Laboratory 3

Introductory to analytic combinatorics course at Wroclaw University of Science and Technology 2020/2021

Deadline: 30.11.2020

Exercise 1 (3 points)

We generate a random 30 bits string. What is the expected number of occurrences of the hidden pattern *'000111'*?

To calculate expected number of occurrences we can calculate number of all 30-bit long strings is to calculate mean number of occurrences, which is described on page 55 of Analytic Combinatorics P. Flajolet

Let's start by setting some variables:
m is alphabet size (**|A|=2**),
k is hidden pattern length (**|p|=6**)
n is string length

In[•]:
```
m := 2
k := 6
n := 30
```

Now calculate number of words of length n

In[•]:
```
Omega[m_,n_]:= m^n
Omega[m,n]
```

Out[•]:
```
1 073 741 824
```

Then calculate number of words containing hidden pattern *'000111'* by taking series coefficient for OGF function:

In[•]:
```
myO[k_,m_] := z^k / (1 - m*z)^(k+1)
myO[k,m]
```

Out[•]:
$$\frac{z^6}{(1-2z)^7}$$

The ratio between the number of occurrences and the number of words of length n, can be calculated in two ways: