

Programming Exercise 2

Implement the SINGLE ROW ALGORITHM for the special case of minimizing total weighted squared movement. The program call must be

```
PROGRAM <INPUTFILE> <OUTPUTFILE>
```

The source code must be written in C or C++ and compile with GCC on Linux. It should be well documented¹. You are allowed to use standard headers including the STL, but no other external libraries.

Input:

The input file is a text file containing the number of circuits $n \in \mathbb{N}$ and the minimum and maximum coordinates $x_{\min}, x_{\max} \in \mathbb{Z}$ as its first line. The following n lines contain the width $w_i \in \mathbb{N}$, the original position $\tilde{x}_i \in \mathbb{Z}$ and the cost $c_i \in \mathbb{N}$ for each circuit $i = 1, \dots, n$. All occurring coordinates will be integers in the interval $[-10000, 10000]$ and $x_{\max} - x_{\min} \geq w_1 + \dots + w_n$ will hold.

In the following example we have $n = 3$, $x_{\min} = 0$, $x_{\max} = 10$. The three circuits have widths 2, 3 and 2, original positions 4, 3 and 5, and weights 1, 2 and 1:

```
3 0 10
2 4 1
3 3 2
2 5 1
```

Output:

The task is to compute positions x_1, \dots, x_n with $x_{\min} \leq x_1, x_i + w_i \leq x_{i+1}$ for $i = 1, \dots, n-1$, $x_n + w_n \leq x_{\max}$ and $\sum_{i=1}^n c_i (\tilde{x}_i - x_i)^2$ minimum.

Note: The positions do not need to be integral.

The program should write the result (the total cost and the computed positions x_1 to x_n) in the following format:

```
Total cost: 9
Positions:
1.5
3.5
6.5
```

¹This can be achieved by using comments and – much more importantly – [self-documenting code](#).

Test instances will be provided on the website of the exercise class

http://www.or.uni-bonn.de/lectures/ss15/chipss15_ex.html.

The complete source code must be sent to *ahrens@or.uni-bonn.de* until

Thursday, June 11, 12:15h.

(15 points)

In case of any questions feel free to contact me at *ahrens@or.uni-bonn.de* .