CS21003 ALGORITHMS-1
Tutorial 8 Solution: Hash Tables
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1 Subarray Sum K

There are three steps:

1. Create cumulative sum array where ith index in this array represents total sum from 1 to ith index element.
2. Iterate all elements of cumulative sum array and use hashing to find two elements where,
value at ith index - value at jth index = K, but i != j.
3. If element is not present in hash, fill hash table with current element.

2 Anagram group

Brute Force Solution:

Sort the strings and then compare them for equality

Hashing Solution:

Generate a Hash value for each string and compare them

The Hash value for a string could be a simple function which adds up the ASCII value of each character.

3 Guess the number of students

The key observation here is that if a group of students have same marks, then all of them must answer the same(Example. If exactly 5 students get 100 marks, then if any one of them answers to you, they'll say that 4 other students have same marks as them)

So, if all X students who got same marks answer to you, then you will have X students answering X-1. But, if you have more than X students who answer X-1, then you need to consider them in a different group.

Example:

Student answers — Possible groups (Students with same group Id are in the same group

[2, 2] — [0, 0]

[2, 2, 2] — [0, 0, 0]

[2, 2, 2, 2] — [0, 0, 0, 1]

In the third case, first three students have the same marks and the fourth student has different marks and other two students who had same marks as the fourth student haven't answered to you.

4 Two integer sum

First store the elements of the array into a hash table. Then iterate over each element A_i and check if it's compliment i.e. K - A_i is present in the hash table. One implementation detail is to verify that compliment and A_i are different

The solution uses two iterations over the array. Think of some approach which uses only one iteration.

Bonus 1: Hint: Store sum of pair of numbers A_i and A_j in the hashmap

5 Flip the switch

Lets denote off light by 0 and on light by 1. Now, suppose a row of lights was R1 = [0, 0, 1, 0, 1]. Then to make all lights of the row turn on, we must flip the 1st, 2nd and 4th column. To make all lights of the row turn off, we must flip 3rd and 5th column.
Now consider the compliment row i.e. R2 = [1, 1, 0, 1, 0]. If we make all lights of R1 turn on, then all lights of R2 will turn off. This is the important observation for solving this question.
Convert each row to a string of ones and zeros. Maintain a hashtable and insert each row and its count in the hash table. Then, iterate over each row and if S rows are same as the current row and C rows are compliment of the current row, the maximum number of rows which can be turned on or off if we consider current row as all on or all off is S + C. You have to find maximum of S + C over all rows.