F. T-shirts
https://codeforces.com/contest/702/problem/F

Input:
8
30 3
22 3
22 16
30 16
15 9
10 12
30 7
15 10
9
10 40 50 10 70 20 25 10 35

Algorithm:

T-shirts:

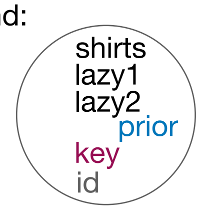
cost →	22	30	10	15	15	30	22	30
quality →	16	16	12	10	9	7	3	3

sorted by descending order of quality and ascending order of price

Customers:

money →	10	40	50	10	70	20	25	10	35
id →	0	1	2	3	4	5	6	7	8

Legend:



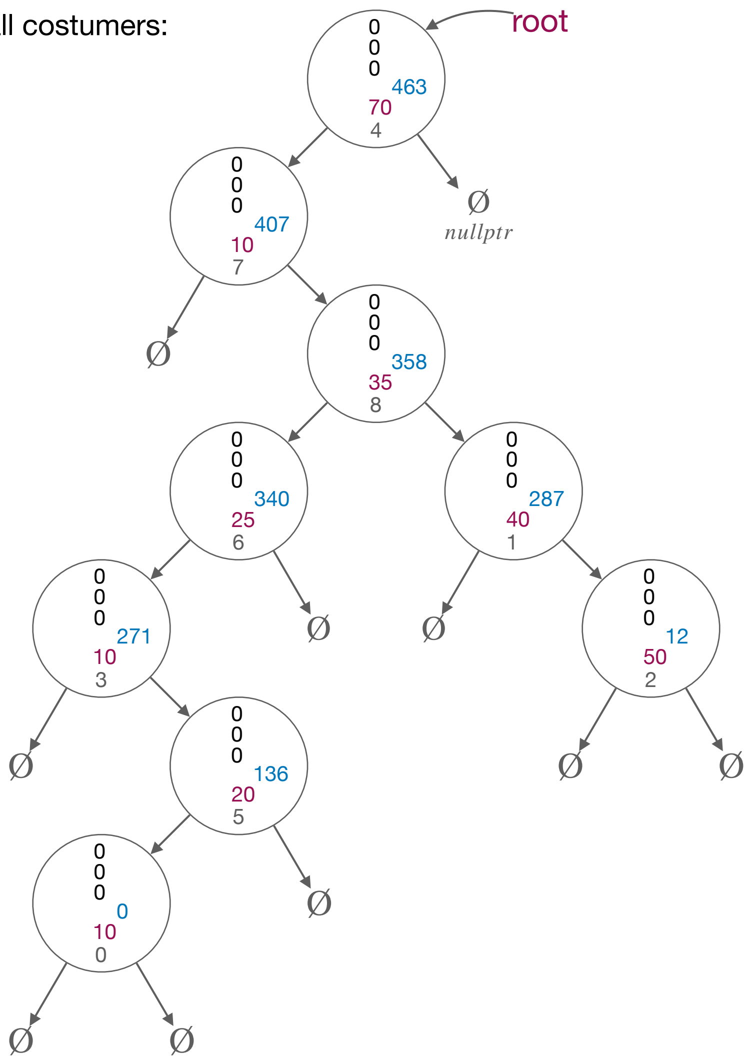
shirts = number of T-shirts purchased from a customer with identification number id;
lazy1 = money to be spent on T-shirts;
lazy2 = number of T-shirts to be purchased;
prior = a random number that keeps the tree balanced;
key = costumer's money;
id = customer's identification number.

To generate random numbers for the nodes of the Treap we use srand(489) when the Treap is initialized and rand()%489 at the initialization of each Treap's node.

We will create a Treap from all the customers using their money as key. After inserting all costumers, the Treap will look the following way shown below:

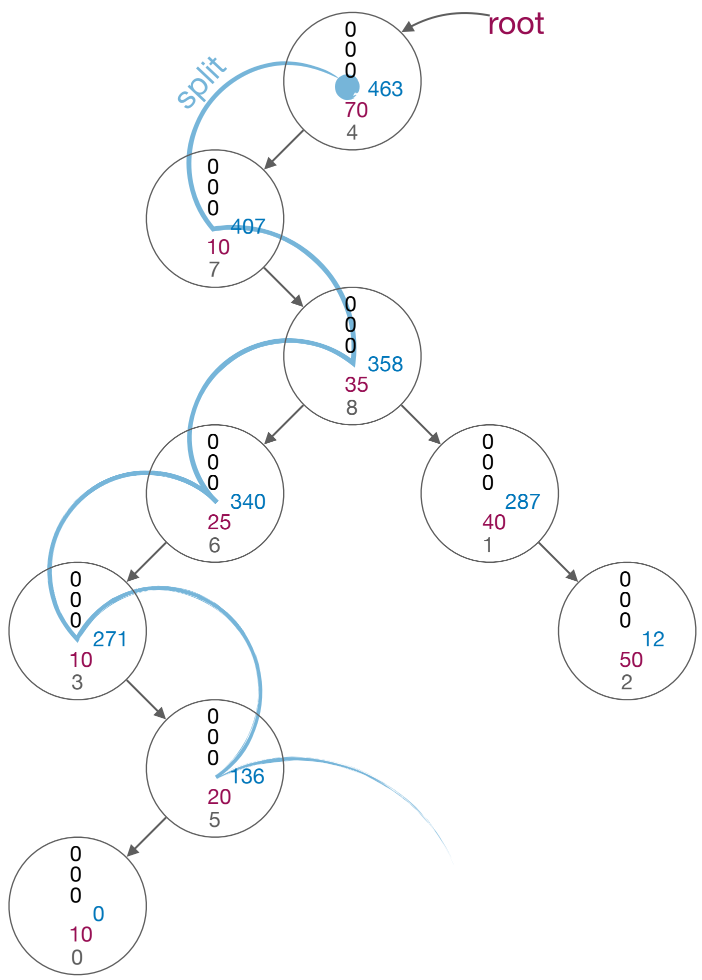
Note: we build the Treap by inserting each client sequentially, which takes us O(n*log(n)) time complexity. This construction can also take linear time if we build the Treap as a balanced binary search tree and then heapify.

Treap representing all costumers:

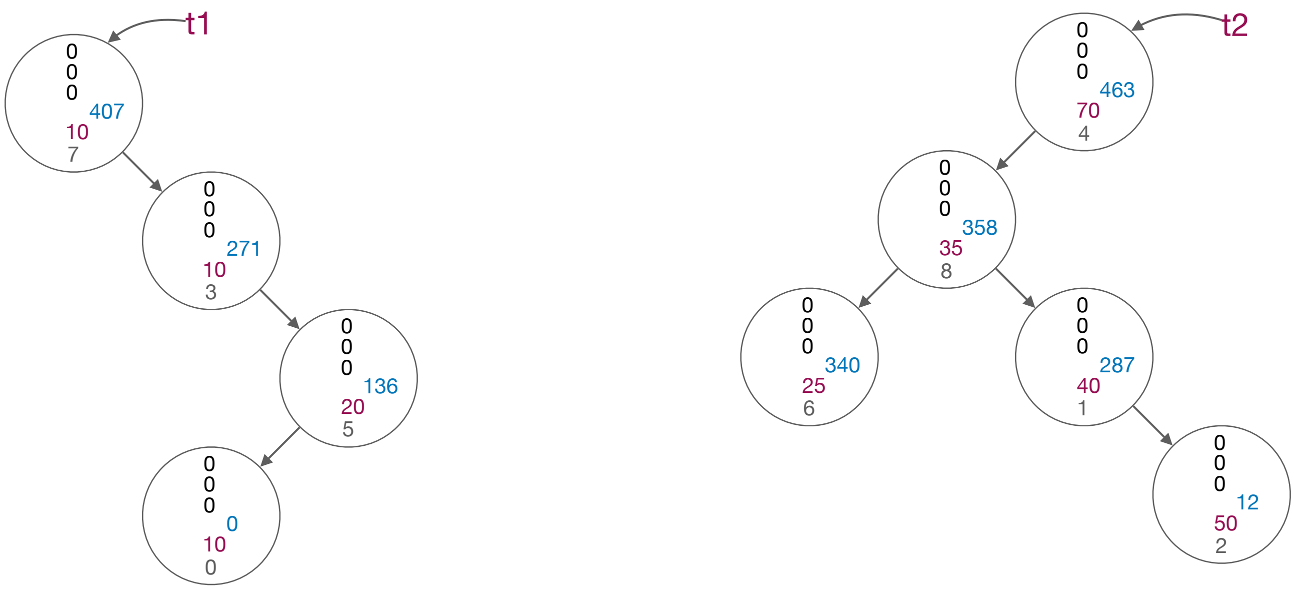


To simplify the visualization of the Treap, we will omit its empty nodes and we will know that if a given node has only a pointer to one existing child, then the other pointer will point to ∅ (nullptr in context of C++ programming language) and if it does not point (has an arrow) to any child, then it is a leaf node.

We start traversing the Treap with every T-shirt starting with the one with largest quality and smallest price.



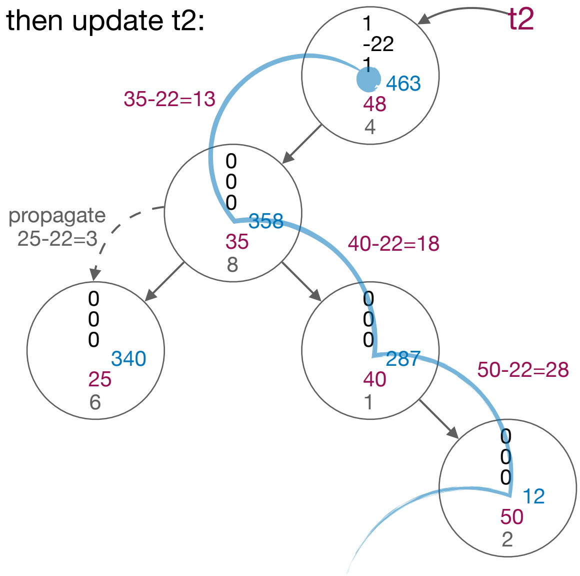
We split the Treap by key = T-shirt[0].cost:



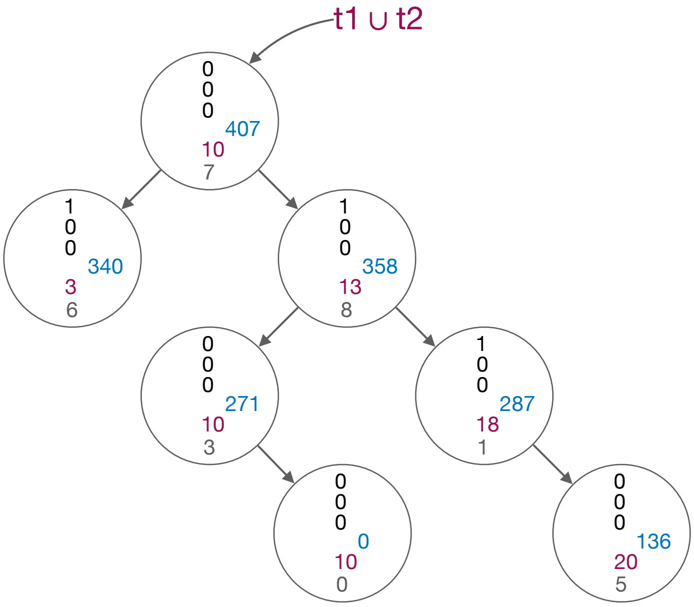
After the split we know that all the nodes in the left Treap (t1) have keys < T-shirt[0].costTreap and all the nodes in the right Treap (t2) have keys $\geq$ T-shirt[0].cost.

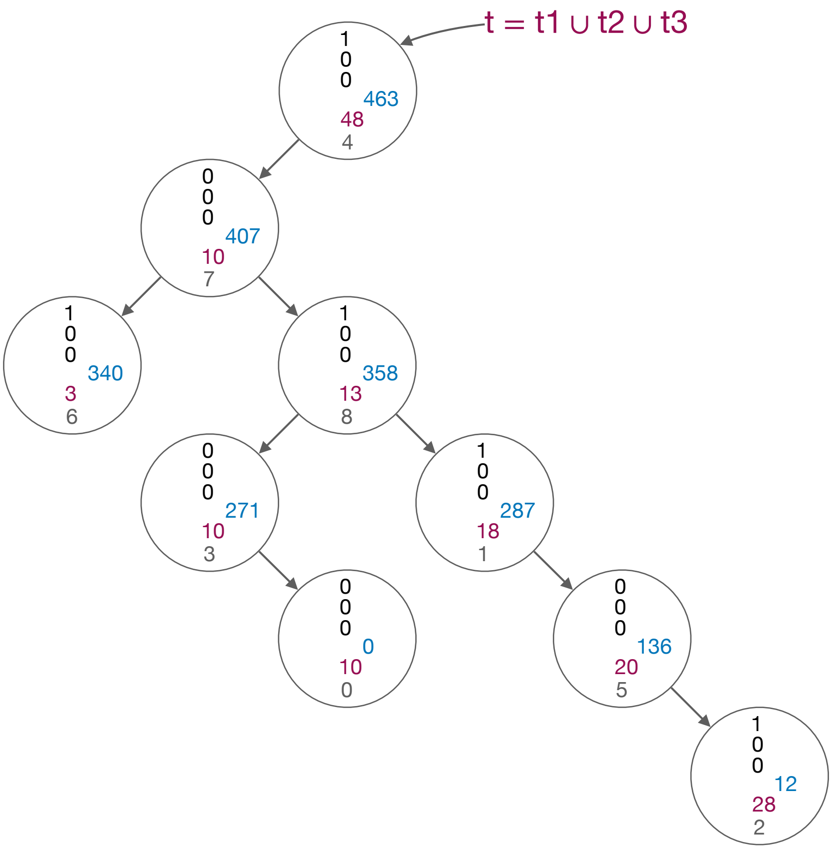
if t2 is not equal to nullptr, then update t2:

key	+=	-22
shirts	+=	1
lazy1	+=	-22
lazy2	+=	1



After the split we know that all the nodes in the left Treap (t2) have keys $<$ T-shirt[0].costTreap and all the nodes in the right Treap (t3) have keys $\geq$ T-shirt[0].cost, i.e. we took out these customers, which purchase amount has decreased so much that it has become less than the price of the current T-shirt and they have to join the left Treap representing buyers who could not afford the current T-shirt, but without the ability to propagate to them.




t = t1 ∪ t2 ∪ t3
1
0
0
463
48
4
0
0
0
407
10
7
1
0
0
340
3
6
1
0
0
358
13
8
0
0
0
271
10
3
1
0
0
287
18
1
0
0
0
0
10
0
0
0
0
136
20
5
1
0
0
12
28
2