Assignment2-PS4-[ASSIGNMENT PROBLEM]

Contributors:

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Contributions from each team member has been equal. Each team member was involved in discussing and devising designs to solve the problem with dynamic programming technique and coding and testing the program

Problem:

There are N topics and N students (N =11). The topics need to be assigned to students such that the preferences specified by students in the inputPS4.txt is satisfied. All the possible combinations with such preference constraint is to be counted and displayed as the final answer

Design considerations:

1. Brute force approach: Complexity O(N!) (N factorial)

* We can have a N x N matrix assignment[N][N] and try generating all the combinations of assignments that is possible and conditionally excluding the ones which do not satisfy the preferences given
* The complexity of such an approach would be : O(N!) (N factorial) which is pretty high

1. Dynamic programming: Complexity: O()

* The above problem can be solved using dynamic programming and bitmasks in a better way compared to the brute force approach
* Suppose that assignment state is (mask, i) where i represent the ith student and 0 to i-1 student have been assigned already and ith bit in mask represents whether the topic has been assigned to the student or not.
* Now the i+1 th assignment can be (mask | 1<< i, i+1) ways.
* So, the subproblems can add up recursively and using caches when necessary to present us with the total combinations.
* There are “n” calls for each topic(complexity n), with a loop for “n” students (complexity n) and the loop in turn makes a recursive call (complexity 2^n)
* So, the implemented code complexity is n\*n\*2^n , that is O(n^2 2^n). O()

Approach chosen and Complexity:

* Dynamic programming with bitmasks , O()