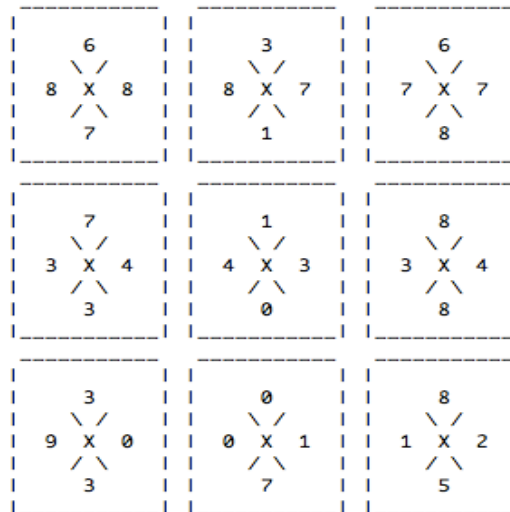


SAT solver for Tetravex



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The game

- edge-matching puzzle game
- set of square tiles
- number on each face of each tile
- each adjacent tile must have same number on facing side



The Goal

0895

7683

5845

2279

9580

...

Task: write an encoder for Tetravex

- ① Input: a text file containing a list of tiles
- ② Encode the problem into SAT
- ③ If unsatisfiable, output UNSATISFIABLE
- ④ If satisfiable, output the solution on the screen, by telling in which cell (1-16) each tile is

The problem

- generate a series of rules for a SAT solver to solve a Tetravex puzzle
- one constraint: facing sides must have same value

First steps

- manually create simple puzzle
- solve it
- reverse engineer field rules

Implementation

- parser => read puzzle definition
- encoder => generate rules
- SAT engine => compile result
- UI => display result

Demo time

- TetraSAT in action

Encoder complexity

- static $\Rightarrow 2n^2 + n^2 \Rightarrow O(n^2)$
- dynamic $\Rightarrow n(n-1) + 4n\sqrt{n}(\sqrt{n-1}) \Rightarrow O(n^2)$
- overall $\Rightarrow O(n^2)$

SAT solver

- given as a black box
- but
- rules' order matters

Rules

- “a tile can’t occupy more than one space” ($\sim a \vee \sim b$)
- “each space can’t hold more than one tile” ($\sim a \vee \sim b$)
- “each tile must stay in one space”
($a \vee b \vee c \dots \vee i$)
- “each tile can’t stay next to incompatibles” ($\sim a \vee \sim b$)

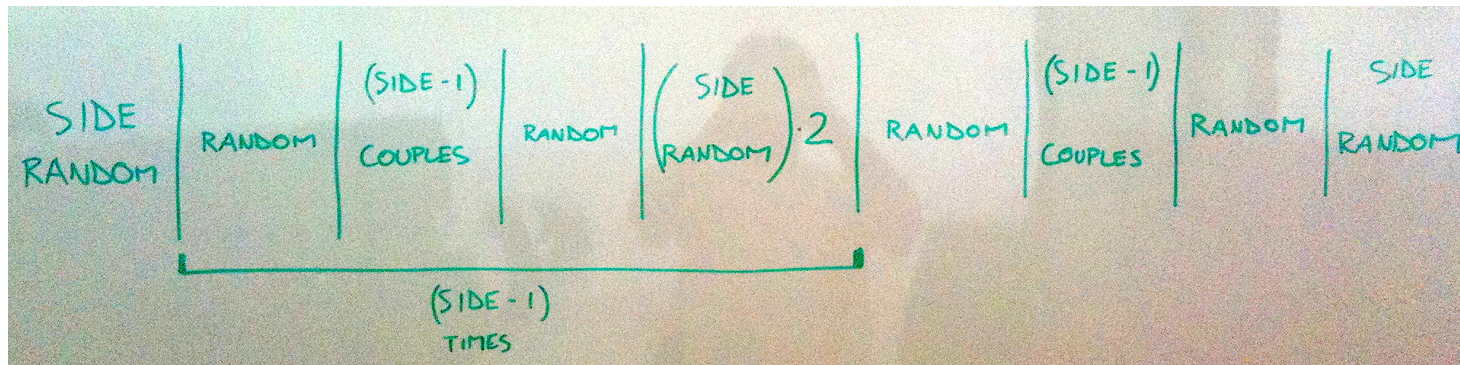
Legend:

$a \Rightarrow \text{tile_i_in_space_k}$

$b \Rightarrow \text{tile_h_in_space_m}$

Extra: the Generator

- $(side)x$
- $(side-1)(x[(side-1)couples]x \mid ((side) \text{ sequence})^2)$
- $x[(side-1)couples]x \mid (side)x$



Thank you!

- <http://code.google.com/p/tetrasat>