Challenges Week 4

ART - 45 points

You are an art thief that steals really valuable paintings and replaces them with self-done replicas. You specialised on two styles of paintings, oil and watercolour paintings. You have stolen a selection of n paintings to replicate, but you have to make sure nobody notices that they are replicas. Each painting has an associated difficulty d_i and skill s_i. Your current painting skills are given by c, meaning that you can only replicate paintings of difficulty d_i less or equal to c in order to not get caught. When successfully completing a replica of difficulty d_i, your skills improve by s_i, so you will be able to replicate paintings of higher difficulty later on.

Given a selection of n paintings, find the maximum number of paintings you can replicate if you never paint 2 paintings of the same style after each other since that makes it more difficult to get detected.

Figure 1: *A picture of one of your best replicas.*

Input: The first line contains two integers, n and c, representing the number of paintings stolen and your initial painting skills. This is followed by n, each containing 3 integers: the painting style t_i, the difficulty of replicating it d_i, and the skill value s_i that you will be rewarded if you're able to replicate it. If number t_i is 0 then it's an oil painting, if it's 1 it's a watercolour painting.

Output: The maximum number of replicas you can do without getting caught.

Constraints:
$1 \leq n \leq 10^5$
$0 \leq c \leq 500$
$0 \leq d_i \leq 10^6$
$0 \leq s_i \leq 10^3$

Example

Input	Output
5 4 1 3 2 0 4 1 0 10 5 1 7 3 0 22 9	4

STICKS - 45 points

A few weeks into course Advanced Datastructures & Algorithms (ADSA) the TAs have acquired a lot of assignment submissions. In an effort to distribute all the assignments to the TAs so that they can be graded, the loyal Themis TA downloads everything and writes the submitted code onto USB sticks. This is the only way to do this, as all the other TAs do not have internet access. Moreover, you should never underestimate the bandwidth of a shipment of USB sticks.

Unfortunately, since the course is now given in C, the submissions are quite large, and there are a lot of them! The size of the submissions (in bytes) are always a power of 2, since the computing scientists that wrote the submissions are very obsessed with powers of 2. Before shipping all of the assignments to the other TAs, the Themis TA wants to make sure that he fills the USB sticks as efficiently as possible, since shipping costs are expensive. You may assume that he has an infinite number of USB sticks of the same size available. Can you help him distribute the files over the USB sticks?

Figure 2: The USB sticks that the Themis TA will use to store the submissions onto.

Input: The first line of the input contains two non-negative integers. The first integer, s, being the amount of storage (in bytes) on every USB stick, and the second integer, f, being the number of files (submissions) that have to be stored. The second line of the input contains a set of integers T separated by a space, with the number of integers being $||T|| = f$. Each integer $t \in T$ represents the size of a file that needs to be stored on the USB stick.

Output: The smallest number of USB sticks that the Themis TA needs to fit all of the files.

Constraints:
$0 < s \leq 10^8$
$0 \leq f \leq 10^8$
$t \in \{2^n \mid 2^n \leq s \wedge n \in \mathbb{N}_0\}$ (t is a power of 2 and smaller or equal to s: $1, 2, 4, 8, \ldots$ up to s).

Example

Input	Output
`15 6` `8 8 8 4 4 2`	`3`