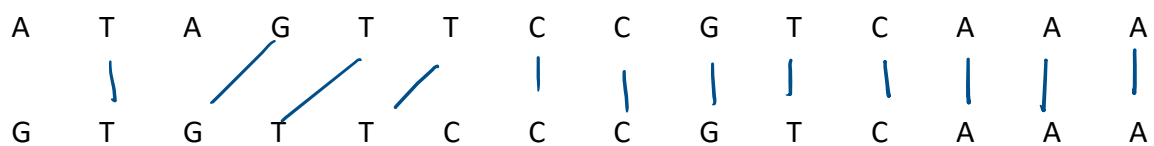# Assignment: Dynamic Programming

1. **Solve a problem using top-down and bottom-up approaches of Dynamic Programming technique**

   DNA sequence is made of characters A, C, G and T, which represent nucleotides. A sample DNA string can be given as 'ACCGTTTAAAG'. Finding similarities between two DNA sequences is a critical computation problem that is solved in bioinformatics.

   Given two DNA strings find the length of the longest common string alignment between them (it need not be continuous). Assume empty string does not match with anything.

   Example: DNA string1: ATAGTTCCGTCAAA   ;   DNA string2: GTGTTCCCGTCAAA

A	T	A	G	T	T	C	C	G	T	C	A	A	A
G	T	G	T	T	C	C	C	G	T	C	A	A	A

   Length the best continuous length of the DNA string alignment: 12 (TGTTCCGTCAAA)

   a. Implement a solution to this problem using Top-down Approach of Dynamic Programming, name your function **dna_match_topdown(DNA1, DNA2)**
   b. Implement a solution to this problem using Bottom-up Approach of Dynamic Programming, name your function **dna_match_bottomup(DNA1, DNA2)**
   c. Explain how your top-down approach different from the bottom-up approach?
   d. What is the time complexity and Space complexity using Top-down Approach
   e. What is the time complexity and Space complexity using Bottom-up Approach
   f. Write the subproblem and recurrence formula for your approach. If the top down and bottom-up approaches have the subproblem recurrence formula you may write it only once, if not write for each one separately.
   Name your file **DNAMatch.py**

2. **Solve Dynamic Programming Problem and Compare with Naïve approach**
   You are playing a puzzle. A random number N is given, you have blocks of length 1 unit and 2 units. You need to arrange the blocks back to back such that you get a total length of N units. In how many distinct ways can you arrange the blocks for given N.
   a. Write a description/pseudocode of approach to solve it using Dynamic Programming paradigm (either top-down or bottom-up approach)
   b. Write pseudocode/description for the brute force approach
   c. Compare the time complexity of both the approaches
   d. Write the recurrence formula for the problem

   Example 1:

   Input: N=2, Result: 2

   Explanation: There are two ways. (1+1 , 2)

Example 2:

Input: N=3, Result: 3

Explanation: There are three ways (1+1+1, 1+2, 2+1)