CHEN 1703 - HOMEWORK 8

Submit your solutions via the course web site. Submit each solution seperately.

Problem 1 (10 pts)

The Fibonacci sequence is given as

$$n_i = \begin{cases} 1 & i \leq 2 \\ n_{i-1} + n_{i-2} & i > 2 \end{cases}$$

For example,

i	1	2	3	4	5	6	7
n_i	1	1	2	3	5	8	13

Create a Matlab code that will prompt the user for the number of the series (i) and then print out the i^{th} number in the Fibonacci series. Submit your Matlab code (no report required).

Problem 2 (10 pts)

There is a cannon on top of a ridge firing at a target in a valley below as depicted in figure 1. You manage to make measurements of the position of the projectile as a function of time, as shown in the table below. You want to determine the initial velocity, and the height of the ridge.

$$y = y_0 + v_{0y}t + \frac{g}{2}t^2 \tag{1}$$

Given the following measurements for when the projectile hits the valley floor (and that the cannon is located at $x = 0$, $y = h_0$), use regression to estimate the height of the ridge and the initial y-component of the velocity. Also report the R^2 value for y as discussed in class.

t (s)	0.86	3.04	3.68	4.25	2.31	4.40	5.35	0.34
y (m)	105.38	93.59	81.34	67.04	106.31	62.38	28.97	106.39
x (m)	6.34	23.25	27.53	31.71	17.74	33.39	41.12	2.49

Submit your Matlab code (no report required).

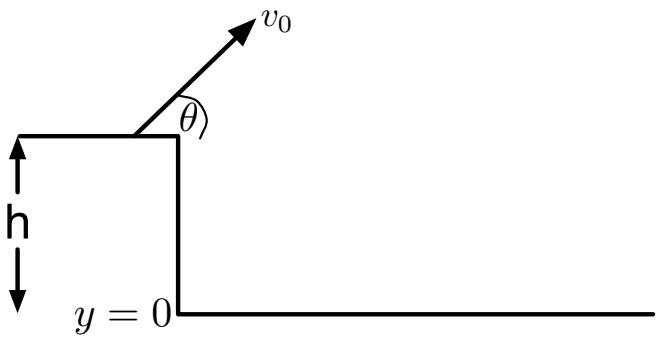

Figure 1: Schematic of the projectile problem.

Problem 3 (10 pts)

Using the data given in Problem 2, estimate the initial angle, θ, that the projectile was launched at. Also report the R^2 value for x as discussed in class. Work this problem *entirely* by hand and show your work. Submit this as a report.

Hints:

- Note that neglecting air resistance, we have

$$x = x_0 + v_{0x}t. \tag{2}$$

- You can use equation (2) to obtain v_{0x} using regression. Then using your results from problem 2, together with the equations

$$\begin{aligned} v_{0x} &= v_0 \cos\theta, \\ v_{0y} &= v_0 \sin\theta, \end{aligned}$$

  you should be able to solve for θ.