Звіт з лабораторної роботи №1
за дисципліною "Елементи хаотичної динаміки"
студента групи ПА-17-2
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Постановка задачі

Розробити алгоритм, реалізуючий систему ітерованих функцій (СІФ) виду:

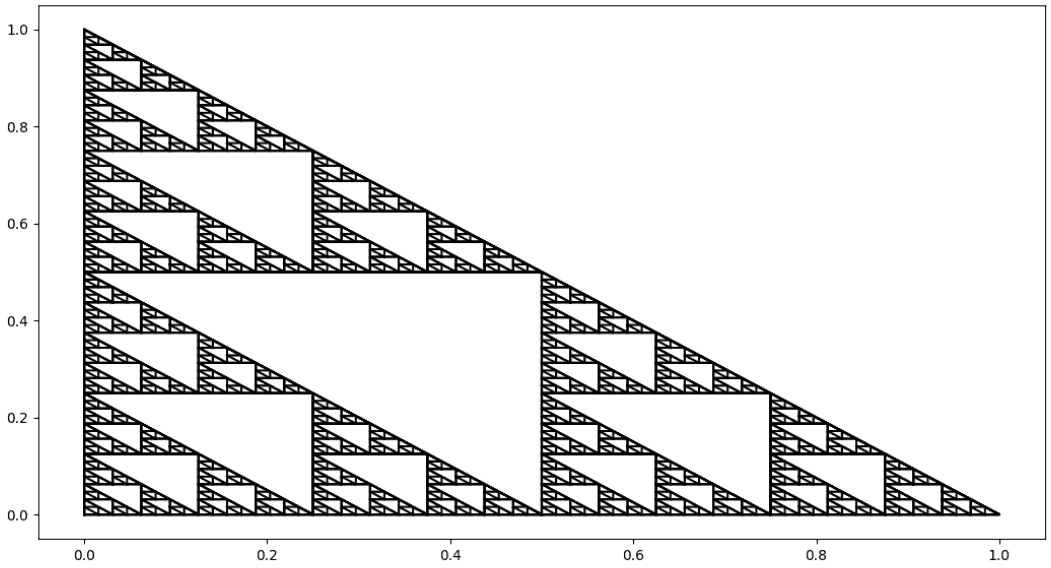
$$T_i(x) = \begin{pmatrix} a_i & b_i \\ c_i & d_i \end{pmatrix} \cdot x + \begin{pmatrix} e_i \\ f_i \end{pmatrix}; i = 1, \ldots, n.$$

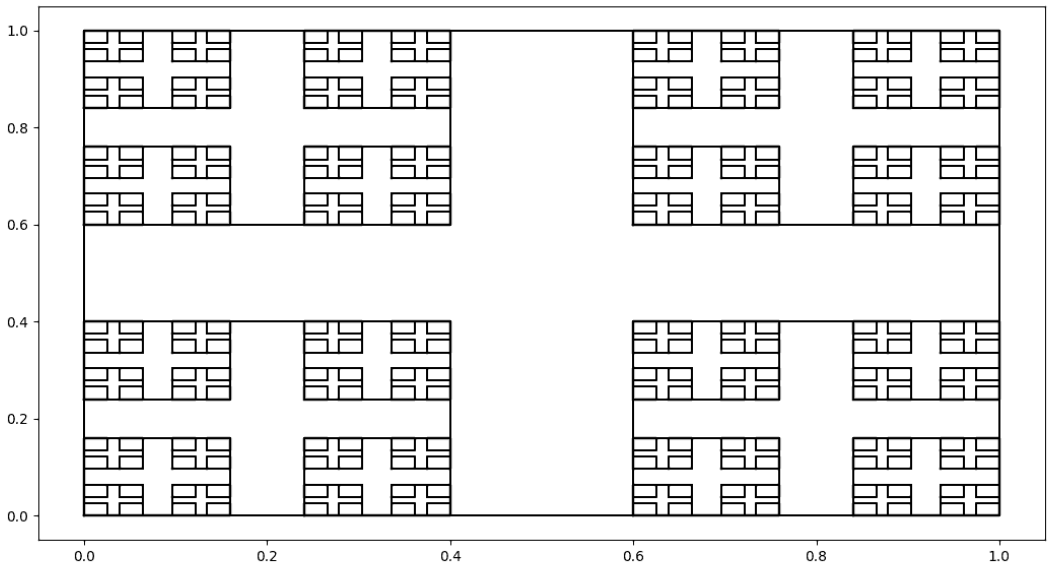
Для даних T, $i = 1, \ldots, n$ побудувати перетворення Хатчинсона

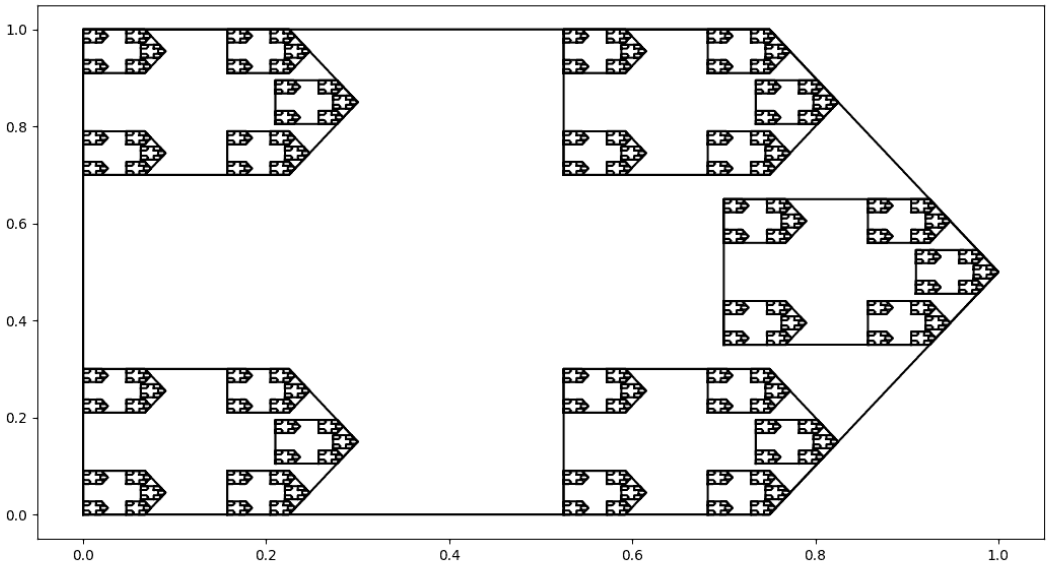
$$T(E) = T_1(E) \cup \ldots \cup T_n(E)$$

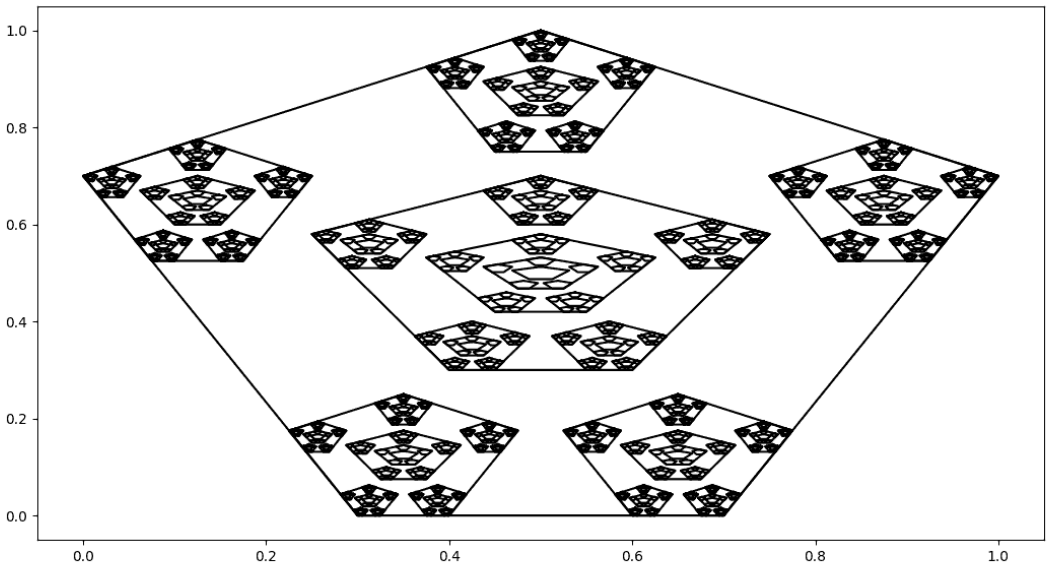
де коіфіцієнти стискання выдображенб T_i вибираються строго меншими за 1. У якості вихідної множини E можна взяти будь яку плоску обмежену фігуру (трикутник, квадрат, прямокутник).

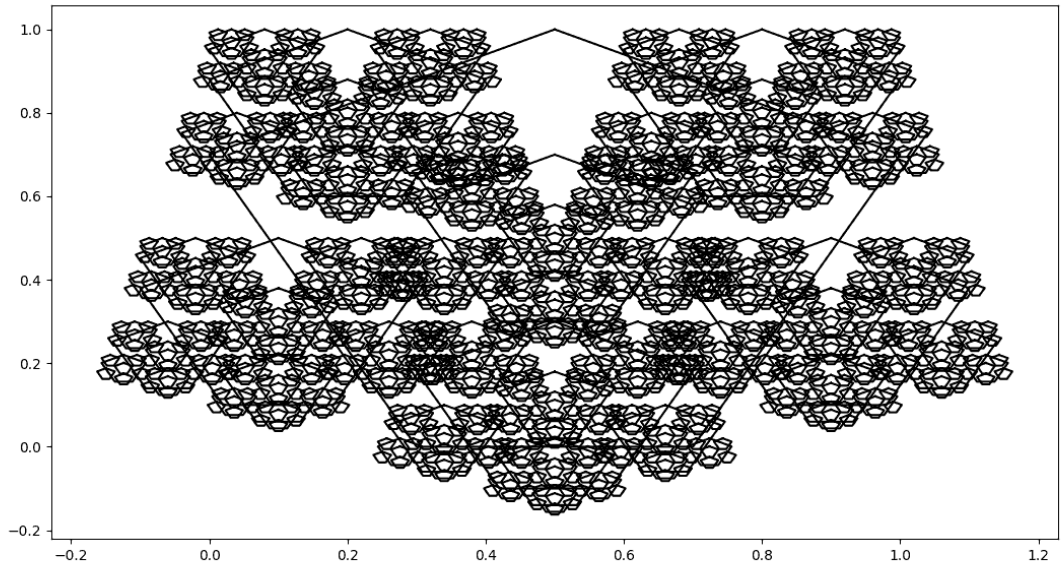
Ілюстрації фракталів


1.0
0.8
0.6
0.4
0.2
0.0
0.0
0.2
0.4
0.6
0.8
1.0


1.0
0.8
0.6
0.4
0.2
0.0
0.0
0.2
0.4
0.6
0.8
1.0


1.0
0.8
0.6
0.4
0.2
0.0
0.0
0.2
0.4
0.6
0.8
1.0


1.0
0.8
0.6
0.4
0.2
0.0
0.0
0.2
0.4
0.6
0.8
1.0



Код програми

```
#!/usr/bin/env python3

fractals = [
    [[ # TRIANGLES
        [[0.5,0], [0,0.5]], [0,   0  ]],
        [[0.5,0], [0,0.5]], [0.5, 0  ]],
        [[0.5,0], [0,0.5]], [0  , 0.5]],
    ], [[0,0], [1,0], [0,1], [0,0]], 6],
    [[ # QUADS
        [[0.4,0], [0,0.4]], [0,   0  ]],
        [[0.4,0], [0,0.4]], [0.6, 0  ]],
        [[0.4,0], [0,0.4]], [0  , 0.6]],
        [[0.4,0], [0,0.4]], [0.6, 0.6]],
    ], [[0,0], [1,0], [1,1], [0,1], [0,0]], 4],
    [[ # ARROW
        [[0.3,0], [0,0.3]], [0,     0   ]],
        [[0.3,0], [0,0.3]], [0.525, 0   ]],
        [[0.3,0], [0,0.3]], [0.7,   0.35]],
        [[0.3,0], [0,0.3]], [0,     0.7 ]],
        [[0.3,0], [0,0.3]], [0.525, 0.7 ]],
    ], [[0,0], [0.75,0], [1,0.5], [0.75,1], [0,1], [0,0]], 4],
    [[ # DANILA
        [[0.25,0], [0,0.25]], [0.225,  0    ]],
```

```
        [[[0.25,0], [0,0.25]], [0.525,  0    ]],
        [[[0.25,0], [0,0.25]], [0,      0.525]],
        [[[0.25,0], [0,0.25]], [0.75,   0.525]],
        [[[0.25,0], [0,0.25]], [0.75/2, 0.75 ]],
        [[[0.5 ,0], [0,0.4 ]], [0.5/2,  0.6/2]],
    ], [[0.5,1], [1,0.7], [0.7,0], [0.3,0], [0,0.7], [0.5,1],], 4],
    [[ # DANILA OUT
        [[[0.4,0], [0,0.4]], [ 0.3, -0.1]],
        [[[0.4,0], [0,0.4]], [-0.1,  0.1]],
        [[[0.4,0], [0,0.4]], [ 0.7,  0.1]],
        [[[0.4,0], [0,0.4]], [ 0.3,  0.3]],
        [[[0.4,0], [0,0.4]], [ 0.0,  0.6]],
        [[[0.4,0], [0,0.4]], [ 0.6,  0.6]],
    ], [[0.5,1], [1,0.7], [0.7,0], [0.3,0], [0,0.7], [0.5,1],], 4],
]

import matplotlib.pyplot as plt
import numpy as np

def arr(*args): return np.array(*args, dtype="float32")

def plot_fractal(shape, t, iterations):
    s = [shape]
    for i in range(iterations + 1):
        for j in s:
            plt.plot([k[0] for k in j], [k[1] for k in j], color="black")
        if i < iterations:
            s = [[l[0].dot(k) + l[1] for k in j] for l in t for j in s]
    plt.show()

for t, s, i in fractals:
    plot_fractal([arr(j) for j in s], [(arr(a), arr(b)) for a, b in t], i);
```