Problem for Online on Greedy Algorithm for Section B1
Fractional Knapsack Problem

The Problem:

You are given a set of items each having a weight and a value and a knapsack with a fixed weight capacity. Now your task is to pick/put items in the knapsack such that total value of the picked items in the knapsack is maximized. You are allowed to pick fraction of an item in case its full weight cannot be accommodated in the knapsack. Hence, this problem is called 'Fractional Knapsack' problem.

The Greedy Solution:

Fractional knapsack problem is solvable by greedy strategy. The basic idea is to calculate for each item the value per unit weight and then iteratively pick the item with the highest value per unit weight. If the next item cannot be taken as a whole, add as much as you can (fraction) of the item.

The Input:

The first line of the input contains an integer '*t*' representing the number of test cases. Then '*t*' test cases follow. Each test case has the following form:

- Line 1: A single integer, *N* representing the number of items to choose from
- Lines 2: Space separated *N* integers representing the weights of the *N* items;
- Lines 3: Space separated *N* integers representing the values of the *N* items;
- Line 4: A single integer, *C* representing the capacity of the knapsack

The Output

For each test case, there will be three lines of output. The lines will be as per following format:

- Line 1: Maximum value achieved
- Lines 2: Space separated *k* integers representing the index of the items where *k* represents the number of items picked by your solution. Assume the starting index *1*. Print the indices in the order they are picked.
- Lines 3: Space separated *k* values representing the weight picked for the item;

Sample Input:	**Sample Output**
2 4 10 20 30 40 40 30 20 10 45 7 100 12 50 20 50 35 25 150 20 55 80 100 60 90 200	80 1 2 3 10 20 15 4 1 3 4 7 5 6 2 1 20 25 50 35 12 42

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1. Solve the fractional knapsack problem using greedy algorithm as you have done in the online using HEAP data structure to extract the item with maximum value/weight ration. The heap should be constructed in O(N) time.

2. Submit a **hand written** report with the following components:

a) Problem description
b) Data structure used
c) Pseudo code of the algorithm
d) Proof of correctness
e) Analysis of running time