

# Constrained 0-1 Knapsack Problem

(Time Limit: 2 seconds)

## Problem Description

A lady shopping a store find  $n$  items  $I_1, I_2, \dots, I_n$ ; the  $i$ th 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  $\left\lceil \frac{v_1 + v_2 + \dots + v_n}{w_1 + w_2 + \dots + w_n} \right\rceil$ . 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  $I_1, I_2, \dots, I_n$  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  $i$ th 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 1 1 2 1 0 3 2 1 20 1 1 1 1 1 1 -1	2 1