

Assignment 4: Flow control

- Make sure that your scripts run without error in order to get credit. Do not hesitate to ask for help if needed!
- Check the output of the Autograder for any issue that should be fixed. In case of “Unexpected error”, email me so I can take a look as it may be an issue with the Autograder rather than your code.
- Take ownership of your learning! Remember that you are responsible for the work you turn in. Simply copying somebody else’s answers, copying from the Internet, using AI to generate your code, sharing your code (or part of your code) in any way, or copying it from someone else will be considered academic dishonesty. Please, contact me if you have any questions about collaborations.

We want to write a code that can easily plot a series of projectile trajectories on a single plot based on a list of initial values provided by the user in a variety of ways (see below). We will also want to code to approximately determine the landing point of the projectile.

A good starting point for this assignment is problem 2 from assignment 3.

Your code should include the following:

- A function called `plot_traj` that takes 5 parameters `y0`, `v0`, `th0`, `tmax`, `color`, the first 3 being the initial parameters for the trajectories, the fourth one being the maximum time used when plotting the trajectory, and the last one being a color code. This function should
 - 1) plot the trajectory of a projectile with the given parameters (assuming the angle is given in degrees) for the time interval $0 < t < t_{\max}$ using the color given in the last argument;
 - 2) add a (visible) symbol of your choice at the end of the plotted trajectory;
 - 3) define a label for the curve that includes the initial values of the parameters (`y0`, `v0`, `th0`, including units).
- A function `tland(y0, v0, th0)` that loops through time values $t > 0$ until the projectile reaches the ground, i.e. $y(t)$ changes sign and becomes negative. The function should return the value of time at which that happens.
Hint: you’ll need to use a combination of loops and an appropriate test.
Note: Make sure to use a time step in your loop that is small enough to get a “visually” good answer (i.e. it looks correct on your plot), but not so small that the code takes forever to run.

Your code should obtain the values of the parameters to use in the plot as follows:

- the program should ask the user for the value of `y0` in meters;
- it should get a list of angles in degrees from the command line; and
- it should read a list of values of `v0`, separated by commas, on the first line of the file `v0vals.txt`.

The program should then create the figure and plot all the trajectories for all provided values of the parameters on a single plot. Make sure that your plot includes axes labels with units, a title, and a legend.

Note: You may need to modify your functions `Xpos` and `Ypos` from assignment 3 so they include the speed `v0` as a parameter to make sure the correct value is used. You’ll also need to think of a way to provide a new color to `plot_traj` each time it is called, even when a large number of parameter values are provided. It is OK if you cycle through a limited number of colors (say 5 or 6).

What to submit: For this problem, submit the Python code `yourName_hw04-p1.py`, the parameter file `v0vals.txt` that you have been using, and a figure created by your code.