There is a long horizontal line at the bottom of the picture known as the **ground line**. All line segments in the picture must be connected by some path to the ground line. Otherwise, they are illegal line segments and cannot be part of the picture.
2. Line segments are separated by dots which each represent a vertex. Multiple line segments can branch out from the same vertex. (**Note:** Line segments do not have to be straight, and can even curl back around to connect to the same vertex that it began from. Pictures below.)
3. On each player's turn, he or she chooses and erases one of the line segments. Then, if any line segments are no longer connected by some path to the ground line, they **fall** off of the board since they are now illegal, and will be erased.
4. On each player's turn, if there are no line segments left on the board, that player loses the game. Accordingly, the player to erase all remaining line segments on the board wins (just like taking away the last piece in nim).

### Example Boards:



## Custom Game:

1. Draw the ground line at the bottom of the game board (white board or paper).
2. Player 1 draws a blue line that is either connected directly to the ground line or is connected to the vertex of a line that has some path to the ground line.
3. Player 2 draws a red line that is either connected directly to the ground line or is connected to the vertex of a line that has some path to the ground line.
4. Repeat Steps 2 and 3 ten to fifteen times.
5. Win conditions (choose one):
  - (a) Play the game as described in the rules on the front of this paper.
  - (b) **Blue-Red Variant:** Only Player 1 can erase blue lines and only player 2 can erase red lines. If there are no blue lines left on Player I's turn, he or she loses the game. If there are no red lines left on Player II's turn, he or she loses the game.

# Toads and Frogs

## Rules:

1. There are  $n$  boxes in a row. Each box either has a toad or frog in it, or the box is empty. An example board would be represented as:  $TTT\Box\Box FFF$ . This board has nine boxes total. The three left-hand boxes have toads in them. The three right-hand boxes have frogs in them. The three middle boxes are empty.
2. On Player I's turn, he or she can move any toad one of two ways:
  - (a) If there is an empty box directly to the right of the toad, Player I can move that toad into it. On the game board,  $T\Box\rightarrow\Box T$
  - (b) If there is a frog directly to the right of the toad and there is an empty box directly to the right of that frog, then Player I can **hop** the toad over the frog into the box to the right of it, leaving an empty box behind. On the game board,  $TF\Box\rightarrow\Box FT$
3. On Player II's turn, he or she can move any frog one of two ways:
  - (a) If there is an empty box directly to the left of the frog, Player II can move that frog into it. On the game board,  $\Box F\rightarrow F\Box$
  - (b) If there is a toad directly to the left of the frog and there is an empty box directly to the left of that toad, then Player II can **hop** the frog over the toad into the box to the left of it, leaving an empty box behind. On the game board,  $\Box TF\rightarrow FT\Box$
4. On either player's turn, if he or she cannot make any move, that player loses the game.
5. Each toad and frog should be labeled with a number at the bottom to reduce confusion when instructors are trying to evaluate your moves. These numbers don't affect each toad or frog in any way, and are simply there to keep track of individual toads and frogs. Below, this notation appears in the example boards.

## Example Boards:

$T_1T_2T_3\Box\Box\Box F_1F_2F_3F_4$

$T_1T_2T_3T_4T_5\Box\Box\Box\Box F_1F_2F_3F_4$

$T_1T_2\Box\Box\Box F_1F_2F_3F_4$

$T_1T_2T_3T_4\Box\Box\Box\Box F_1F_2F_3$

$T_1T_2T_3\Box\Box\Box F_1F_2F_3$

$T_1T_2T_3T_4T_5\Box T_6\Box T_7\Box\Box F_1\Box F_2\Box F_3F_4F_5F_6$

## Custom Game:

Simply make your own board with at least a few empty boxes and at least two toads and two frogs. Then follow the rules as laid out above.



# Cram

## Rules:

1. There is an  $m \times n$  grid that **dominoes** are placed on. Dominoes are  $2 \times 1$  objects (they are simply two grid boxes in a row).
2. On each player's turn, he or she can place a domino anywhere that there is room on the board.
3. Win Conditions (choose one):
  - (a) On each player's turn, if he or she cannot make a move, that player **loses** the game.
  - (b) (**Misère Variant**) On each player's turn, if he or she cannot make a move, that player **wins** the game.

## Boards:

Simply make your own board and play with the rules laid out above. However, anything smaller than a  $6 \times 6$  board will not be very fun.



# Kayles

## Rules:

1. There are  $n$  lines in a row. Each of these lines represent a **pin**.
2. On each player's turn, he or she can make one of two moves:
  - (a) Remove one pin (a bowling ball striking the single pin).
  - (b) Remove two adjacent pins (a bowling ball striking two pins that are next to each other). (**Note:** Two pins are considered adjacent only if they were in a consecutive order when the row of pins was first drawn.)
3. On each player's turn, if he or she cannot make a move, that player **wins** the game.

## Boards:

Simply draw your own line of any number of pins. However, any line shorter than 15 pins will not be very fun.