8. LC 39. Combination Sum

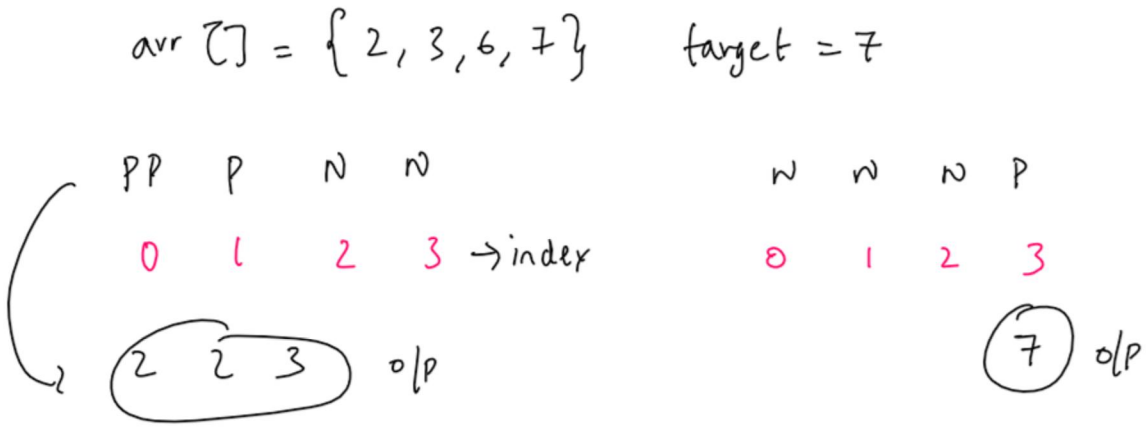
Given an array of **distinct** integers `candidates` and a target integer `target`, return *a list of all **unique** **combinations** of `candidates` where the chosen numbers sum to `target`*. You may return the combinations in **any order**.

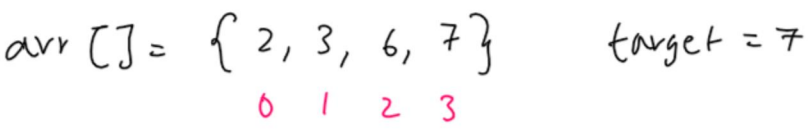
The **same** number may be chosen from `candidates` an **unlimited number of times**. Two combinations are unique if the frequency of at least one of the chosen numbers is different.

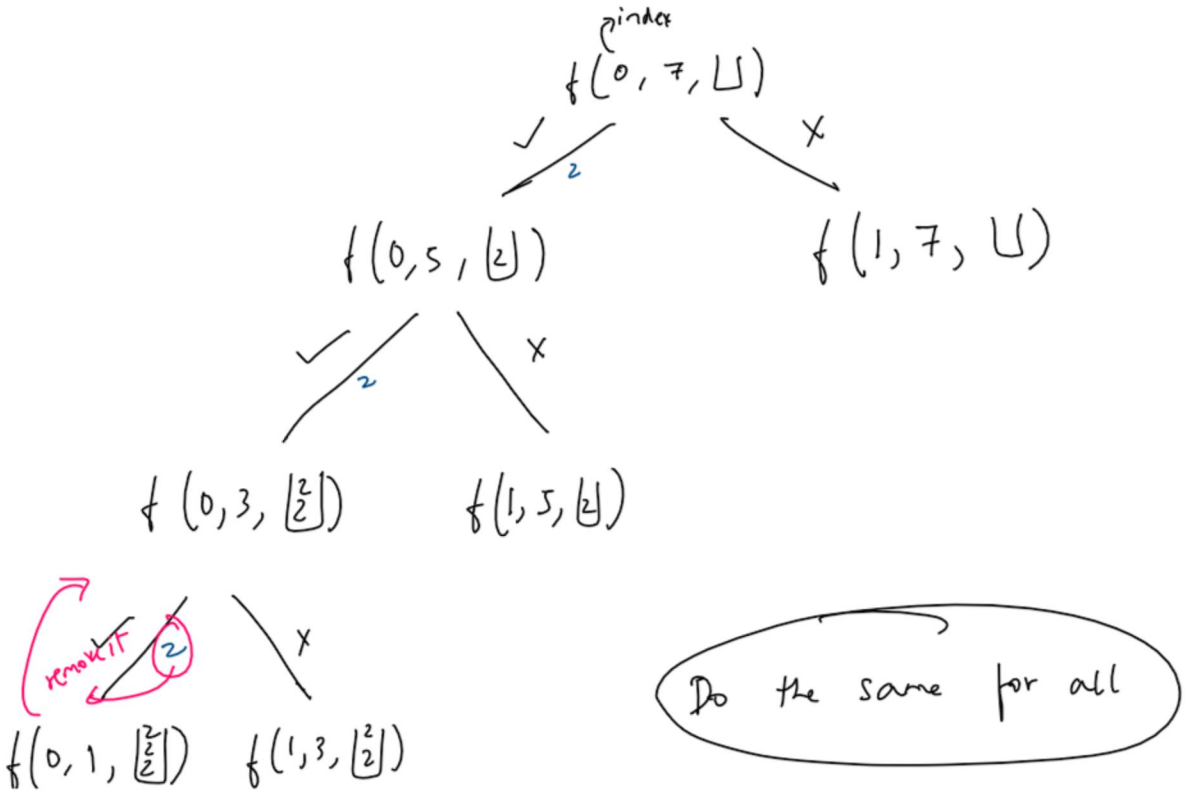
It is **guaranteed** that the number of unique combinations that sum up to `target` is less than `150` combinations for the given input.

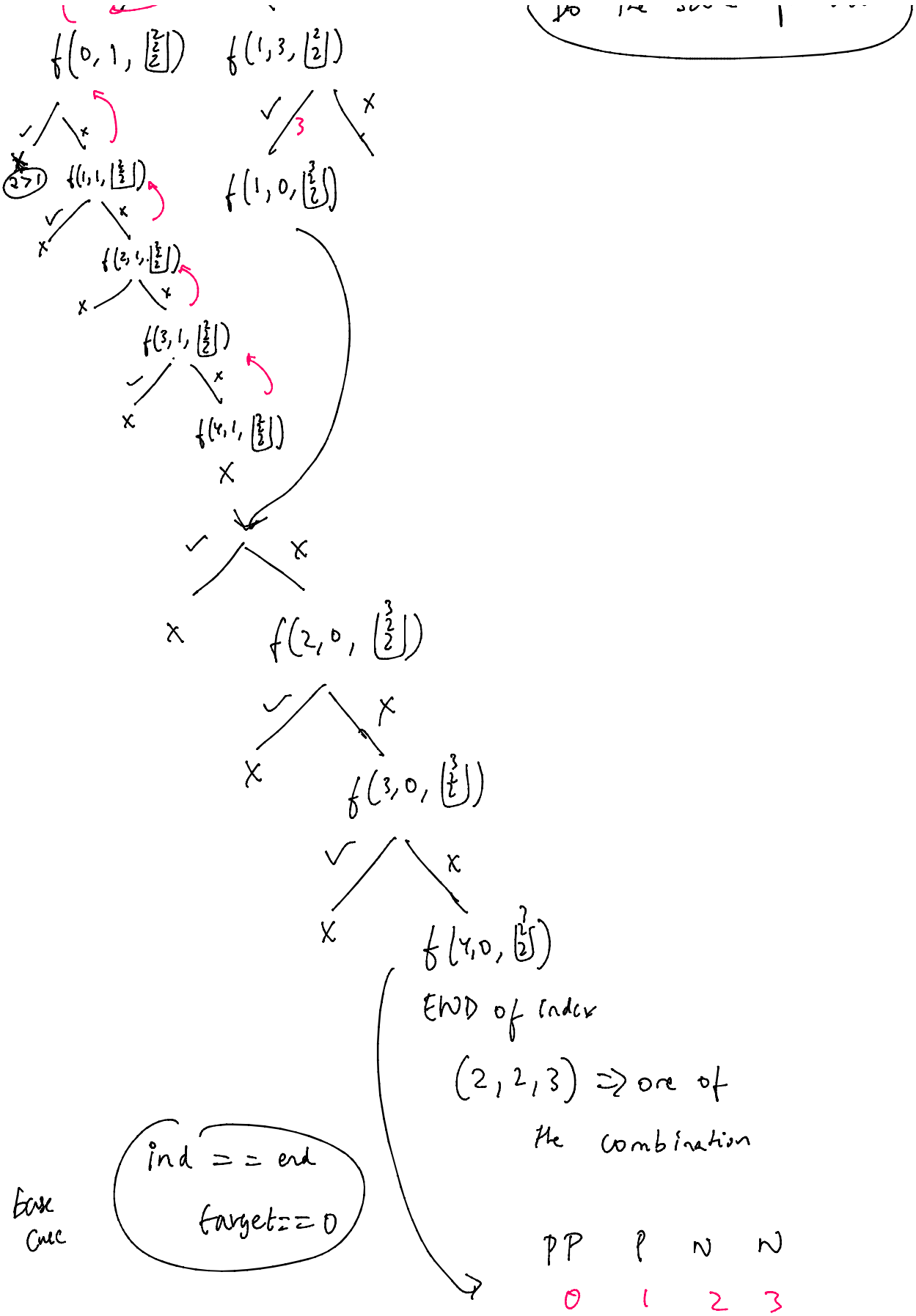
Example 1:

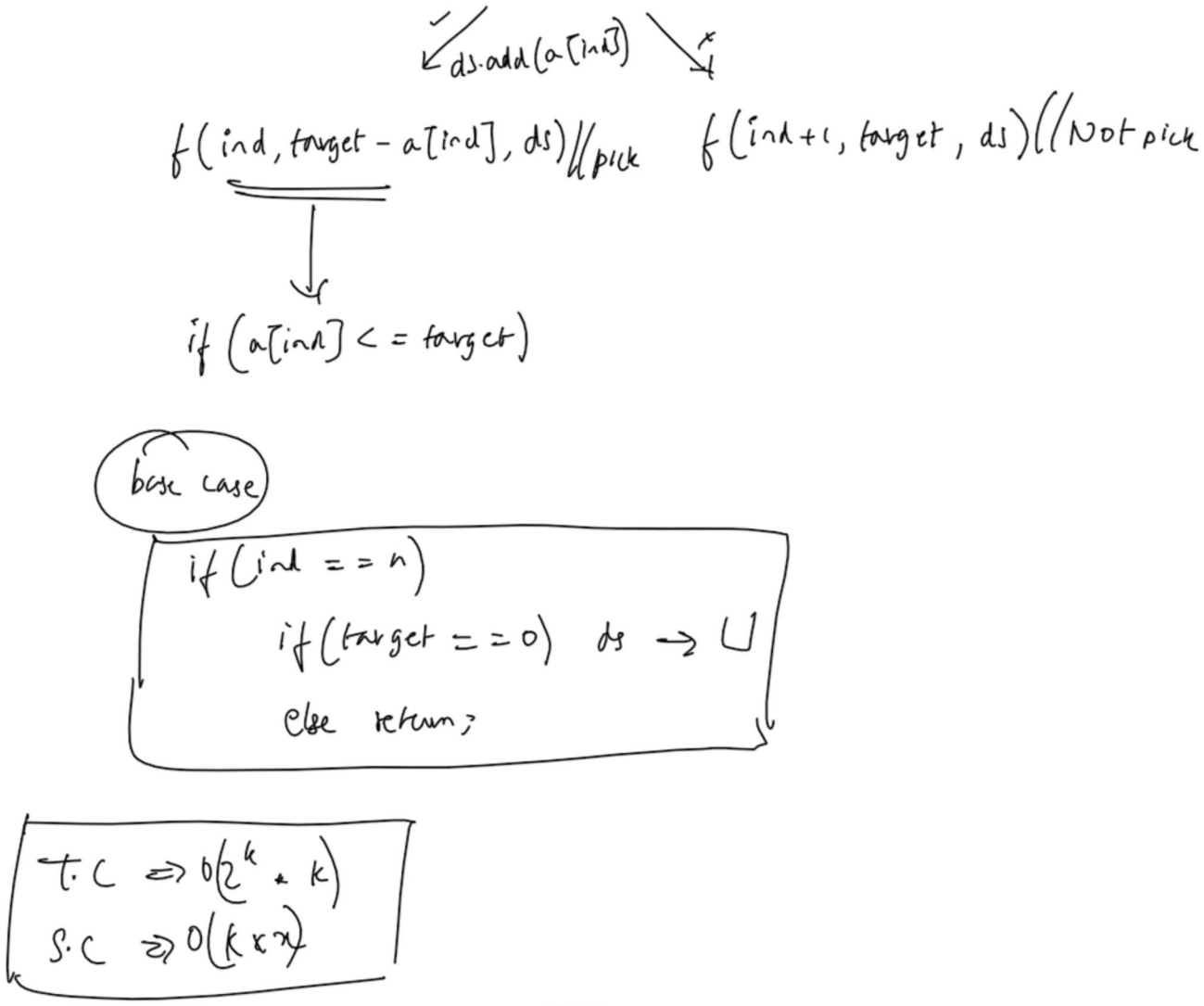
```
Input: candidates = [2,3,6,7], target = 7
Output: [[2,2,3],[7]]
Explanation:
2 and 3 are candidates, and 2 + 2 + 3 = 7. Note
that 2 can be used multiple times.
7 is a candidate, and 7 = 7.
These are the only two combinations.
```








f(0, 1, [2/2])
f(1, 3, [2/2])
f(1, 0, [3/2])
f(2, 0, [3/2])
f(3, 0, [3/1])
f(4, 0, [3/2])
END of index
(2, 2, 3) ⇒ one of the combination
ind == end
target == 0
Base Case
PP P N N
0 1 2 3
f(ind, target, ds)




```java
class Solution {
    private void findCombination(int ind, int[] arr, int target, List<List<Integer>> ans, List<Integer> ds){
        // base case
        if(ind == arr.length){
            if(target == 0){
                ans.add(new ArrayList<>(ds));
            }
            return;
        }
        //pick condition
        if(arr[ind] <= target){
            ds.add(arr[ind]);
            findCombination(ind, arr, target - arr[ind], ans, ds);
            ds.remove(ds.size() - 1); //backtrack
        }
        // not pick condition
        findCombination(ind + 1, arr, target, ans, ds);
    }

    public List<List<Integer>> combinationSum(int[] candidates, int target) {
        List<List<Integer>> ans = new ArrayList<>();
        // new ArrayList<>() in findCombinatin is empty ds as we start with empty ds
        findCombination(0, candidates, target, ans, new ArrayList<>());
        return ans;
    }
}
```

```
class Solution {
public:
    void findCombination(int ind, int target, vector<int> & arr, vector<vector<int>> &ans, vector<int> &ds){
        if(ind == arr.size()){
            if(target == 0){
                ans.push_back(ds);
            }
            return;
        }
        //pick up
        if(arr[ind] <= target){
            ds.push_back(arr[ind]);
            findCombination(ind, target - arr[ind], arr, ans, ds);
            ds.pop_back();
        }
        //not pick-up
        findCombination(ind + 1, target, arr, ans, ds);
    }
```

```
public:
    vector<vector<int>> combinationSum(vector<int>& candidates, int target) {
        vector<vector<int>> ans;
        vector<int>ds;
        findCombination(0, target, candidates, ans, ds);
        return ans;
    }
};
```