DYNAMIC PROGRAMMING-3

This last document on dynamic programming deals with using dynamic programming with bitmasking. Bitmasking essentially consists of manipulating bits using dynamic programming approach. The reader is suggested to first read about bitwise operations from the following article: bitwise operations.

Bitmasking can be used in a variety of ways not only in dynamic programming but for representation of a situation. For example you have a set containing n integers and you want to list down all its subsets. One way to do it to call a function recursively that prints all the subsets. Another easy to understand iterative approach is to represent each subset with an integer. For example a subset $\{1, 3\}$ of a set $\{1, 2, 3, 4\}$ can be represented in a binary form as 1010 where 1 corresponds to the index of the element which is taken in the subset and 0 corresponds to elements which is not taken in the subset. So, here 1 is at position 1 and 3 (counting from left) which are the elements we took in the subset. The decimal value of 1010 is 10. Now consider all integers from 0 to $2^n - 1$. Convert every such integer into its binary representation and find its corresponding subset. You will notice that every possible subset of an n sized set has been listed.

Now you see, this is the basic idea of using bitmasking. Every integer (generally named as $mask$) when converted to binary representation corresponds to a particular subset.

Here are some articles and problems you can go through:

- hackerearth tutorial
- Sos dynamic programming
- Problem-1
- Problem-2

- Problem-3