# Dynamic Programming: Matrix Chain Multiplication

**Description** In this assignment you are asked to implement a dynamic programming algorithm: matrix chain multiplication (chapter 15.2), where the goal is to find the most computationally efficient matrix order when multiplying an arbitrary number of matrices in a row. You can assume that the entire input will be given as integers that can be stored using the standard C++ `int` type and that matrix sizes will be at least 1. You will use Grade06 to grade your code. Your execution file name must be "MatrixChain.exe". Refer to the previous lab assignments for instructions on how to use the grading tool.

**Input** The input has the following format. The first number, $n \geq 1$, in the test case will tell you how many matrices are in the sequence. The first number will be then followed by $n + 1$ numbers indicating the size of the dimensions of the matrices. Recall that the given information is enough to fully specify the dimensions of the matrices to be multiplied.

**Output** First, you need to output the minimum number of scalar multiplications needed to multiply the given matrices. Then, print the matrix multiplication sequence, via parentheses, that minimizes the total number of number multiplications. Each matrix should be named A#, where # is the matrix number starting at 0 (zero) and ending at $n - 1$. See the examples below.

**Examples of input and output**

```
2
2 3 5
30
(A0A1)

3
10 100 5 50
7500
((A0A1)A2)

3
10 30 5 60
4500
((A0A1)A2)

6
30 35 15 5 10 20 25
15125
((A0(A1A2))((A3A4)A5))
```

**Submission** As usual, before the posted deadline, submit a .zip or zipped tar archive of your program through the assignments page of CatCourses. Please use your UCMNetID as the filename for the zipped archive. Be careful since CatCourses strictly enforces the assignment deadline. Recall that submission alone is not enough, you must present your work to your TA before submission.

**Important Reminder** Never change the grading scripts of the files under the "testfiles" folder. If you do so, it will be considered as SERIOUS CHEATING.