CS 4630/5630 Kresman Homework 5

The manager let you take last Friday off b/c you finished the stoichiometry task ahead of schedule😊 Time to get back to work after the long weekend and checkout the next task; interns are frequently rotated b/w projects to challenge them and to help expand their skillset, so you know you are off of stoichiometry and onto some else.

While interns and new college graduates typically work on updates to projects already underway (as was the case with the stoichiometry task), the new (mechanical engineering) team leader wants you to build something from scratch: build a kinematics app to study projectile behavior in two dimensions (assuming negligible air/frictional resistance) and plot the graph of the projectile and display other pertinent information.

The (python) app is console or GUI driven, you decide.

CS 5630 ONLY Additionally, four similar computations—projectile angles 15 degrees, 30, 45, and 75. Plot all five graphs in the **same** 2-dimensional figure/axes.

**Notes**:

* The app takes user inputs from a file (all in one line, in order): height (meters) above the ground the projectile is shot from; initial projectile velocity (meters/s); angle (degrees) of the projectile.
* Homework 5 short sample input.txt: sample file to try out though the app should work with any valid input.
* Acceleration due to gravity, g, is 9.8 m/sec2. a = -g in the y direction
* Only two (hard-coded) projectile equations: s(t) = integral (v(t) dt); v(t) = integral (a dt) [see Unit 10]
* Derive (**no** hardcoding) the four kinematics equations noted in class: two equations that express (x and y) velocity as a function of time, and two that express (x and y) displacement as a function of time. As well, reflect the constant, as needed, in the sympy integration.
* Compute max height, time for max height & range using sympy routines such as simplify, substitution, etc. (no hardcoding the formulae)
* (Pretty) print the following quantities:
  + The two hard-coded equations and the four (derived) kinematics equations in symbolic form
  + Initial velocity, angle, and height above the ground; time to reach the maximum height, maximum height from the ground, and range.
* Plot range against height. Use appropriate legend/colors in the plot so one can easily infer the projectile angle and other items of interest.
* This project may be a bit challenging – will take some time to think through and get it done right, consider starting early
* CS 4630 group size 2: Both members are 4630 students; no brownie points if you choose to work on your own.

Use concepts through Unit 13. Canvas turn-in: lastnameHw5.ipynb.

Grading Rubric

\_/8 2 points for each of the 4 derived equations

\_/6 plot

\_/6 2 points for each of the 3 computed quantities

**Bonus credit (4 points)**

* Your team leader is all about presentation and likes better visuals, a 2nd animated plot with time on the x axis; if time of flight is T seconds, the animation runs for T seconds, that shows the projectile position at that point in time. (if CS 5630, do the animation just for the original user input, not for the extra four angles)
* Did not discuss animation in class and you are on your own.