Homework 6

Due Monday, February 28 before 5:00pm

Use [Live Editor > Save > Export to PDF] to prepare your submission for Gradescope.

This assignment uses data from the MAT file HW6_data.mat. Download this file and run

```
load HW6_data.mat
```

to load variables `x`, `y`, `blood`, and `ecm` into the workspace.

Part 1: Polynomial Fitting

Variables `x` and `y` contain 12 values from an unknown cubic polynomial, i.e.

$$y = \beta_0 + \beta_1 x + \beta_2 x^2 + \beta_3 x^3$$

Using the values `x` and `y`, compute estimates for parameters $\beta_0, \ldots, \beta_3$ using linear regression. **For this problem, you are not allowed to use `fitlm`, `regress`, `polyfit`, or any other linear regression or curve fitting tools.** You must construct the design matrix and calculate parameter estimates via pseudoinversion.

```
% place your code here
```

Using your parameter estimates, plot the points in variables `x` and `y` and a line corresponding to the best fit polynomial. Both the points and the line should be on the same plot.

```
% place your code here
```

Part 2: Cell Growth

Variables `t` and `cells` contain six cell counts for dividing mammalian cells in a culture dish. (The times in `t` are in hours.) Your task is to find the exponential growth rate of the cells using linear regression. **For this problem, you are not allowed to use `fitlm`, `regress`, `polyfit`, or any other linear regression or curve fitting tools.**

a.) Plot the number of cells over time.

```
% place your code here
```

b.) Set up a design matrix for the linearized exponential growth equation from section 9.4.

```
% place your code here
```

c.) Calculate the pseudoinverse of the design matrix and use it to fit your model.

```
% place your code here
```

d.) Calculate the exponential growth rate of the cells. What are the units?

<*place your answer here*>

e.) Use the fitted parameters to find the inital number of cells. How does this value compare with the number of cells at t = 0 h in your data?

<*place your answer here*>