Name: \<Xinyu Liu \>
Github Username: \<xinyuJames\>
Purdue Username: \<0036322415\>
Instructor: \< Qiu\>

Problem 1.

(1) **Estimated Functions:**

$\hat{y}_1(x) = a_1 x + b$ (Write numerical values for $a_i's$ and $b's$)

[np.float64(27.406798636142433), np.float64(76.54862254204514)]

$\hat{y}_2(x) = a_2 x^2 + a_1 x + b$

[np.float64(-1.2648866448486864), np.float64(27.027736669039708),
np.float64(88.44135382520402)]

$\hat{y}_3(x) = a_3 x^3 + a_2 x^2 + a_1 x + b$

[np.float64(1.7623831939447872), np.float64(-1.368257266230858), np.float64(-
0.6498400559682587), np.float64(101.1643665365012)]

$\hat{y}_4(x) = a_4 x^4 + a_3 x^3 + a_2 x^2 + a_1 x + b$

[np.float64(-0.022514493706441763), np.float64(1.7558870976971808),
np.float64(-0.8882893402084635), np.float64(-0.651881085288025),
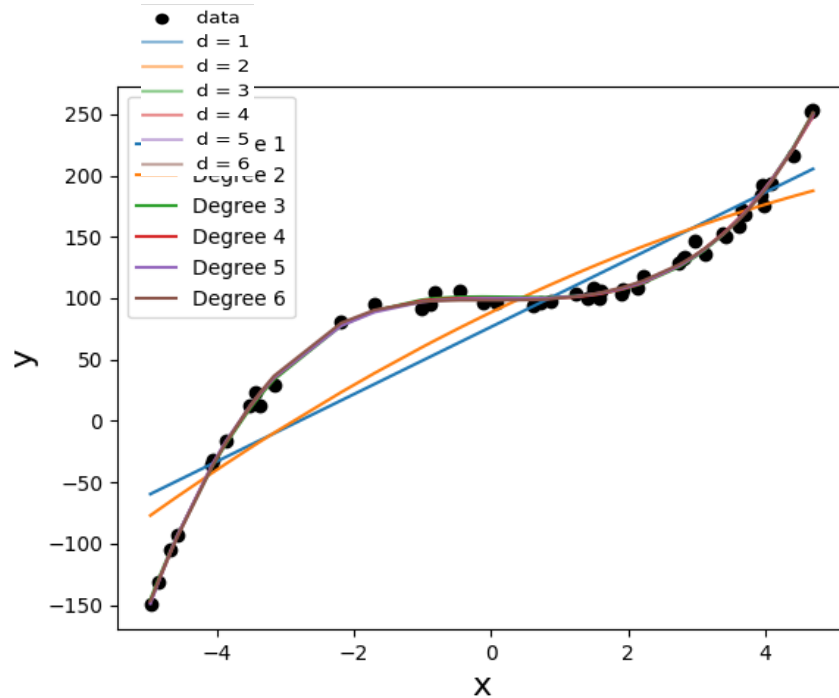np.float64(99.92393813058682)]

$\hat{y}_5(x) = a_5 x^5 + a_4 x^4 + a_3 x^3 + a_2 x^2 + a_1 x + b$

[np.float64(0.005007633185101307), np.float64(-0.020435144478005096),
np.float64(1.614518486029466), np.float64(-0.8993207004894201),
np.float64(0.1705612875644274), np.float64(99.7076810284181)]

$\hat{y}_6(x) = a_6 x^6 + a_5 x^5 + a_4 x^4 + a_3 x^3 + a_2 x^2 + a_1 x + b$

[np.float64(0.004056621447540695), np.float64(0.005285210041176304),
np.float64(-0.16206024287976317), np.float64(1.6376473758416836),
np.float64(0.33538593987024745), np.float64(-0.23809253411232056),
np.float64(98.30732978191577)]

(2) **Data Visualization:**

*(Insert plot obtained from data in poly.txt. Note that the plot below is not the
solution)*

Figure 1

Legend:
- data
- d = 1
- d = 2
- d = 3
- d = 4
- d = 5
- d = 6
- e 1
- e 2
- Degree 3
- Degree 4
- Degree 5
- Degree 6

(3) <u>What degree polynomial does the relationship seem to follow? Please explain your answer.</u>

Sample answer:

I think the degree of 3 is the best, because it is not very complex, and it pretty much matches the actual data.
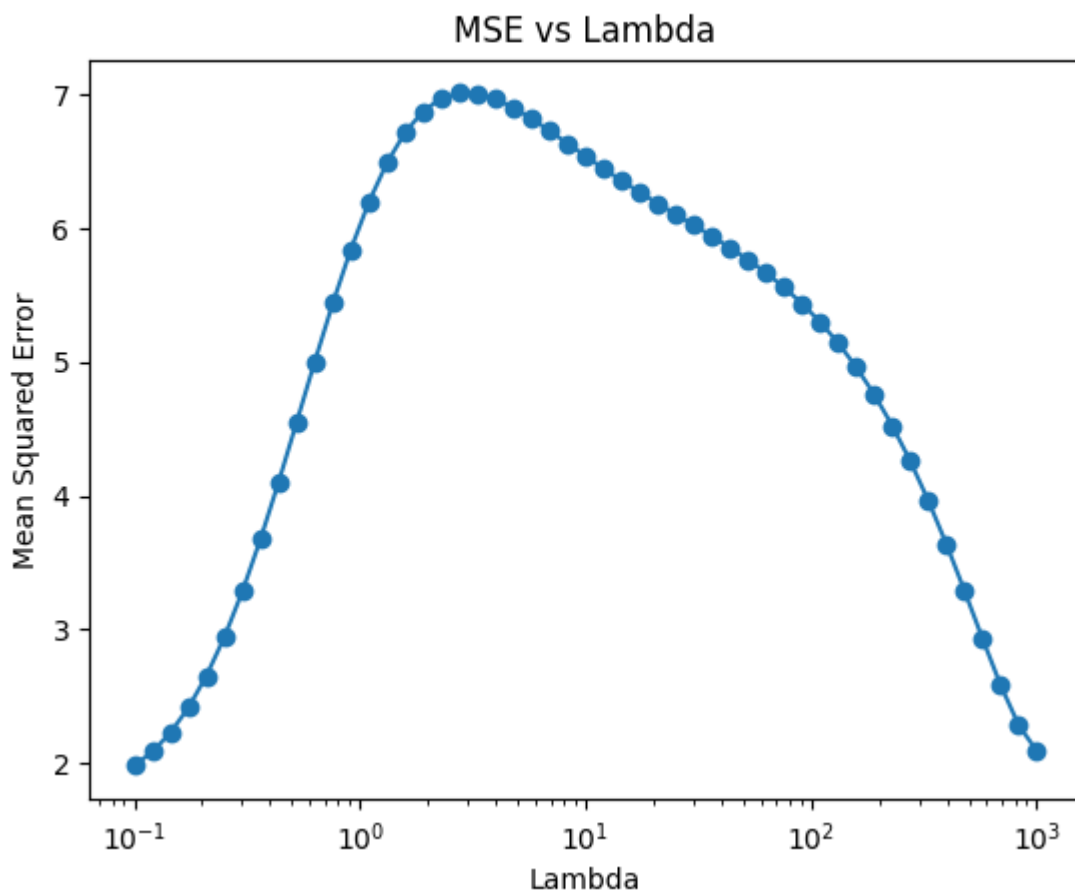
(4) <u>If we measured a new data point, $x = 4$, what would be the predicted value of y, based on the polynomial identified as the best fit in Question (3)?</u>

Sample answer: predicted value is 189.717

Problem 2.

(1) <u>Plot the mean squared error as a function of lambda in Ridge Regression:</u>

*(Insert plot obtained by completing the **main** function. Note that the plot below is not the solution)*

(2) Find best lambda:

Sample answer: *(insert numerical values for c and d)*

Based on the range of Lambda values tested, the best lambda value is 0.1, which yields an MSE of 1.9815144074864866 as shown on the plot above.

(3) Find equation of the best fitted model:

(Insert numerical values for a_i's and b)
$$\hat{y}(x) = a_1 x_1 + a_2 x_2 + a_3 x_3 + a_4 x_4 + a_5 x_5 + a_6 x_6 + b$$

[-4.33992630e-01 8.16204762e-01 5.19495066e-01 3.83342192e+00
 2.11359089e-01 4.53719310e-04]

(4) <u>Plot the predicted stock prices and actual stock prices using Google data</u>

(Note that the plot below is not the solution)