***Dynamic Programming Principle***

***Background:***

Although we had focused on solving two problems by using Dynamic Programming, but we still can not figure out when to use Dynamic Programming.

This Chapter would discuss two basic Elements when using Dynamic Programming to solve the Best Optimization Problem: *Best Sub - Structure* and *Overlapping Sub - Question*. *Also we will continue to discuss the Memo Method, and go deeper into How to use the overlapping feature best with the help of Memo Method.*

***Best Sub - Structure:***

The first step of solving the Best Optimization Problem by using Dynamic Programming it to describe the Structure by Best Solution. Two Problems all have the Best Sub-Structure. *(Matrix Chain Multiplication and Dynamic Programming Introduction)*

*One Normal Principle when try to find the Best Sub-Structures:*

1. To Solve the Best Sub-Structure is to make one choice, to choose the first Cutting Location for Steel, and choose the Division Location for the Matrix Chain Multiplication. The result of this kind of Selection would bring one or more Problems which need to be solved.
2. For the Given Problem, in the possible first step, you already know which choice can get the Best Solution. But now do not need to care how to get the Best Solution, just assume that we already get this kind of solution.
3. Given the specific Selection which can get Best - Solution, then you will make sure how many solutions must be generated, and how to describe the Sub - Problem Space.
4. Using ‘Cut - and - Paste’ technology to prove that the Solution of the Part of Original Solution, each solution of the problem is itself’s solution.

Th Good Experience to describe the Sub - Problem is to try to keep the Sub - Problem Space as simpler as it could be, only needs to enlarge it when necessary.

*For different problems in different ranges, the different of Best Sub - Structure has two different sides:*

1. *How many Sub - Problems have been involved in the Original Problem.*
2. *How many choices need to be considered when we make sure one Sub - Problem.*

*First Question:*

* Cutting Pattern of the length of n Steel, make sure how many Sub - Problems in the Original Problem.
* Figure out how many Best Choices in the n - j Steel Cutting Question.

*Second Question:*

* Matrix Chain Multiplication Ai\*Ai+1...Aj-1\*Aj, there have two Sub - Problems, we need to figure out the Best Solution of Ai\*Ai+1...Ak and Ak+1\*Ak+2...Aj, and both Sub - Problems need to solve the Best Solution.
* Once figure out the Best Solution of Sub - Problem, then we can get the value of k among j - i choices.

***Tricky Points:***

***Overlapping Sub - Question:***

***Re - Construction of Best Solution:***

***Memo:***