Лабораторная работа №3

Выполнил Казачинский Глеб, 3 курс **6** группа

Код программы:

```
1. def iteration(b, c):
2.     r = c[0] * b[0]
3.     for i in range(1, len(b)):
4.         r = int(r != c[i] * b[i])
5.
6.     for i in range(len(b) - 1):
7.         b[i] = b[i + 1]
8.
9.     b[-1] = r
10.    return b
11.
12.
13. def get_sequence(n, a, c):
14.    res = []
15.    b = a
16.    for i in range(n):
17.        res.append(b[0])
18.        b = iteration(a, c)
19.    return res
20.
21.
```

```
22. def lfsr(a, c):
23.     b = iteration(a, c)
24.     p = 0
25.     map_sequence_period = []
26.     result_sequence = []
27.     while b not in map_sequence_period:
28.         result_sequence.append(b[0])
29.         map_sequence_period.append(b.copy())
30.         b = iteration(b, c)
31.         p += 1
32.     return p, result_sequence
33.
34.
35. def geffe_generator(n, sequence_1, sequence_2, sequence_3):
36.     y = []
37.     for i in range(n):
38.         s1 = int(sequence_1[i] != sequence_2[i])
39.         s2 = int(((sequence_1[i] + 1) % 2) != sequence_3[i])
40.         y.append((s1 + s2) % 2)
41.     return y
42.
43.
44. def r(geffe_sequence, i):
45.     res = 0
46.     for j in range(len(geffe_sequence) - i):
47.         res += (-1) ** ((geffe_sequence[j] + geffe_sequence[j + i]) % 2)
48.     return res
49.
```

```
50.
51. a_1 = [0, 0, 1, 0, 0]
52. c_1 = [0, 1, 1, 1, 1]
53. period_1, sequence_1 = lfsr(a_1, c_1)
54. print('period_1:', period_1)
55. print('lfsr_1:', sequence_1)
56.
57. a_2 = [1, 0, 1, 0, 1, 1, 1]
58. c_2 = [1, 0, 1, 0, 0, 0, 1]
59. period_2, sequence_2 = lfsr(a_2, c_2)
60. print('period_2:', period_2)
61. print('lfsr_2:', sequence_2)
62.
63. a_3 = [0, 0, 1, 0, 1, 1, 0, 0]
64. c_3 = [1, 1, 1, 1, 0, 1, 0, 1]
65. period_3, sequence_3 = lfsr(a_3, c_3)
66. print('period_3:', period_3)
67. print('lfsr_3:', sequence_3)
68.
69. n = 10000
70. geffe_sequence = geffe_generator(n, get_sequence(n, a_1, c_1),
get_sequence(n, a_2, c_2), get_sequence(n, a_3, c_3))
71. print('geffe:', geffe_sequence)
72.
73. print('count zeros:', len([x for x in geffe_sequence if x == 0]))
74. print('count ones:', len([x for x in geffe_sequence if x == 1]))
75. for i in range(1, 6):
76.         print('r', i, ':', r(geffe_sequence, i))
```

Результат выполнения программы:

period_1: 5

lfsr_1: [0, 1, 0, 0, 1]

period_2: 63

lfsr_2: [0, 1, 0, 1, 1, 1, 1, 1, 1, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 1, 1, 0, 0, 0, 1, 0, 1, 0, 0, 1, 1, 1, 1, 0, 1, 0, 0, 0, 1, 1, 1, 0, 0, 1, 0, 0, 1, 0, 1, 1, 0, 1, 1, 1, 0, 1, 1, 0, 0, 1, 1, 0, 1]

period_3: 217

lfsr_3: [0, 1, 0, 1, 1, 0, 0, 0, 0, 1, 1, 1, 1, 0, 0, 1, 0, 0, 0, 0, 0, 1, 0, 1, 0, 0, 0, 1, 1, 1, 1, 1, 1, 0, 0, 1, 1, 1, 1, 0, 1, 0, 1, 0, 1, 1, 1, 0, 1, 0, 1, 1, 0, 0, 1, 1, 0, 1, 0, 0, 1, 1, 0, 1, 1, 1, 0, 1, 1, 0, 0, 0, 1, 0, 0, 1, 0, 1, 1, 0, 1, 1, 1, 1, 0, 0, 1, 1, 0, 1, 1, 0, 1, 0, 1, 0, 0, 1, 1, 0, 1, 0, 0, 1, 1, 0, 1, 1, 1, 0, 1, 1, 0, 0, 1, 0, 0, 1, 0, 1, 0, 0, 1, 0, 0, 1, 0, 0, 0, 1, 1, 0, 0, 0, 1, 1, 1, 0, 0, 0, 0, 1, 0, 0, 0, 0, 1, 0, 1, 1, 1, 1, 1, 0, 0, 0, 0, 0, 1, 1, 0, 1, 0, 1, 0, 0, 0, 0, 0, 0, 1, 0, 0, 1, 1, 0, 0, 0, 0, 0, 0, 0, 1, 1, 1, 0, 1, 1, 1, 1, 1, 1, 1, 0, 1, 0, 0, 1, 0, 1, 0, 1, 0, 1, 0, 0, 1, 1, 1, 0, 0, 1, 1, 0, 0, 1, 1, 1, 0, 1, 0, 0, 0, 1, 0, 0]

geffe: [1, 1, 1, 1, ..., 1]

count zeros: 5019

count ones: 4981

r 1 : 3

r 2 : -30

r 3 : 25

r 4 : 24

r 5 : -29

Вывод:

Реализовано 3 РСЛОС, на их основе генератор Геффе длительностью 1000 элементов. Построены статистики r. Наблюдаем баланс в соотношении единиц и нулей.