

30.03.2022

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Fig. 1: Patterns (species)

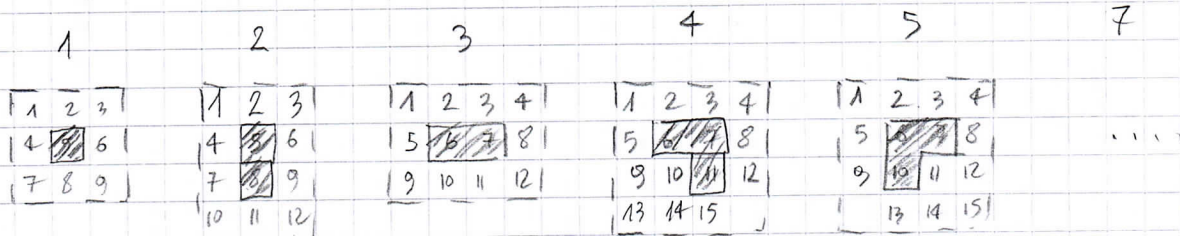
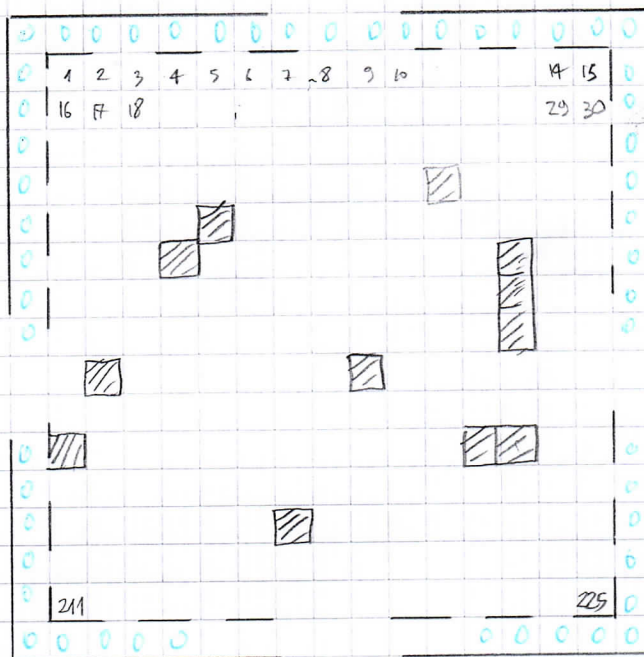
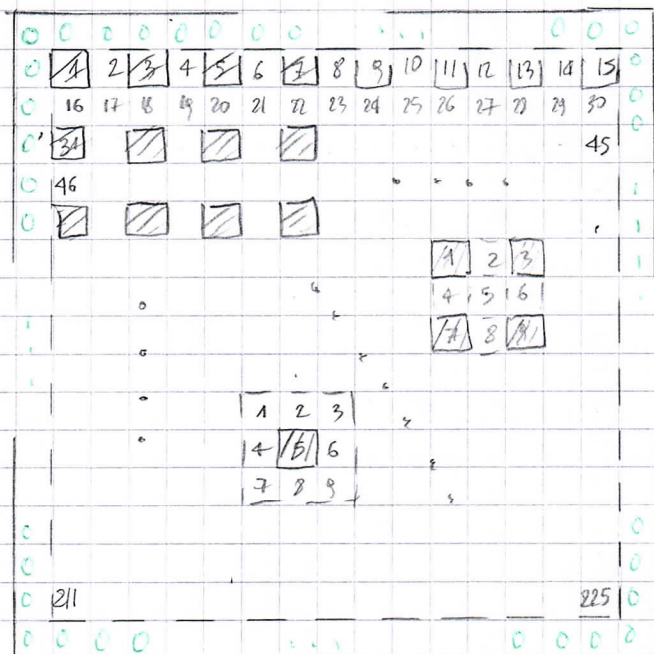


Fig. 2: CA[M+1,N+1]

initial state (clear=0)



final state: option A (only species 1)



final state: option

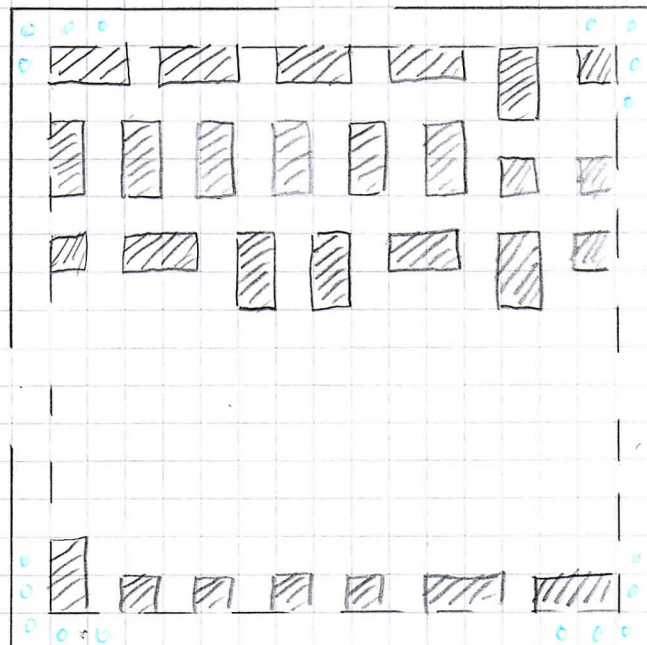


Fig. 3

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- each agent-player plays a game with each of his 8 neighbours, and receives in each game a payoff

$$u_{ij}(s_{ij}, s_{ikjk})$$

according to the payoff function

- he cumulates his payoff from 8 games:

$$\sum_{k=1}^8 u_{ij}(s_{ij}, s_{ikjk})$$

and his average cumulated payoff is equal to

$$\sum_{k=1}^8 u_{ij}(s_{ij}, s_{ikjk}) / 8$$

- each player wants to maximize his payoff, but we will be interested in maximization of the average total payoff $\bar{u}()$ of the whole set of players

$$\bar{u}(s_{11}, s_{12}, \dots, s_{m,n}) = \frac{1}{m \cdot n} \sum_{j=1}^m \sum_{i=1}^n \sum_{k=1}^8 u_{ij}(s_{ij}, s_{ikjk}) / 8$$

Fig. 4

Payoff function of (i,j) -th player when we have to do with ONLY species 1

opponent player
(player: 1, 2, 3, 4, 6, 7, 8, 9)

	0	1
player 5 (i,j)	<div style="border: 1px solid black; padding: 5px; display: inline-block;"> $[-1, 0]$ </div> <div style="display: flex; align-items: center;"> <div style="margin-right: 10px;">↖</div> <div style="margin-right: 10px;">↘</div> <div>1*</div> </div>	<div style="border: 1px solid black; padding: 5px; display: inline-block;"> $[-1, 0]$ </div> <div style="display: flex; align-items: center;"> <div style="margin-right: 10px;">↖</div> <div style="margin-right: 10px;">↘</div> <div>1*</div> </div>
1	1	<div style="border: 1px solid black; padding: 5px; display: inline-block;"> $[1, 0]$ </div>

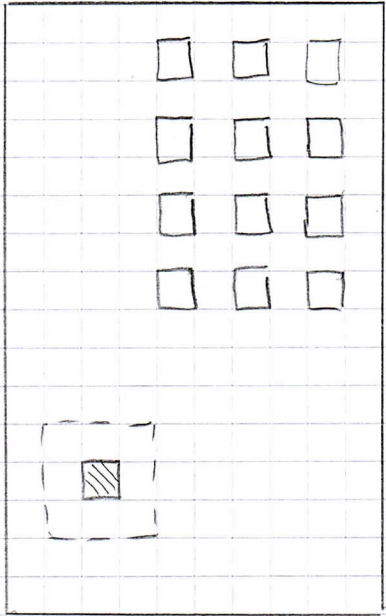
neighbor
D C

	D	C
player D	<div style="border: 1px solid black; padding: 5px; display: inline-block;">a</div> <div style="border: 1px solid black; padding: 5px; display: inline-block;">1</div>	<div style="border: 1px solid black; padding: 5px; display: inline-block;">b</div> <div style="border: 1px solid black; padding: 5px; display: inline-block;">1</div>
player C	<div style="border: 1px solid black; padding: 5px; display: inline-block;">1</div>	<div style="border: 1px solid black; padding: 5px; display: inline-block;">c</div>

see, GUI

Fig. 5b3:

CALCULATION OF PAYOFF FUNCTION

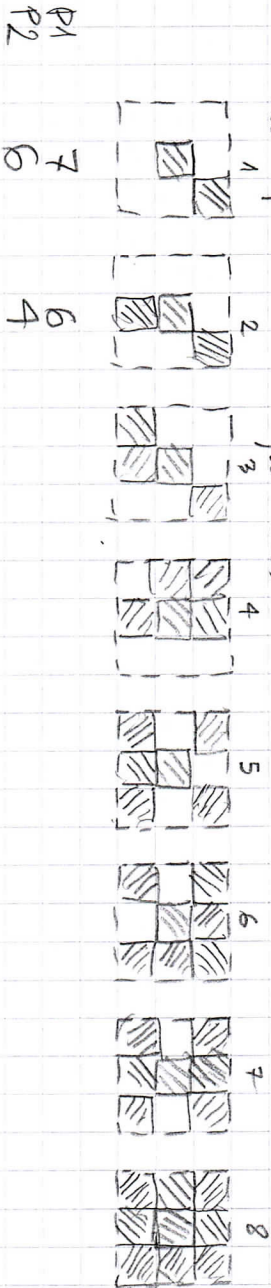


A central cell is ON

The set of correct neighborhoods: 1



The set of incorrect neighborhoods



$\left\{ \begin{array}{l} P1: a=b=c=0 \\ P2: a=b=c=-1 \end{array} \right\}$

central cell is ON
Algorithm to calculate
value of payoff function

Simulation parameters

(M+1) rows
 (N+1) cols
 p-init - C

Shorcup ☐

Competition-type
☐ loc-prop-nd
☒ loc-ldun

p-stdc-mut
 p-strcd-mut

seed
 num-of-iter
 num-of-expi

payoff function

neighbor

	D	C
D	<input type="text" value="a"/> <input type="text" value="1"/>	<input type="text" value="b"/> <input type="text" value="1"/>
C	<input type="text" value="1"/> <input type="text" value="1"/>	<input type="text" value="c"/> <input type="text" value="1"/>

START

Strategies

all-C
 all-D
 k-D
 k-C
 k-DC

k-const
 k-var

Species:

type 1 ☒
 type 2 ☒
 type 3 ☒

debug

☐ random initpl
☐ deterministic initpl
 Read CA states
 Read CA strategies

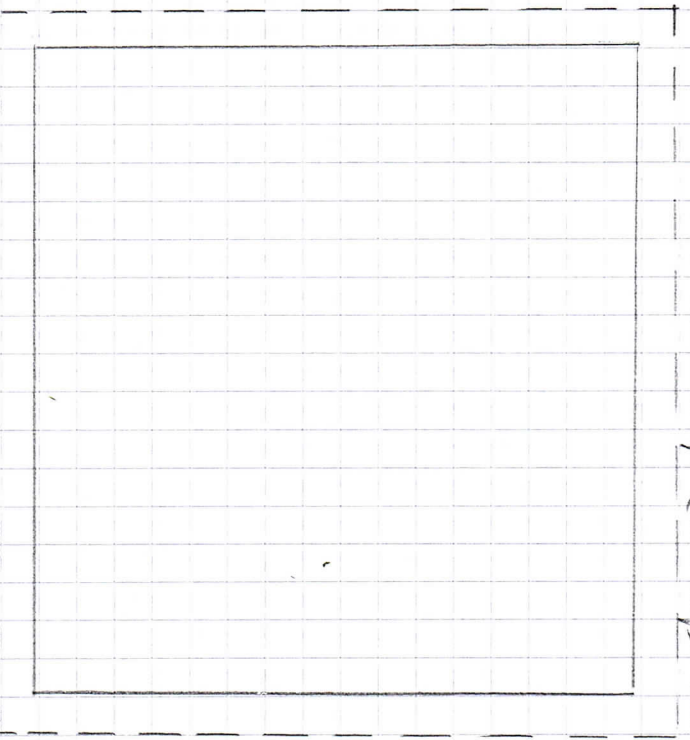
States

Strategies

CA strategy

KC strategy

KC and



iter stop

save statistics

start animation

stop animation

save pictures

GUI

STRATEGY MUTATION

Model strategy \rightarrow Resolving strategy

all-C \rightarrow all-D

all-D \rightarrow all-C

k-D $\xrightarrow[0.5]{0.5}$ all-D
 $\xrightarrow[0.5]{0.5}$ all-C

k-C $\xrightarrow[0.5]{0.5}$ all-D
 $\xrightarrow[0.5]{0.5}$ all-C
 $\xrightarrow[0.5]{0.5}$ k-D
 $\xrightarrow[0.5]{0.5}$ k-DC

k-DC $\xrightarrow[0.5]{0.5}$ all-D
 $\xrightarrow[0.5]{0.5}$ all-C
 $\xrightarrow[0.5]{0.5}$ k-D
 $\xrightarrow[0.5]{0.5}$ k-C