Constrained 0-1 Knapsack Problem

(Time Limit: 2 seconds)

Problem Description

A lady shopping a store find n items $I_1, I_2, \ldots, I_n$; the ith item is worth v_i dollars and weight w_i pounds, where v_i is a non-negative integer and w_i is a positive integer. The average value of these n items is defined to be $\left\lceil \frac{v_1 + v_2 + \cdots + v_n}{w_1 + w_2 + \cdots + w_n} \right\rceil$. Her sister asks her to take at least L items (**constraint I**) whose total weight is at least W_a pounds and at most W_b bounds (**constraint II**), where L, W_a, and W_b are all positive integers. She wants to take several items among the given n items to maximize the average value and satisfy the constraints I and II.

Given a set of n items $I_1, I_2, \ldots, I_n$ associated with the corresponding dollar-weight pairs and three positive integers L, W_a, and W_b, your task is to write a computer program to compute the maximum average value under the constraints I and II.

Input Format

The input consists of at most 8 test cases. For each test case, the first line contains four positive integers, n, L, W_a, and W_b, separated by a single space, where $n \leq 20$. The next n lines contain n dollar-weight pairs such that the ith line of these n lines contains the value v_i and the weight w_i of the item I_i. Each line is represented by two numbers separated by a single space; the first number represents v_i and the second one represents w_i. Finally, a 0 at the $(n + 2)$th line indicates the end of this test case. Both the total value and the total weight are at most 10^9.

The next test case starts after the previous ending symbol 0. A "-1" indicates the end of the whole inputs.

Output Format

The output contains one line for each test case. Each line contains an integer, which is the maximum average value of the corresponding test case. If there is no solution, then output -1.

Example

Sample Input:	Sample Output:
2 1 1 18	2
1 1	1
2 1	
0	
3 2 1 20	
1 1	
1 1	
1 1	
-1	