Matrix Chain Multiplication

Time: 1 sec / Memory: 256 MB

Problem Statement

There are n matrices, $A_1, A_2, \cdots, A_n$, where $A_i \in \mathbb{R}^{a_i \times a_{i+1}}$ for all $1 \leq i \leq n$.

Your task is to find the optimal way to fully parenthesize the product

$$A_1 \times A_2 \times \cdots \times A_n$$

such that the total number of multiplications is minimized. Here we assume that, if we multiply two matrices with size $p \times q$ and $q \times r$, the number of multiplications required is $p \times q \times r$.

For example, if $(a_1, a_2, a_3, a_4) = (10, 30, 5, 60)$,
then A_1 is a 10×30 matrix, A_2 is a 30×5 matrix, and A_3 is a 5×60 matrix.

There are two ways to compute $A_1 \times A_2 \times A_3$, namely $(A_1 \times A_2) \times A_3$ and $A_1 \times (A_2 \times A_3)$.

The former way $(A_1 \times A_2) \times A_3$ needs

$$(10 \times 30 \times 5) + (10 \times 5 \times 60) = 1500 + 3000 = 4500$$

multiplications, while the latter way $A_1 \times (A_2 \times A_3)$ needs
$(30 \times 5 \times 60) + (10 \times 30 \times 60) = 9000 + 18000 = 27000$ multiplications.

Hence the optimal way is $(A_1 \times A_2) \times A_3$.

Input

The first input line contains an integer n: the number of matrices.
The second input line contains $n + 1$ integers $a_1, a_2, \cdots, a_{n+1}$.

Output

In the first line print one integer: the minimum number of multiplications.

In the second line print one of such optimal ways.

Note that the output must be fully-paranthesized.

Constraints

$2 \le n \le 200$

$1 \le a_i \le 200$

Example

Input 1:

```
3
10 30 5 60
```

Output 1:

```
4500
(((A1)(A2))(A3))
```

Input 2:

```
4
5 1 3 4 2
```

Output 2:

```
30
((A1)(((A2)(A3))(A4)))
```