Università della Svizzera italiana

Faculty of Informatics

Numerical Algorithms

Fall 2020

Assignment 1

September 15, 2020

Exercise 1 [5 points]

Sheila is a student and she drives a typical student car: it is old, slow, rusty, and falling apart. Recently, the needle on the speedometer fell off. She glued it back on, but she might have placed it at the wrong angle. Thus, when the speedometer reads s, her true speed is $s + c$, where c is an unknown constant (possibly negative). Sheila made a careful record of a recent journey and wants to use this to compute c. The journey consisted of n segments. In the i-th segment she travelled a distance of d_i and the speedometer read s_i for the entire segment. This whole journey took time t. Help Sheila by computing c. Note that while Sheila's speedometer might have negative readings, her true speed was greater than zero for each segment of the journey.

Write a program that takes as input:

- the number n of Sheila's journey segments;
- the total time t (in hours) of her journey;
- the distances d_i (in miles) and speedometer readings s_i (in miles per hour) of the i-th segment, $i = 1, \ldots, n$.

You can assume all input variables to be integers, and only the s_i may be negative. Compute and print out the constant c (in miles per hour).

Hint: use Newton's method.

Test your program for the following input:

- $n = 4$;
- $t = 10$;
- $d_1 = 5$, $s_1 = 3$; $d_2 = 2$, $s_2 = 2$; $d_3 = 3$, $s_3 = 6$; $d_4 = 3$, $s_4 = 1$.

Hand in your code, an explanation of your approach, and the output of your program for the data above.

Solutions must be returned on September 22, 2020 in class