# Homework 5 Writeup

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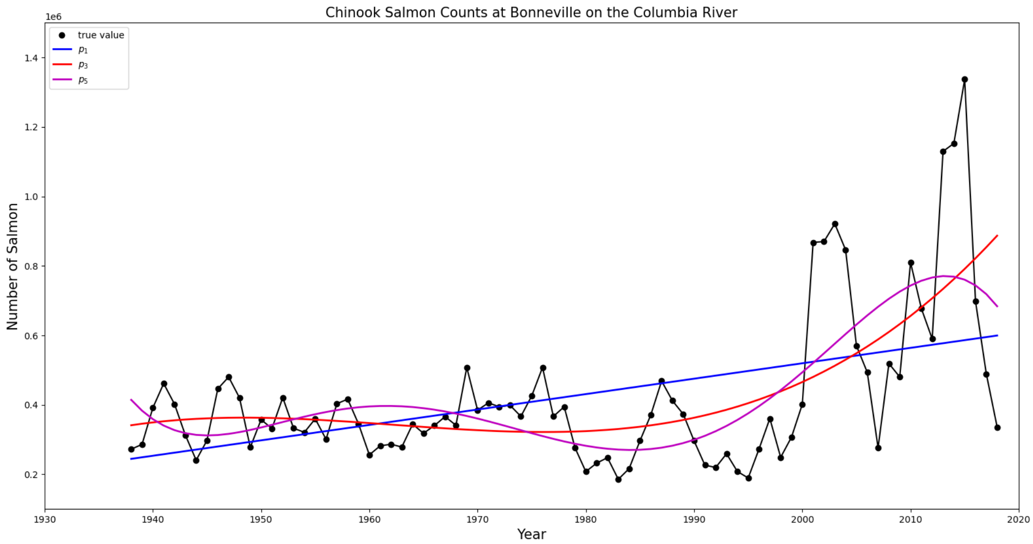
AMATH 301 B

## Problem 1

The real-world interpretation of the slope of the line of best fit is the rate of change of the salmon population, i.e. how fast the population is growing or decaying.
**p1** gave the most accurate prediction for the 2019 salmon population and **p3** gave the least accurate.
The following are the predictions each model makes for the salmon population in 2050: **p1** = 741528, **p3** = 2757671, **p5** = -15330581. The order I would rank them based on this is **p1**, **p3**, **p5**. **p1** predicts the number of salmon to be 741528, which is the most realistic number. **p5** gives a negative number and **p3** gives a very high number, which has yet to be recorded.




```
from HW5Coding import *
import matplotlib.pyplot as plt

salmon = np.genfromtxt("salmon_data.csv", delimiter=",")
year = salmon[:,0]
nfish = salmon[:,1]
fig1, ax1 = plt.subplots()
ax1.plot(year, nfish, "ko", label="true value")
ax1.plot(year, nfish, "-k")
ax1.plot(year, np.polyval(A1, year), "b", linewidth=2, label="$p_1$")
ax1.plot(year, np.polyval(A2, year), "r", linewidth=2, label="$p_3$")
ax1.plot(year, np.polyval(A3, year), "m", linewidth=2, label="$p_5$")
ax1.set_xlim(1930, 2020)
ax1.set_ylim(100000, 1500000)
ax1.set_xlabel("Year", fontsize=15)
ax1.set_ylabel("Number of Salmon", fontsize=15)
ax1.set_title("Chinook Salmon Counts at Bonneville on the Columbia River", fontsize=15)
ax1.legend()
```

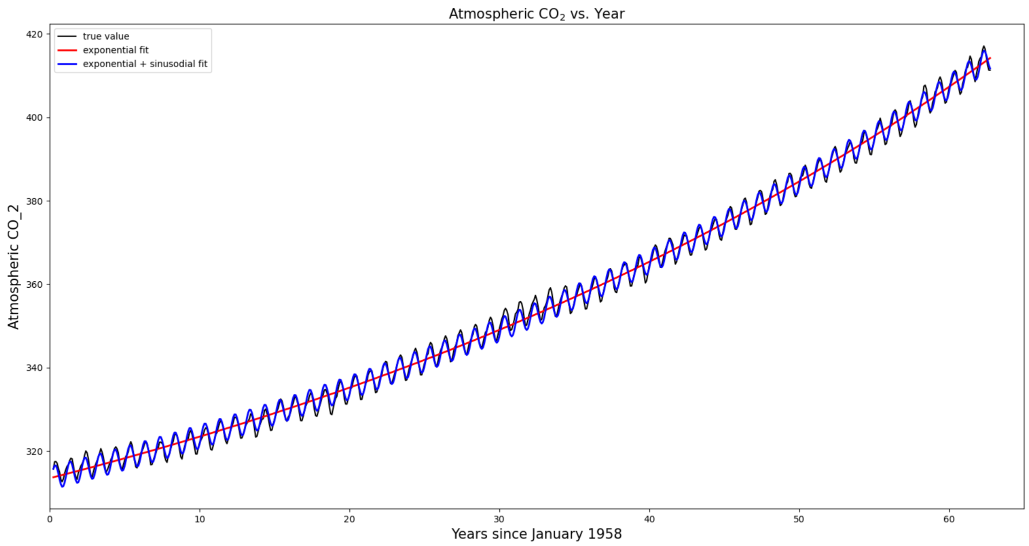
## Problem 2

The sum of squares error for the exponential fit was **3722.633050789583**. The sum of squares error for the sinusoidal fit was **692.2808318265863**. The sinusoidal fit gives a smaller error because it oscillates like the true value graph while the exponential fit does not.

We would use the **sinusoidal** fit to predict the amount of CO2 in November 2019 because it oscillates, reflecting the changing CO2 amount for each month throughout the year.

The models **would not** give significantly different estimates for the CO2 levels for the whole year 2040. This is because while the sinusoidal model does oscillate during each year, the exponential model goes right through the middle of its waves. Therefore, the averages that each model would compute would not be significantly different.

The **exponential** model is preferred for making a rough estimate of CO2 levels for all of 2040. This is because it does not oscillate, so we can look anywhere along the line for an estimate for the year.




```
co2 = np.genfromtxt("CO2_data.csv", delimiter=",")
co2_val = co2[0,:]
times = co2[1,:]
fig2, ax2 = plt.subplots()
ax2.plot(times, co2_val, "ok", markersize=2)
ax2.plot(times, co2_val, "-k", label="true value")
ax2.plot(times, A5[0]*np.exp(A5[1]*times) + A5[2], "r", linewidth=2, label="exponential fit")
ax2.plot(times, A7[0]*np.exp(A7[1]*times) + A7[2] + A7[3]*np.sin(A7[4]*(times - A7[5])), "b",
         linewidth=2, label="exponential + sinusoidal fit")
ax2.set_xlim(0, 65)
ax2.set_xlabel("Years since January 1958", fontsize=15)
ax2.set_ylabel("Atmospheric CO_2", fontsize=15)
ax2.set_title("Atmospheric CO$_2$ vs. Year", fontsize=15)
ax2.legend()
plt.show()
```