Homework Assignment #6
Due: March 7, 2025 at 5:00 p.m.

This assignment is to be done individually, not in pairs.

1. Suppose you are given a set of n items numbered 1 to n. Item i has weight w_i (in kilograms), volume v_i (in litres) and value p_i (in dollars). You would like to choose the maximum value subset of the n items subject to two constraints: the total volume of the items you choose must be at most V and the total weight of the items you choose must be at most W. Assume all inputs are positive integers. You can assume that n, W and V are at most 100.

Design an algorithm that outputs an optimal set. Implement your algorithm in either Java or C++.

Your programme should take input from the standard input and write output to the standard output. Your programme should handle multiple problem instances. Each instance will consist of four lines:

- three non-negative integers n W V separated by single spaces
- n positive integer weights w_1 w_2 $\ldots$ w_n separated by single spaces
- n positive integer volumes v_1 v_2 $\ldots$ v_n separated by single spaces
- n positive integer values p_1 p_2 $\ldots$ p_n separated by single spaces

The end of the input will be indicated by a single line containing the character 0.

For each problem instance, your programme should generate one line of output listing an optimal set of items (i.e., integers in the range 1..n separated by single spaces) in sorted order. If there are multiple optimal solutions, your programme can output any one of them.

Sample input file:

```
4 5 9
4 2 1 2
6 3 7 5
4 9 5 6
2 1 3
1 1
2 3
5 4
0
```

Sample output file:

```
2 4
1
```

Instructions for submitting

Save your programme in a file called `A6.java` or `A6.cc`. Your programme will be tested by running it on some test files. Before submitting, you should test your programme as described below. Download the files `A6.in` and `A6.out` from the course web page. Run the following commands on one of the departmental linux machines.

For Java:

```
javac A6.java
java A6 < A6.in > my.out
diff A6.out my.out
```

For C++:

```
g++ -o A6 A6.cc
A6 < A6.in > my.out
diff A6.out my.out
```

The `diff` command should indicate that there are no differences between `A6.out` and `my.out`. This is important, because formatting errors in your output could cause the automatic grader to assign you a grade of 0.

Use the instructions at `https://wiki.eecs.yorku.ca/dept/tdb/services:submit:start` to submit your source code file `A6.cc` or `A6.java` . For the course name, use 3101Z. For the assignment name, use a6. If you wish to declare that you have discussed your solution with other students, type your declaration in a plain text file called `declaration.txt` and submit it as well.