ER02 – Molecular Programming
Project Presentation

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January 20, 2017

Part I

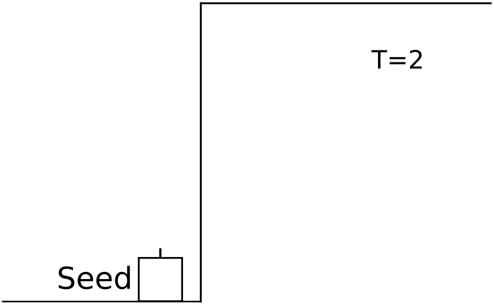
Project 4 – Scale the Wall

Outline

1. Attempts to Find a Solution
2. Evaluation of Impossibility Proofs

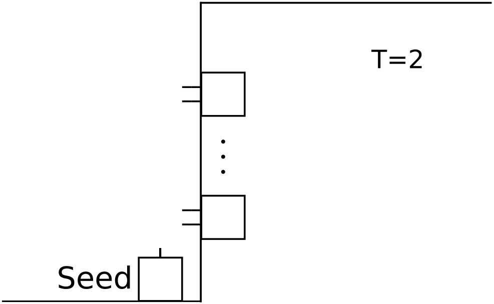
First Steps

- Can not find a solution with an empty wall



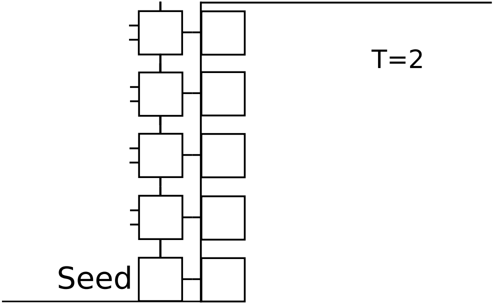
First Steps

- Can not find a solution with an empty wall
- Solution: Add glue to the wall

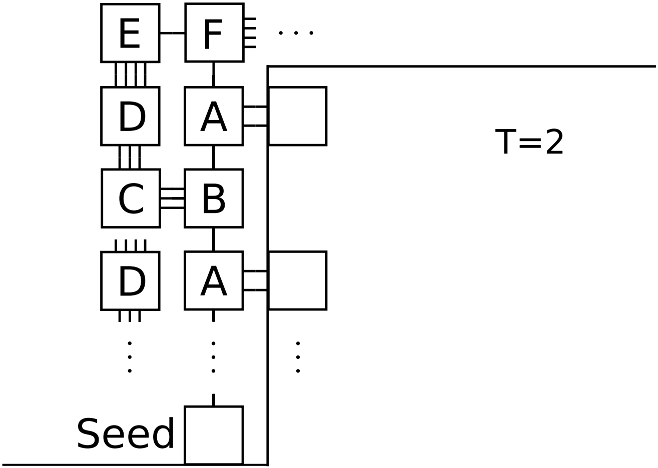


First Steps

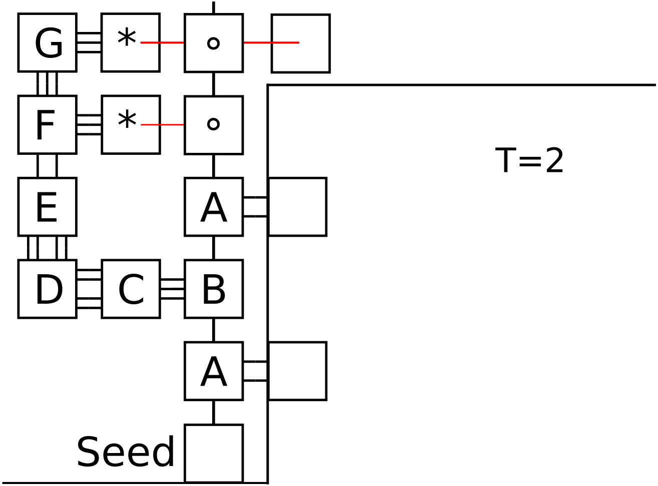
- Can not find a solution with an empty wall
- Solution: Add glue to the wall
- Glue on the wall with strength 2 can be simulated with glue on the wall with strength 1



Simplified Attempt



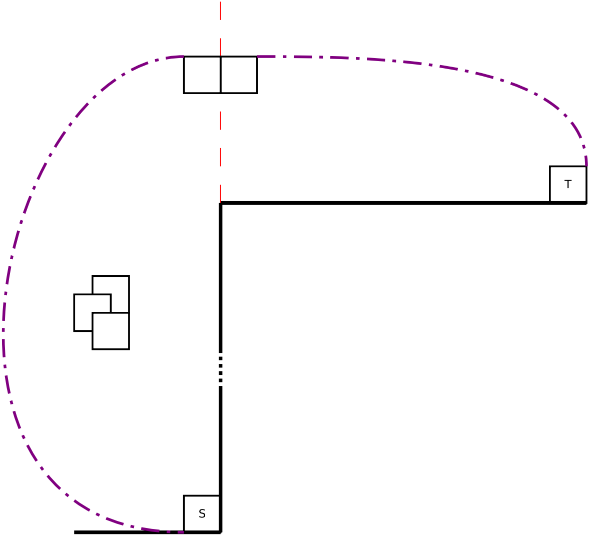
Complicated Attempt



Outline

1. Attempts to Find a Solution
2. Evaluation of Impossibility Proofs

Proof Attempts



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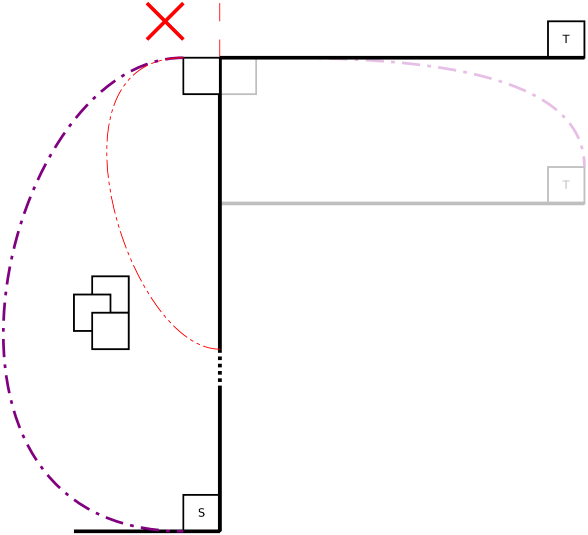

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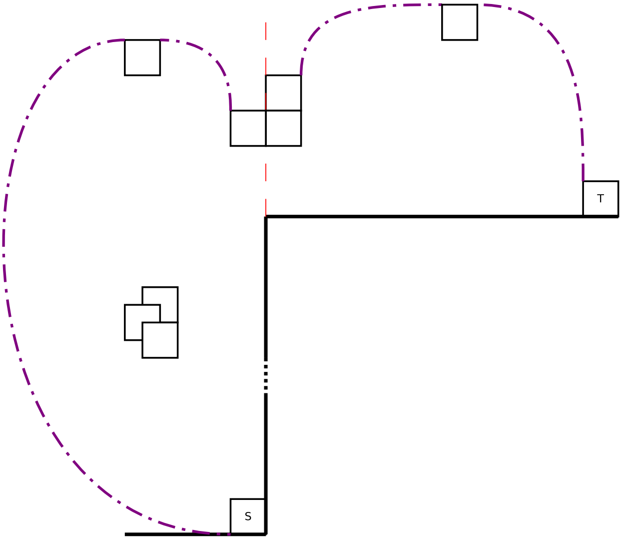

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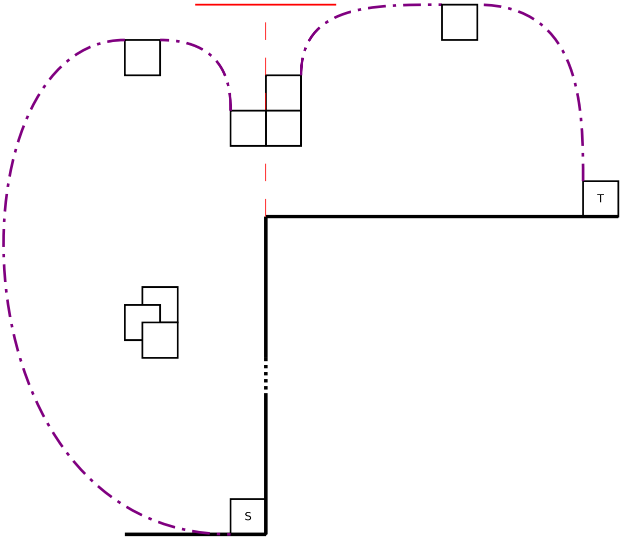

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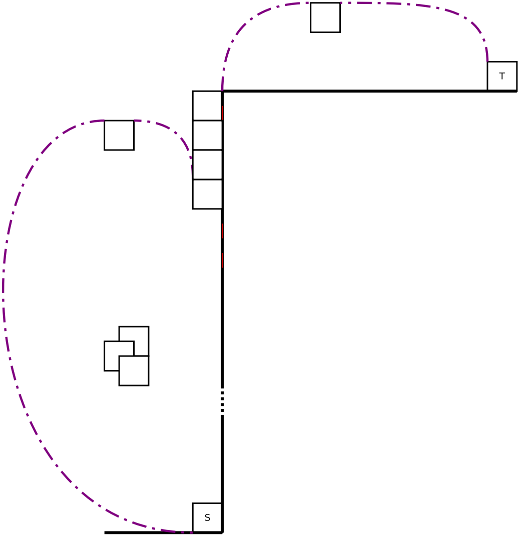

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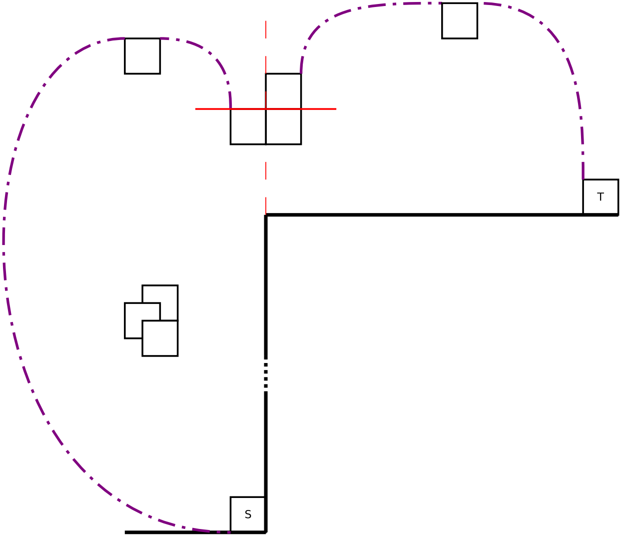

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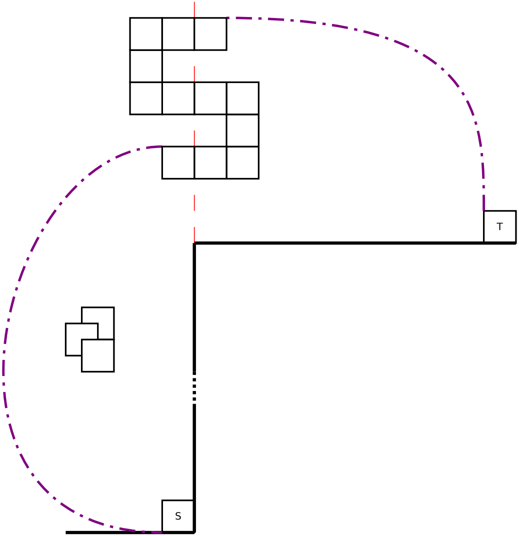

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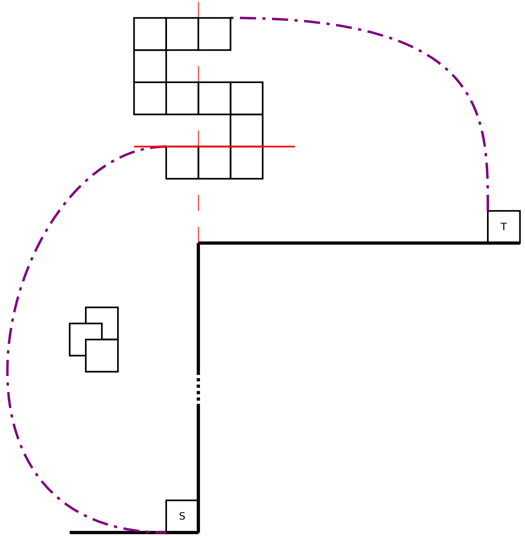

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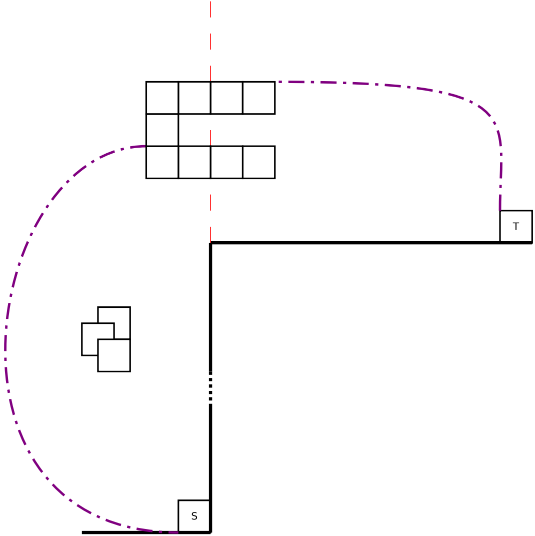

Part II

Project 5 – Rock Paper Scissors Reaction Networks

Trying to play shifumi with reaction networks

same guys as before

20 january 2017

Introduction

Two networks can play each other using chemicals:

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- As soon as one concentration exceeds 1.0, the player is assumed to make a move;
- $C_4, \ldots, C_{n-1}$ are "helper" chemicals product;
- C_n represents the fuel; each move consumes fuel.

Example of game

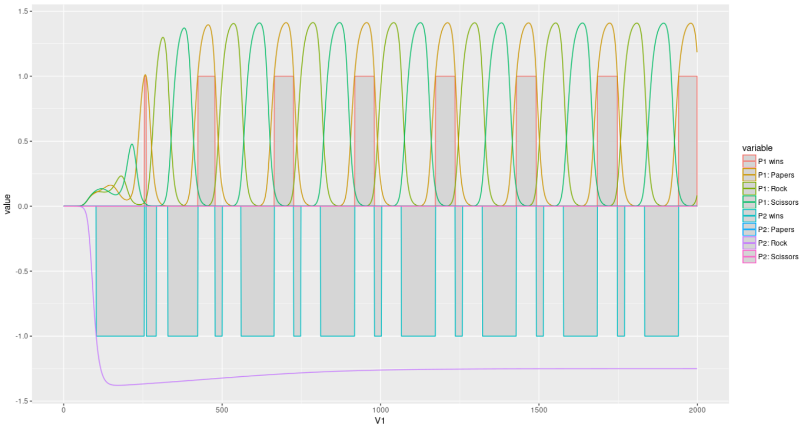

FIGURE 1 – Example of a game between two networks

Example of game

1	-1	0	0
0	1	-1	0
-1	0	1	0
0	0	0	0

TABLE 1 – Player 1

Example of game

1	-1	0	0
0	1	-1	0
-1	0	1	0
0	0	0	0

TABLE 1 – Player 1

1	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0

TABLE 2 – Player 2

Project

What has been done:

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- Implementing a simulator;

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- Implementing a simulator;
- Trying to find a ~~good~~ reaction network;

Simulator

- Using euler method with those equations:

$$\frac{dx_i}{dt} = 10^{-6} - 0.4x_i + \frac{x_n}{2 + x_n} . \frac{\sum_{j>0} a_{ij} x_j}{1 + \sum_{j>0: a_{ij}>0} a_{ij} x_j + 10 \sum_{j>0: a_{ij}<0} |a_{ij}| x_j}$$

$$\frac{dx_n}{dt} = 0.5 - \frac{x_n}{2 + x_n} . \sum_{i>0} \frac{\sum_{j>0} a_{ij} x_j}{1 + \sum_{j>0: a_{ij}>0} a_{ij} x_j + 10 \sum_{j>0: a_{ij}<0} |a_{ij}| x_j}$$

Simulator

During the simulation, do in a loop:

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    - Update the fuel;

Simulator

During the simulation, do in a loop:

- For each player, for each chemical:
  - Update the chemical concentration;
  - Update the fuel;
- Update the scores.

Finding good networks to fight!

SPOILER:

Finding good networks to fight!

SPOILER:

Well it failed.

The idea

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Theory

- Taking random networks, simple networks like the previous one;
- **LET THEM FIGHT** (in a tournament);
- Take the best, mutate them, shuffle everything;

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Practice

- Have bad networks;
- Mutate them in bad networks (takes ***age***. . .);
- Get bad networks.

MOAR Examples

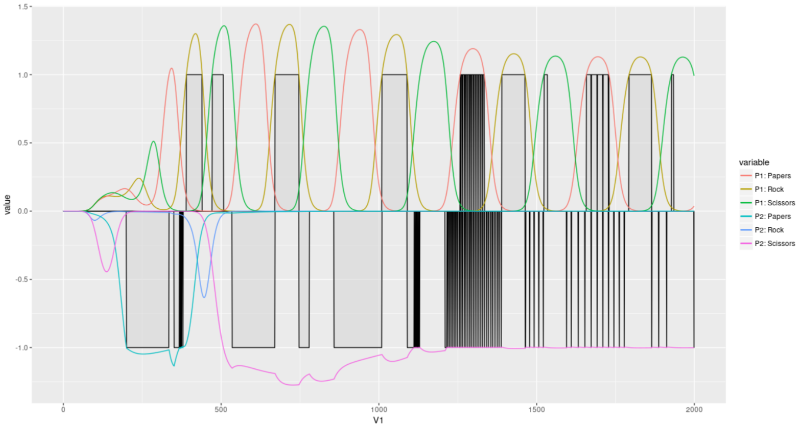

FIGURE 2 – I do not even know how I got this network

MOAR Examples

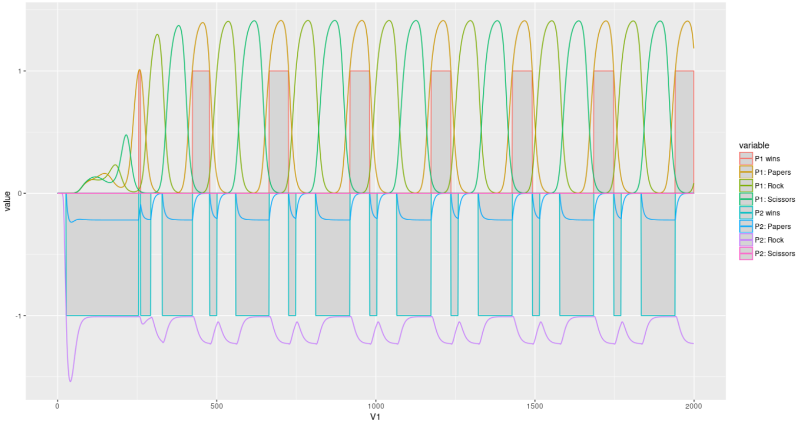

FIGURE 3 – Trivial variations

MOAR Examples

5.02106	0.551144	0.654704	1.26085
-0.18263	0.0215417	-0.82885	0.650672
-0.880956	-0.0868306	-1.14483	-0.855841
0.0116319	0.0846469	-0.868768	-0.0630371

TABLE 3 – Matrix of the trivial variation

Conclusion

Genetic algorithm: Well, why not but with good initialization heuristics.