CS490
Assignment 2

0/1 Knapsack

In this assignment you will design an algorithm to solve the infamous Knapsack Problem, which plagues Indiana Jones. You are provided with a knapsack with limited space and a collection of items with different values and weights. Your task is to maximize the value of items packed into your knapsack without exceeding its total capacity.

The problem is mathematically formulated in the following way. Given n items to choose from, each item $i \in 0..n-1$ has a value v_i and a weight w_i . The knapsack has a limited capacity K. Your job is to maximize the profit of all items taken while having the weight of the objects taken be $\leq K$

A knapsack input contains n + 1 lines. The first line contains two integers, the first is the number of items in the problem, n. The second number is the capacity of the knapsack, K. The remaining lines present the data for each of the items. Each line after the first contains two integers, the item's value v_i followed by its weight w_i.

The output contains a knapsack solution and is made of two lines. The first line contains the maximum profit you computed. The next line is a list of n 0/1 values, corresponding to whether you've taken(1) or not taken(0) the item. **Make sure the order of items in your output matches the order of items in your input!** So if you sort of something, make sure you keep track of the original position of each item for when you do output.

Sample Input:

```
4 11
8 4
10 5
15 8
4 3
```

Output to the sample input:

```
19
0 0 1 1
```