Simulation

Natural Computing Homework

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Document Preparation and Updates

Current Version [1.1.0]

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Revision History

Date	***Author***	***Version***	***Comments***
4/29/15	*Paul Blasi*	*1.0.0*	*Wrote down problem set.*
4/29/15	*Paul Blasi*	*1.1.0*	*Finished Chapter 9 Problems*

1

Fractals - Text Chapter 7

1.1 Problem 10

Implement a bracketed OL-system and reproduce all plant-like structures of Figure 7.24 in the text. Change some derivation rules and see what happens. Make your own portfolio with at least ten plants.

The first step to solving this problem was to gather the necessary test input. The parameters from Figure 7.24 in the text were summarized into Figure **??**. The images were created using the program developed for the problem.

IMAGE1 $t = 8, \delta = 22.5^\circ$ $\omega = G$ $G \rightarrow F + [[G] - G] - F[-FG] + G$ $F \rightarrow FF$	IMAGE2 $t = 4, \delta = 22.5^\circ$ $\omega = F$ $F \rightarrow FF + [+F - F - F] - [-F + F + F]$	IMAGE3 $t = 6, \delta = 22.5^\circ$ $\omega = G$ $G \rightarrow F[+FFG][G] - FG$ $F \rightarrow FF$
IMAGE4 $t = 9, \delta = 20^\circ$ $\omega = G$ $G \rightarrow F[-G]F[+G] - G$ $F \rightarrow FF$	IMAGE5 $t = 9, \delta = 25.7^\circ$ $\omega = G$ $G \rightarrow F[-G][+G]FG$ $F \rightarrow FF$	IMAGE6 $t = 5, \delta = 22.5^\circ$ $\omega = G$ $G \rightarrow FG[-F[G] - G][G + G][+F[G] +$ $F \rightarrow FF$

Figure 1.1: Reproduction of figure 7.24 in the text

1.2 Problem 15

Implement a recursive iterated function system (RIFS) to generate all the fractals whose codes are presented in Table 7.3 in the text.

Again, the first step was to reproduce the data needed for the problem. Table 7.3 from the text has been reproduced in Table ??

w	a	b	c	d[1]	e	f	p
1	0.5	0	0	0.5	1	1	0.33
2	0.5	0	0	0.5	1	50	0.33
3	0.5	0	0	0.5	50	50	0.34

Sierpinski Gasket

w	a	b	c	d	e	f	p
1	0.5	0	0	0.5	1	1	0.25
2	0.5	0	0	0.5	50	1	0.25
3	0.5	0	0	0.5	1	50	0.25
4	0.5	0	0	0.5	50	50	0.25

Square

w	a	b	c	d	e	f	p
1	0	0	0	0.16	0	0	0.01
2	0.85	0.04	-0.04	0.85	0	1.6	0.85
3	0.2	-0.26	0.23	0.22	0	1.6	0.07
4	-0.15	0.28	0.26	0.24	0	0.44	0.07

Barnsley Fern

w	a	b	c	d	e	f	p
1	0	0	0	0.5	0	0	0.05
2	0.42	-0.42	0.42	0.42	0	0.2	0.40
3	0.42	0.42	-0.42	0.42	0	0.2	0.40
4	0.1	0	0	0.1	0	0.2	0.15

Tree

Table 1.1: Reproduction of Table 7.3 from the text

1.3 Problem 21

Implement the random midpoint displacement algorithm in 3D and generate some fractal landscapes. Study the influence of H on the landscapes generated.

2

Cellular Automata - Chapter 7

2.1 Problem 1 (from slides)

Modify the heat flow example to deal with insulated conditions on the top and bottom boundary. Insulation means zero flux or u[N][j] = u[N-1][j]. This implies that instead of fixed valued ghost points on the top and bottom, you modify the CA rule using the previous relation.

2.2 Problem 2 (from slides)

Reproduce patterns theta, lambda, mu, and alpha in the Gray-Scott Model CA. You don't need to follow their color scheme.

3

ALife - Text Chapter 8

3.1 Problem 3

Choose one of the sample projects of StarLogo and solve its exploration tasks (`http://education.mit.edu/starlogo/projects.html`). Write a brief report with the results obtained including any theoretical background knowledge that may eventually be necessary to perform the exploration.

3.2 Problem 4

Implement a bi-dimensional CA following the rules of 'The Game of Life'.

4

DNA Computing - Text Chapter 9

4.1 Problem 1

Name four problems that cannot be solved by a Turing machine.

4.2 Problem 2

Name four NP-complete and four NP-hard problems.

Test

Table 4.1: 4 NP-complete problems

Test

Table 4.2: 4 NP-hard problems

4.3 Problem 5

The two most basic DNA sequencing techniques are known as a) Maxam-Gilbert and b) Sanger, after their proponents. Explain how each of these techniques work and contrast them.

A

Supporting Materials

Supporting ...

B

Code

Insert code here. You can use the listing environment or use doxygen.