FEDERAL STATE AUTONOMOUS EDUCATIONAL INSTITUTION

OF HIGHER EDUCATION

ITMO UNIVERSITY

Report

on the practical task No. 1

“Experimental time complexity analysis”

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**Goal**

Experimental study of the time complexity of different algorithms

**Problems**

For each n from 1 to 2000, measure the average computer execution time (using timestamps) of programs implementing the algorithms and functions below for five runs. Plot the data obtained showing the average execution time as a function of n. Conduct the theoretical analysis of the time complexity of the algorithms in question and compare the empirical and theoretical time complexities.

**I.** Generate an n-dimensional random vector with non-negative elements. For , implement the following calculations and algorithms:

1. (constant function);
2. (the sum of elements);
3. (the product of elements);
4. supposing that the elements of are the coefficients of a polynomial 𝑃 of degree *n − 1*, calculate the value 𝑃(1.5) by a direct calculation of (i.e. evaluating each term one by one) and by Horner’s method by representing the polynomial as ;
5. Bubble Sort of the elements of ;
6. Quick Sort of the elements of ;
7. Timsort of the elements of .

**II.** Generate random matrices 𝐴 and 𝐵 of size 𝑛 × 𝑛 with non-negative elements.

Find the usual matrix product for 𝐴 and 𝐵.

**III.** Describe the data structures and design techniques used within the algorithms.

**Brief theoretical part**

**Results**

**Conclusion**

**Appendix**