

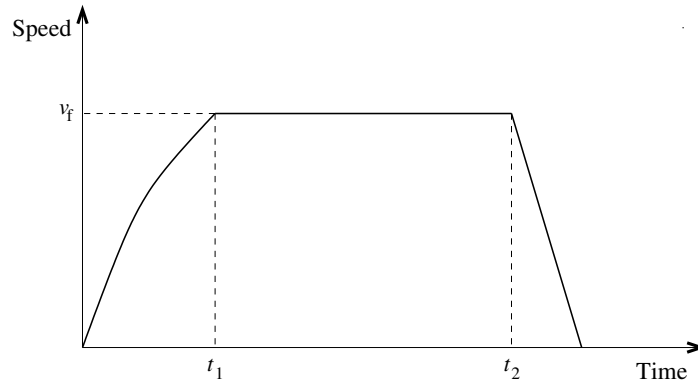
# Programming Project #2

## EGRE245 Fall 2017

### Accelerating Train

## 1 Overview

A train starts at rest and then begins a trip with an average acceleration (measured in *meters/second<sup>2</sup>*) for a given number of minutes. Acceleration will eventually stop and the train will travel at a fixed velocity (in *meters/second*) for a certain number of minutes. Then its brakes will be applied and it will decelerate at a constant rate (again of course measured in *m/s<sup>2</sup>*) until it stops. For this project you will write a C program to input appropriate acceleration rates and times and then compute and output the total distance the train travels.



Here is a description of the variables you might need for your computations:

$r_a$ $r_d$	the acceleration and deceleration rates
$t_1$ $v_a$ $v_f$ $d_1$	the time, average velocity, final constant velocity, and distance achieved at the point when acceleration stops
$t_2$ $d_2$	the total time and total distance achieved at the point when deceleration starts
$d_3$	the distance achieved during the deceleration phase

Given these, we can use the usual equations of motion to get the velocity and distance over the periods of acceleration/deceleration and constant velocity as:

$$v_f = r_a t_1 \tag{1}$$

$$v_a = \frac{v_f}{2} \tag{2}$$

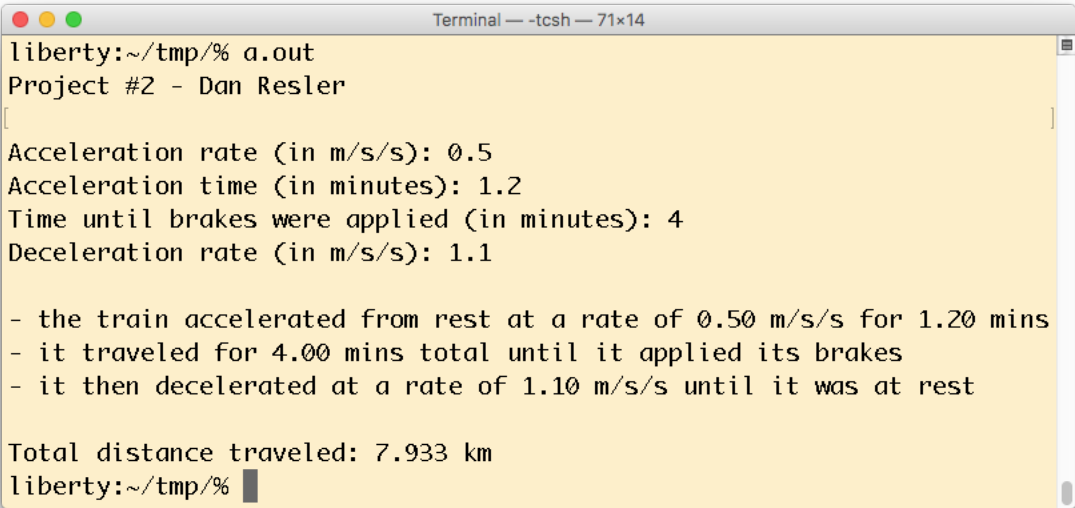
$$d_1 = \frac{r_a t_1^2}{2} \tag{3}$$

$$d_2 = v_f (t_2 - t_1) + d_1 \quad (4)$$

$$d_3 = \frac{v_f^2}{2r_d} \quad (5)$$

You should input the initial acceleration rate, the amount of time it took before it reached a constant speed, the amount of total time the train traveled until braking, and the deceleration rate. All values should be stored in your program as floating point values of type `float`. The run of your program should look *exactly* (with possibly different data values and your name instead of mine!) as the sample run below. All floating point values should be printed with 2 digits after the decimal point *except* the total distance (which you should print with 3 digits after the decimal point). Your distance should be reported in kilometers.

## 2 Sample Run



```

liberty:~/tmp/% a.out
Project #2 - Dan Resler
[
Acceleration rate (in m/s/s): 0.5
Acceleration time (in minutes): 1.2
Time until brakes were applied (in minutes): 4
Deceleration rate (in m/s/s): 1.1

- the train accelerated from rest at a rate of 0.50 m/s/s for 1.20 mins
- it traveled for 4.00 mins total until it applied its brakes
- it then decelerated at a rate of 1.10 m/s/s until it was at rest

Total distance traveled: 7.933 km
liberty:~/tmp/%

```

## 3 Deliverables

You should turn in a stand-alone, complete application program (your source code) containing a `main` function. Name your source code file `proj2XXXX.c` where `XXXX` is the last 4 digits of your student id number. For example, if your student id number is V12345678, your file will be named `proj25678.c`. Projects this term will be submitted via the web using a link off of the class web page (<http://danresler.net/egre245>). Make sure to document your code in the manner previously discussed in class. Note you need not turn in anything other than your source code text file!

**Due date: Tuesday, September 12**