**Dafuq is dynamic programming?**

Basically the divide and conquer method, except the results of solved subproblems are stored and used to check if other subproblems have already been resolved instead of computing duplicate subproblems.

**Optimal solutions:**

When solving a problem, there exist multiple solutions. Each solution is represented by some value (basically, the output). The most optimal solutions are the ones the lead to either the greatest or lowest value possible. Whether you should aim for min or max is contextual. For example, if you need to find a solution that gives you a score, you generally want the highest score possible, while if the solution gives some measurement of speed, say for a car, you generally want the lowest time possible.

To make an algorithm that finds the most optimal solution, the following steps serve as great guidelines:

1. Characterize the structure of an optimal solution.
2. Recursively define the value of an optimal solution.
3. Compute the value of an optimal solution, typically in a bottom-up fashion.
4. Construct an optimal solution from computed information.

The first 3 steps serve as the core for algorithms designed to find optimal solutions, but on their own can only help find the value of it. If you include step 4 you can also make the algorithm actually define the solution, however this may require that you maintain extra information during step 3.

**Rod cutting example problem.**

You have a company that sells rods. They charge based on length. Longer rods = greater price per inch. Find the optimal solution.

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| length i | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Price Pi | 1 | 5 | 8 | 9 | 10 | 17 | 17 | 20 | 24 | 30 |

As can be seen in the table above, the price increases erratically with the length of the rod. Granted, even if it did not, that would just mean the optimal solution would be different, despite the problem technically being the same. It should be noted that a rod of length I can be cut up in different ways.