

Matrix Chain Multiplication

Linear Algebra and Random Processes (CS6015) Assignment 2

1 Problem Statement

Given a chain $\langle A_1, A_2, \dots, A_n \rangle$ of n matrices, where matrix A_i ($i = 1, 2, \dots, n$) has the dimension $p_{i-1} \times p_i$, find the optimal sequence of pairings for multiplication of matrices A_1, A_2, \dots, A_n . Once the sequence of pairings for matrix multiplication is done, the matrix chain product can be calculated with the best computation cost.

2 Input

Chain $\langle A_1, A_2, \dots, A_n \rangle$ of n matrices, each of which is initialized with random numbers

Assumptions. The number of matrices in the sequence chain ($n > 10$), and the dimensions of the matrix in the chain p_i is such that $2 \leq p_i < 100$

3 Output

- Optimum pairing for calculating the product $A_1 A_2 \dots A_n$. An example output with $n = 4$ is $((A_1 A_2)(A_3 A_4))$
- Number of scalar multiplications to compute the given product $A_1 A_2 \dots A_n$ by performing pairing from left to right
- Computation time for calculating the product by performing pairing from left to right
- Optimum number of scalar multiplications to compute the product $A_1 A_2 \dots A_n$
- Computation time for calculating the product using optimal pairing

4 References

- Cormen, Thomas H., et al. Introduction to algorithms. MIT press, 2009. (Section 15.2)