Fall 2020
Problem Solving through Computational Thinking ECE30017

Week 5

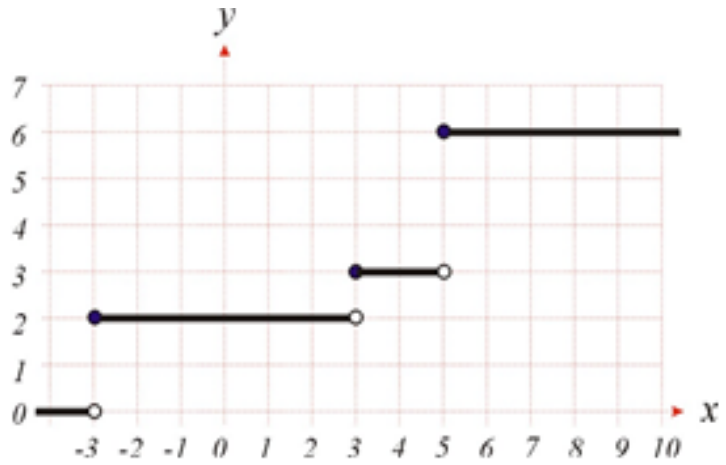
- P5. Step Function
  Deadline: 11:59 PM, 5 October (Mon)

P5. Step Function (1/2)

A step function is a function $f: X \rightarrow C$ where the domain X is a real line, $R^1 = (-\infty, +\infty)$ and $C = \{c_0, c_1, \ldots, c_k\}$ is a finite set of constants such that

1. $X = A_0 \cup A_1 \cup \cdots \cup A_k$ where $A_0 = (-\infty, a_1)$, $A_k = [a_k, \infty)$ and $A_i = [a_i, a_{i+1})$ where $a_i < a_{i+1}$ for $0 < i < k$.
2. $f(x) = c_i$ for all x in A_i for $0 \le i \le k$.

You may assume that f is non-negative and non-decreasing in X, that is, $c_0 = 0$ and $c_i < c_{i+1}$ for $0 \le i < k$. An example of a non-negative, non-decreasing step function is shown below:



$A_0 = (-\infty, -3)$, $A_1 = [-3, 3)$, $A_2 = [3, 5)$, $A_3 = [5, \infty)$,

$c_0 = 0$, $c_1 = 2$, $c_2 = 3$, $c_3 = 6$

(Continued)

P5. Step Function (2/2)

A step function f can be represented as a sequence of starting points,

$((a_1, f(a_1)), (a_2, f(a_2)), \ldots\ldots, (a_k, f(a_k)))$.

For example, the function in the previous page can be specified by

$((-3, 2), (3, 3), (5, 6))$.

Given two such step functions f and g, together with two integers p and q such that $p \leq q$, write a program that evaluate the following expression:

$$\left(\sum_{i=p}^{q} \max\{f(i), g(i)\} \right) \mod 10007$$

(continued)

Requirement

- **Input**
  - Input data are given from the standard input
  - The first part of input data is a representation of function f.
    - The definition starts with value k_f for $1 \leq k_f \leq 1{,}000{,}000$ which is the number of points to specify function f.
    - Subsequently, k_f lines follow where the i-th line has a_i and $f(a_i)$ for $-2{,}000{,}000{,}000 \leq a_i \leq 2{,}000{,}000{,}000$ and $1 \leq f(a_i) \leq 2{,}000{,}000{,}000$.
  - After that, the specification of function g is provided in the same manner.
    - The first line gives value k_g, that is, the number of points for function g. After that, k_g lines follow where the i-th line has a_i and $g(a_i)$.
  - The last line gives p and q for $-2{,}000{,}000{,}000 \leq p \leq q \leq 2{,}000{,}000{,}000$.

- **Output**
  - Your program should print one number to the standard output within 0.5 second.

Test Case Example

Input data

```
3
-3 2
3 3
5 6
1
4 5
1 5
```

output

```
18
```