Artificial Life : Assignment # 1

Group # 1
Date: May 03, 2020

1. Stephen Abikoye, s6stabik@uni-bonn.de
2. Cüneyt Erem, s6cuerem@uni-bonn.de
3. Karim Baidar, s6kabaid@uni-bonn.de

$\Sigma = 10$

1] Weak artificial life creates a simulation of life with its properties, mechanism and structure

1

Strong artificial life creates an artificial living organism by combining nonliving materials and forms.

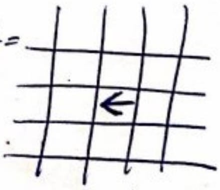
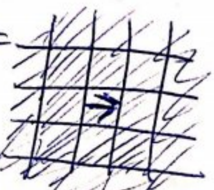
2] There are 3 phases that occur when Langton's Ant getting started on a white grid.

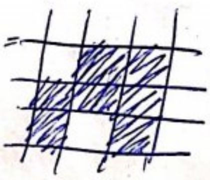
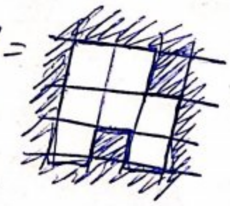
1 - symmetric growth = ant makes almost symmetric growth pattern up to 400 steps

1

2 - chaotic growth = ant makes almost deterministic chaotic pattern without regular path from 400 to 10,000 steps

3- highway = ant makes repetitive and continuous behavior from 10,000 steps to infinite.

3] We have case A =  and case B =  as mirrored ant positions and uniform white and black grids. After N steps (for ex ~~t~~=11), we have inverted colors and mirrored grid structure;

case A =  and case B = 

2

4.) $Z = K^L$

$L = K^{(2^*r+1)}$

$Z = K^{K^{(2^*r+1)}}$

$Z = 4^{4^{(2^*1+1)}}$ $(k=1, r=1)$

$Z = 4^{4^3}$

$Z = 4^{64} = 2^{128}$ possible rules.

(100 secs)

$= Z/100 \Rightarrow 2^{128}/100 = \underline{\underline{3.40 \times 10^{36}}}$ seconds.

1

5.) $d = 1$, $k = 2 = [0, 1]$

Sum(t)	3	2	1	0
$a_i(t+1)$	0	0	0	1

* All totalistic rules are legal, because they are Symmetric
* ~~It~~ and have a silent state.

$\Rightarrow$ Statement is false, because it is symmetric but it has no silent state.

1

6.) $150_D = 10010110$

Sum(t)	3	2	1	0
$a_i(t+1)$	1	0	1	0

0

$$a_i(t+1) = [a_{i-1}(t) + a_i(t) + a_{i+1}(t)] \text{ MOD } 2$$

$$= \left(\sum_{x=-1} a_i + x(t)\right) \text{ MOD } 2$$

Drawing missing

Scanned by CamScanner

Assignment #7: 2

a) A Rule is Symmeteric, if symmeteric neighborhood states map to the same cell state (for a 1-dim. cellular Automation, Symmeteric neigh. states = mirrored neigh'. states)

b) A Rule has a silent state, if the neighborhood with all cells in state 0 maps to State 0

c) A Rule is legal, if it is Symmeteric and has a silent state.

d) A Rule is totalistic, if neighborhoods with the same sum map to the same cell state, where the sum is typically defined as the number of "set" (= not in state 0) cells.

e) A rule is Peripheral, if neighborhood with same periphery map to the same cell state.

⇒ According to wolfram notation, a number N between 0 and 255 encodes a rule for a 1-dim cellular Automation with $r=1$, $k=2$ in the Following way:

⇒ if N has binary representation $N = b_7 \cdot 2^7 + \dots + b_0 \cdot 2^0$, then neighborhood state i maps to state b_i, where the eight possible neighborhood states are labeled with the numbers from 0-7 by interpreting them as binary number.

⇒ Converting the numbers to binary and interpreting them in this way, we get the rule tables corresponding to the wolframe numbers 0, 17, 42, 51, 110, 165, 204, 243.

⇒ From the table we can check whether each rule is symmeteric, legal, totalistic, or peripheral.

⇒ Legal = L, Symmeteric = S, Totalistic = T, Peripheral = P

150? 243?

	111	110	101	100	011	010	001	000	L	S	T	P
0	0	0	0	0	0	0	0	0	✓	✓	✓	✓
17	0	0	0	1	0	0	0	1				
42	0	0	1	0	1	0	1	0				
51	0	0	1	1	0	0	1	1		✓		
110	0	1	1	0	1	1	1	0				
165	1	0	1	0	0	1	0	1		✓		✓
204	1	1	0	0	1	1	0	0	✓	✓		

* Assignment #8 (AL)

Answer:

WolFrame's classification is having 4 behaviors of CAs as follow:

4 These classes are conveniently numbered in order of increasing complexity and each one has certain immediate distinctive features.

(1) class 1: Homogeneous:

The behavior is very simple and almost all initial conditions lead to exactly the same uniform final state.

(2) class 2: Periodic:

There are many possible different Final states, but all of them consist Just a certain set of simple structures that either remain same forever or repeat every Few steps.

2

(3) Class 3: Chaotic:

The behavior is more complicated and seems in many respects random. although triangles other small scale structures are essentially always at the same level seen.

(4) class 4: Complex patterns: This involves a mixture or order and randomness. Localize structures interact with each other in a very complicated way.