CSCI 1320 Computer Science I: Engineering Applications – Fall 2018
Instructor: Zagrodzki
Lab 2
Due Sunday, September 23, by 6pm

Plotting a mathematical equation

Write a script that calculates and plots the trajectory of a ball thrown with a certain velocity and under a certain angle. Below are all the steps you need to follow, but you should also add your own meaningful comments to the code as you write it.

a. Start a new script in the Matlab Editor and save it as `throwBall.m`
b. At the beginning of your script, define some constants (you can pick your own variable names)
   i. Initial height of ball at release = 1.5 m
   ii. Gravitational acceleration = 9.8 m/s^2
c. Ask the user to enter values for the following variables:
   i. Velocity of ball at release (in m/s)
   ii. Angle of the velocity vector at time of release (in degrees)
d. Next, create a time vector that has 10000 ls between 0 and 20, inclusive.
e. If *x* is distance and *y* is height, the equations below describe their dependence on time and all the other parameters (initial height *h*, gravitational acceleration *g*, initial ball velocity *v*, angle of velocity vector in degrees θ). In your script, write expressions to solve for *x* and *y:*

   i. $x(t) = v\cos\left(\theta\frac{\pi}{180}\right)t$. We multiply θ by $\frac{\pi}{180}$ to convert degrees to radians.

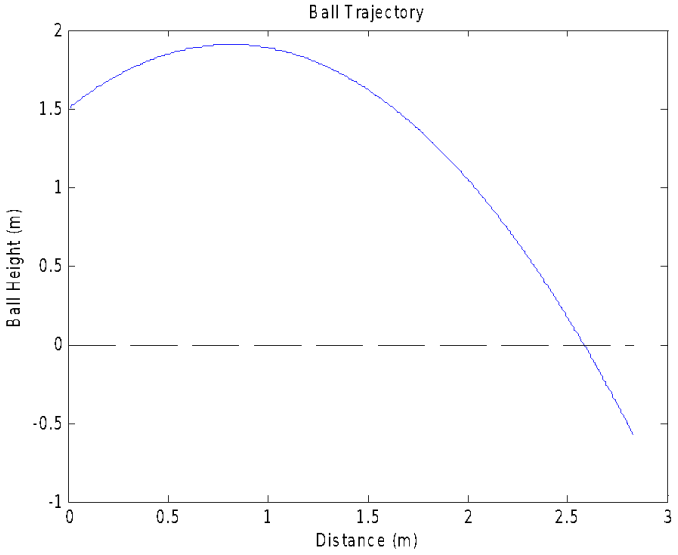
   ii. $y(t) = h + v\sin\left(\theta\frac{\pi}{180}\right)t - \frac{1}{2}gt^2$

f. Approximate when the ball hits the ground.
   i. Find the index when the height first becomes negative (you can use the built-in function `find`).
   ii. The distance at which the ball hits the ground will be the value of *x* at the index found above.
   iii. Display the words: "The ball hits the ground at a distance of X meters", where X is the distance you found in part ii above.
g. Plot the ball's trajectory
   i. Open a new figure (use the command `figure`)
   ii. Plot the ball's height on the y axis and the distance on the x axis (`plot`)
   iii. Label the axes meaningfully and give the figure a title (use `xlabel`, `ylabel`, and `title`)
   iv. Hold on to the figure (use `hold on`)

v. Plot the ground as a dashed black line. This should be a horizontal line going from 0 to the maximum value of x. The height of this line should be 0. See `help plot` for line colors and styles.

h. Run the script from the command window and verify that the ball indeed hits the ground around the distance you estimated in f,ii. You should get something like this (Note: for this plot, the velocity was 4 m/s and the angle was 45 degrees):

```
>> throwBall
The ball hits the ground at a distance of 2.5821 meters
```



Submitting the assignment:

Make sure your script file is well commented and it includes in the header your name, student ID, course number, lab number and recitation section. If you finish the script in recitation, you can show your code and then demonstrate it to your TA. Submit the *.m* file through Moodle as Lab 2 by due date.