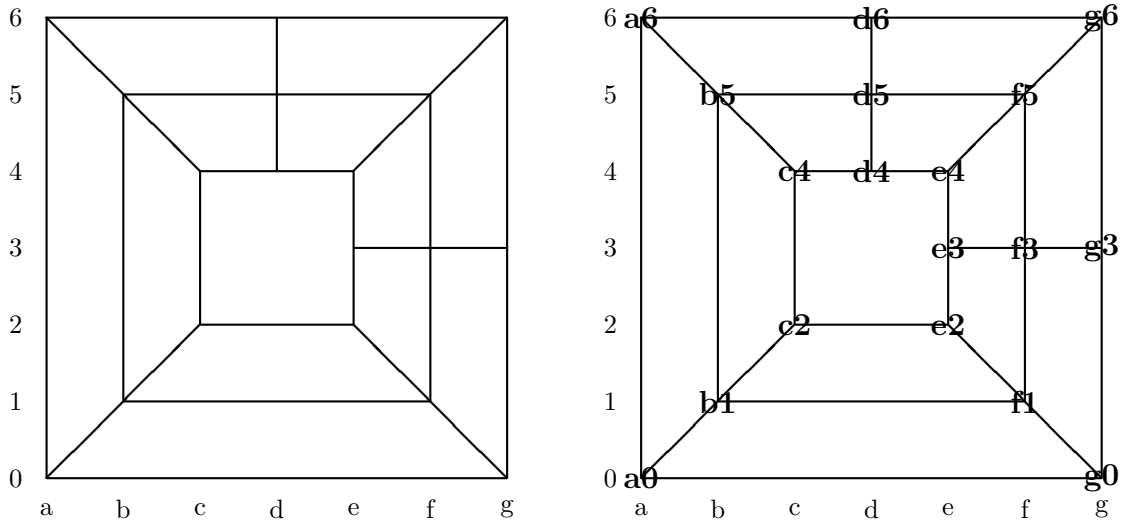
Morris Game

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
a0	g0	b1	f1	c2	e2	e3	f3	g3	c4	d4	e4	b5	d5	f5	a6	d6	g6



Game rules

The Morris Game, Variant , is a variant of Nine Men's Morris game. It is a board game between two players: White and Black. Each player has 8 pieces, and the game board is as shown above. Pieces can be placed on intersections of lines. (There are a total of 18 locations for pieces.) The goal is to capture opponents pieces by getting three pieces on a single line (a mill). The winner is the first player to reduce the opponent to only 2 pieces, or block the opponent from any further moves. The game has three distinct phases: opening, midgame, and endgame.

Opening: Players take turns placing their 8 pieces - one at a time - on any vacant board intersection spot.

Midgame: Players take turns moving one piece along a board line to any adjacent vacant spot.

Endgame: A player down to only three pieces may move a piece to any open spot, not just an adjacent one (hopping).

Mills: At any stage if a player gets three of their pieces on the same straight board line (a mill), then one of the opponent's isolated pieces is removed from the board. An isolated piece is a piece that is not part of a mill.

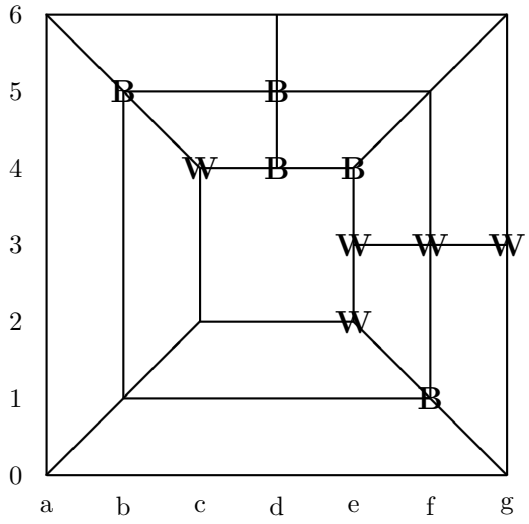
A computer program that plays Variant

The basic components of a computer program that plays Variant are a procedure that generates moves, a function for assigning a static estimation value for a given position, and a MiniMax or AlphaBeta procedure.

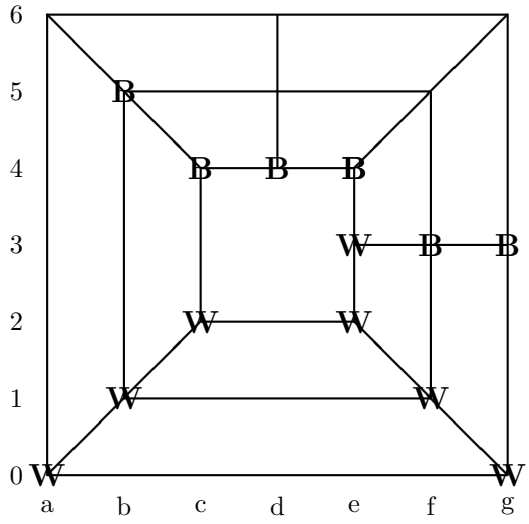
Representing board positions

One way of representing a board position is by an array of length 18 , containing the pieces as the letters W, B, x. (The letter x stands for a "non-piece".) The array specifies the pieces starting from bottom-left and continuing left-right bottom up. Here are a two examples:

xxxBxWWWWWBBBBxxxx



WWWWWWWBBBBBBxxxxx



Move generator

A move generator gets as input a board position and returns as output a list of board positions that can be reached from the input position. In the next section we describe a pseudo-code that can be used as a move generator for White. A move generator for Black can be obtained by the following steps.
Input: a board position b.
Output: a list L of all positions reachable by a black move.
1. compute the board **tempb** by swapping the colors in b. Replace each W by a B, and each B by a W.
2. Generate L containing all positions reachable from **tempb** by a white move.
3. Swap colors in all board positions in L, replacing W with B and B with W.

A move generator for White

A pseudo-code is given for the following move generators: **GenerateAdd**, generates moves created by adding a white piece (to be used in the opening). **GenerateMove**, generates moves created by moving a white piece to an adjacent location (to be used in the midgame). **GenerateHopping**, generates moves created by white pieces hopping (to be used in the endgame). These routines get as an input a board and generate as output a list L containing the generated positions. They require a method of generating moves created by removing a black piece from the board. We name it **GenerateRemove**.