2020/2021 SOUTHERN CALIFORNIA REGIONAL INTERNATIONAL COLLEGIATE PROGRAMMING CONTEST

Problem 5
Digital Speedometer

A digital speedometer shows a vehicle's speed as integer miles per hour. There are occasions when the sensed speed varies between two integer values, such as during cruise control. Using a single threshold to round between adjacent integers often makes the display toggle rapidly between the two integers, which is distracting to the driver.

Your team must implement a smoothing technique for the display using separate rising and falling thresholds (t_r and t_f, respectively). See Figure 1 for a graphical depiction of the Sample Input for use with the following rules.

Each sensed speed, s, falls between two adjacent integers i and j, $i \leq s < j$, where $j = i + 1$. When displaying the sensed speed s as an integer:

- When s falls between i and $i + t_f$, s is displayed as i.
- When s falls between $i + t_r$ and j, s is displayed as j.
- When s falls between $i + t_f$ and $i + t_r$, s is displayed as i if the most recent preceding value for s outside of range $[i + t_f, i + t_r]$ is less than $i + t_r$, and s is displayed as j if the most recent preceding value for s outside of range $[i + t_f, i + t_r]$ is greater than $i + t_r$.
- Any sensed speed, $0 < s < 1$, must display as 1 because any non-zero speed, no matter how small, must display as non-zero to indicate that the vehicle is in motion.

The first line of input contains t_f, the falling threshold. The second line of input contains t_r, the rising threshold. The speed sensor reports s in increments of 0.1 mph. The thresholds are always set halfway between speed increments. All remaining lines until end-of-file are successive decimal speeds, s, in miles per hour, one speed per line. The third line of input, which is the first measured speed, will always be 0.

$$0 < t_f, t_r < 1; \quad t_f < t_r; \quad 0 \leq s \leq 120$$

Output is the list of speeds, one speed per line, smoothed to integer values appropriate to t_f and t_r.

Sample Input

```
0.25
0.75
0
2.0
5.7
5.8
5.7
5.2
5.7
0.8
0.2
```

Problem 5
Digital Speedometer (continued)

Output for the Sample Input

```
0
2
5
6
6
5
5
1
1
```

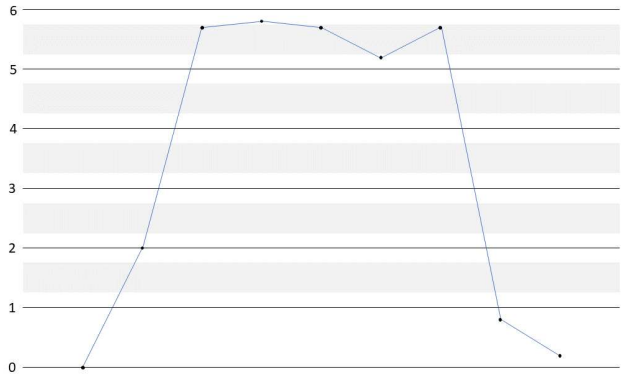

Figure 1. Sensor readings from the Sample Input, with $t_f = 0.25$ and $t_r = 0.75$.

Explanation of the Sample Data

Input	*Output*	*Explanation*
0.25		Value of t_f.
0.75		Value of t_r.
0	0	Initial input.
2.0	2	Input greater than 0, outside of threshold range.
5.7	5	Input greater than 2.0, in threshold range.
5.8	6	Input greater than 2.0, exceeds upper threshold of 5.75.
5.7	6	Input less than 5.8, in threshold range.
5.2	5	Input less than 5.8, below threshold range of 5.25.
5.7	5	Input greater than 5.2, in threshold range.
0.8	1	Input greater than 0 and less than 1.
0.2	1	Input greater than 0 and less than 1.