Assignment#4 Report
Team members: Yunfan Li, Haichao Zhang, Jingyuan Xu
Course: CS325-001

1. Description for a linear program for finding the best fit curve for temperature data.
We have TMAX and TMIN values, so we can use these two values to calculate the average temperature value. Once we have average temperature value, and we have already known the value of day, so according to the formula in the introduction, we will have a equation:

$$T(d) - x0 - x1*d - x2*\cos(2*pi*d / 365.25) - x3*\sin(2*pi*d / 365.25) - x4*\cos(2*pi*d / (365.25*10.7)) - x5*\sin(2*pi*d / (365.25*10.7)) = 0$$

So we can solve this problem by following linear programming formula:

$$\min t$$
$$\text{s.t. } \max| T(d) - x0 - x1*d - x2*\cos(2*pi*d / 365.25) - x3*\sin(2*pi*d / 365.25) - x4*\cos(2*pi*d / (365.25*10.7)) - x5*\sin(2*pi*d / (365.25*10.7)) | <= t \ (0 <= d <= \text{length of .csv file})$$

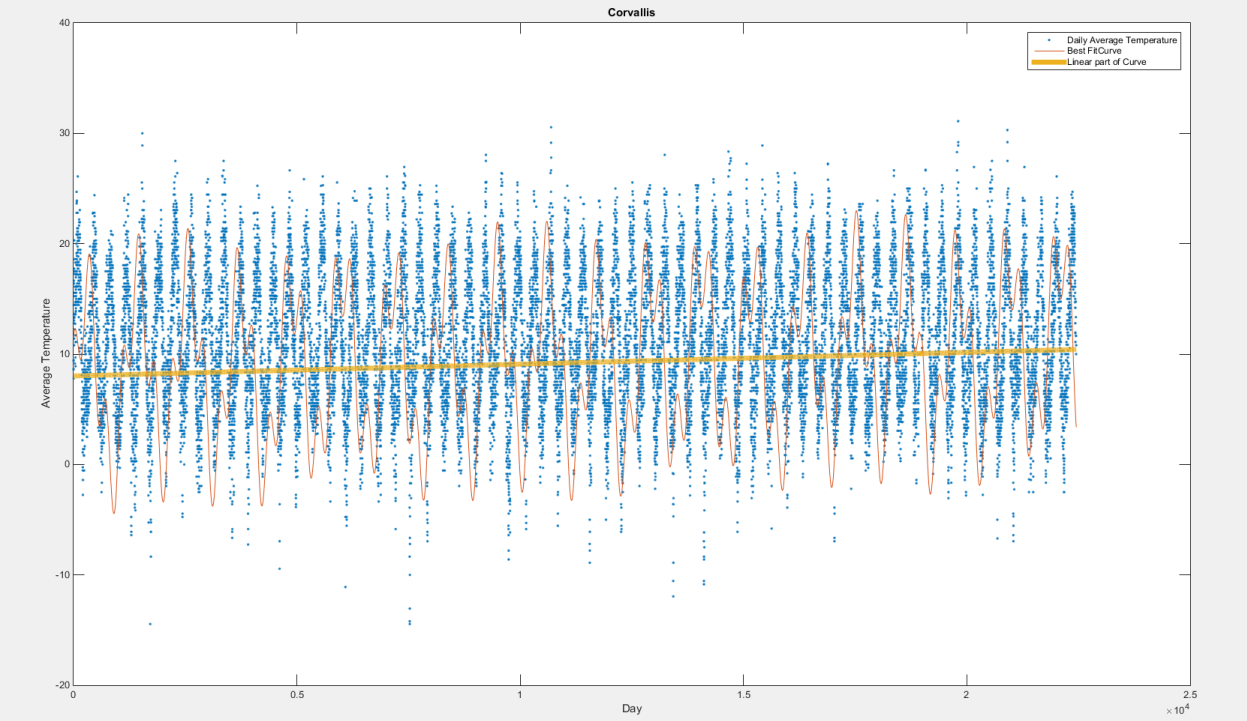
2. The values of all of the variables to your linear program in the optimal solution that your linear program solver finds for the Corvallis data.

```
>> temperature
Optimization terminated.

x =

   14.2355
    8.0214
    0.0001
    4.2809
    8.1869
   -0.7906
   -0.2954
```

x means the eventual result
so:
x0 = 8.0214
x1 = 0.0001
x2 = 4.2809
x3 = 8.1869
x4 = -0.7906
x5 = -0.2954

min t = 14.2355

3. Corvallis plot.



4. Based on the value x1 how many degrees Celsius per century is Corvallis changing and is it a warming or cooling trend?

According to x1, we know that a century has one hundred years, that means a century has 36500 days, so we can know that:

$$T(d) = x0 + x1*d$$
$$\Rightarrow T(d) = 8.0214 + 0.0001*d$$
$$\text{here } d = 36500$$
$$T(d) = 8.0214 + 3.65$$

So Corvallis changing 3.65 degrees per century, and due to it is a positive number, so it is warming trend.

5. Other cities I chose are: BEIJING, CHANGSHA, SACRAMENTO.

a) BEIJING

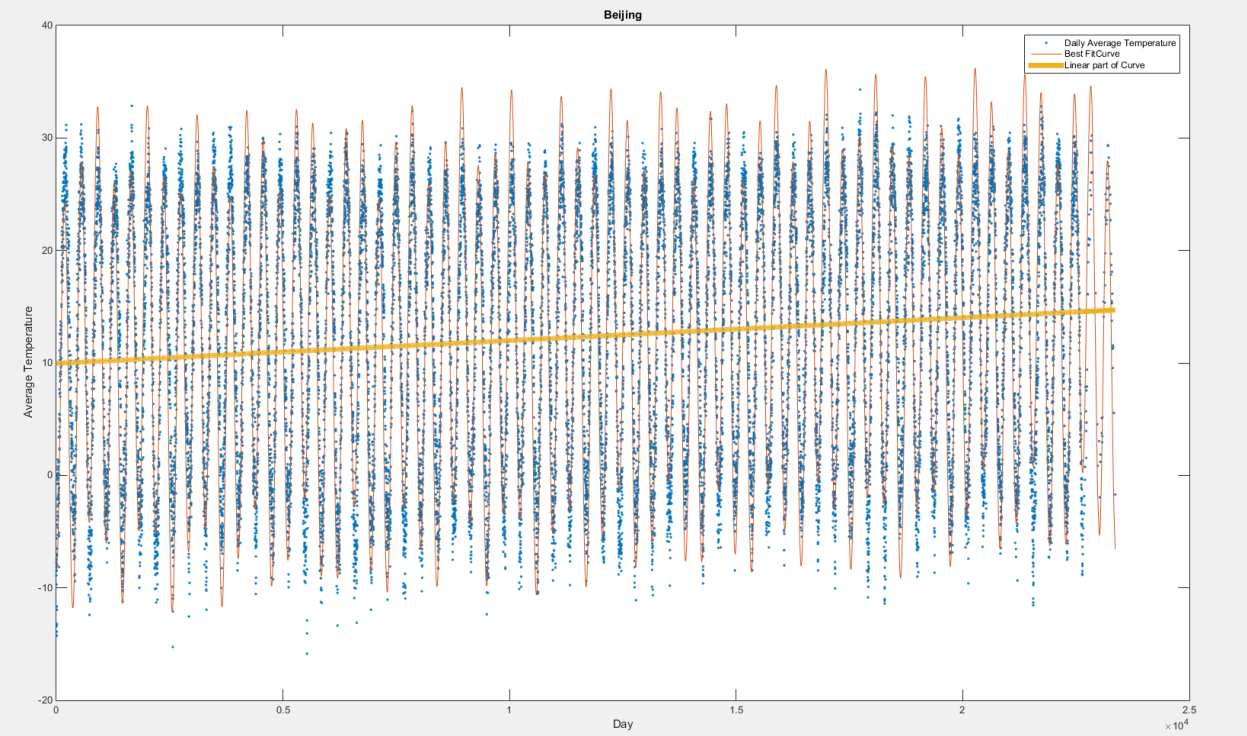
2. The values of all of the variables to your linear program in the optimal solution that your linear program solver finds for the Beijing data:

```
>> temperature
Optimization terminated.

x =

   12.9013
    9.9569
    0.0002
  -17.9812
   -4.3082
   -0.2774
    0.5846
```

x0 = 9.9569
x1 = 0.0002
x2 = -17.9812
x3 = -4.3082
x4 = -0.2774
x5 = 0.5846

min t = 12.9013

3. Beijing Plot



4. Based on the value x1 how many degrees Celsius per century is Beijing changing and is it a warming or cooling trend?

According to x1, we know that a century has one hundred years, that means a century has 36500 days, so we can know that:

$$T(d) = x0 + x1*d$$
$$\Rightarrow T(d) = 9.9569 + 0.0002*d$$
$$\text{here } d = 36500$$
$$T(d) = 9.9569 + 7.3$$

So Beijing changing 7.3 degrees per century, and due to it is a positive number, so it is warming trend.

b) CHANGSHA

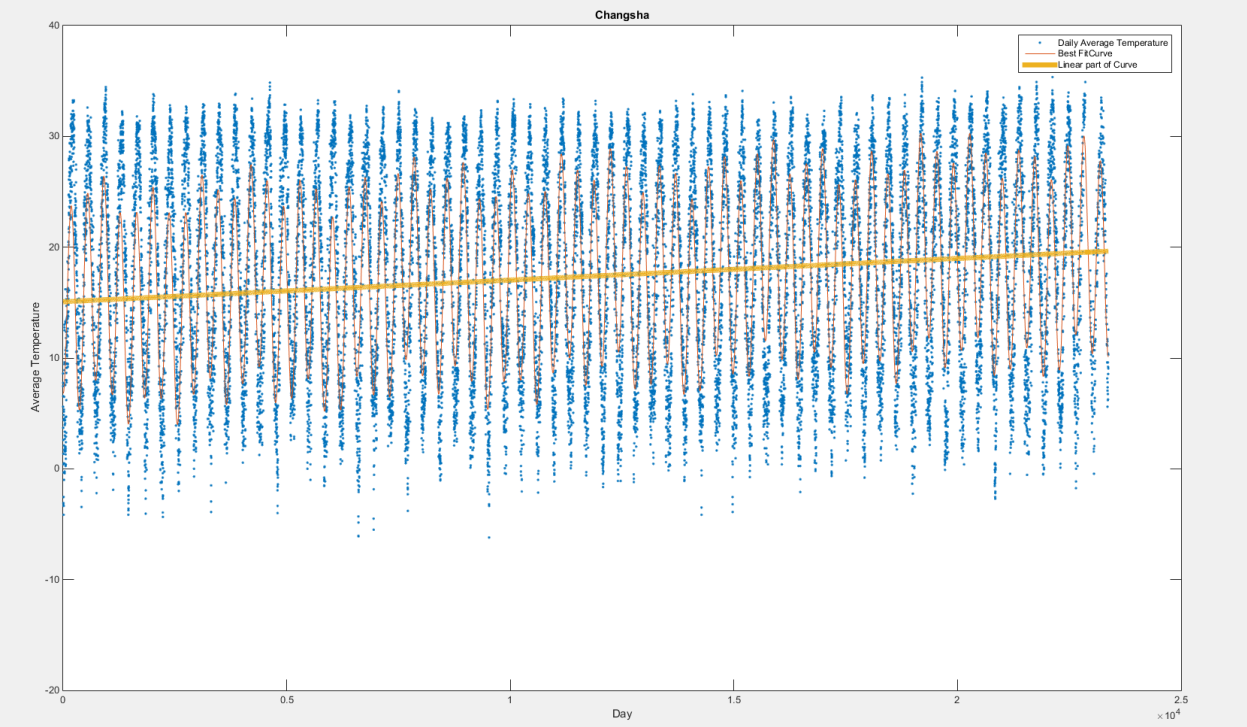
2. The values of all of the variables to your linear program in the optimal solution that your linear program solver finds for the Changsha data:

```
>> temperature
Optimization terminated.

x =

   13.5424
   15.0739
    0.0002
   -9.1525
   -1.7395
    0.9133
    0.2478
```

x0 = 15.0739
x1 = 0.0002
x2 = -9.1525
x3 = -1.7395
x4 = 0.9133
x5 = 0.2478

min t = 13.5424

3. Changsha Plot



4. Based on the value x1 how many degrees Celsius per century is Changsha changing and is it a warming or cooling trend?

According to x1, we know that a century has one hundred years, that means a century has 36500 days, so we can know that:

$$T(d) = x0 + x1*d$$

$$\Rightarrow T(d) = 15.0739 + 0.0002*d$$

here d = 36500

$$T(d) = 15.0739 + 7.3$$

So Beijing changing 7.3 degrees per century, and due to it is a positive number, so it is warming trend.

c) SACRAMENTO

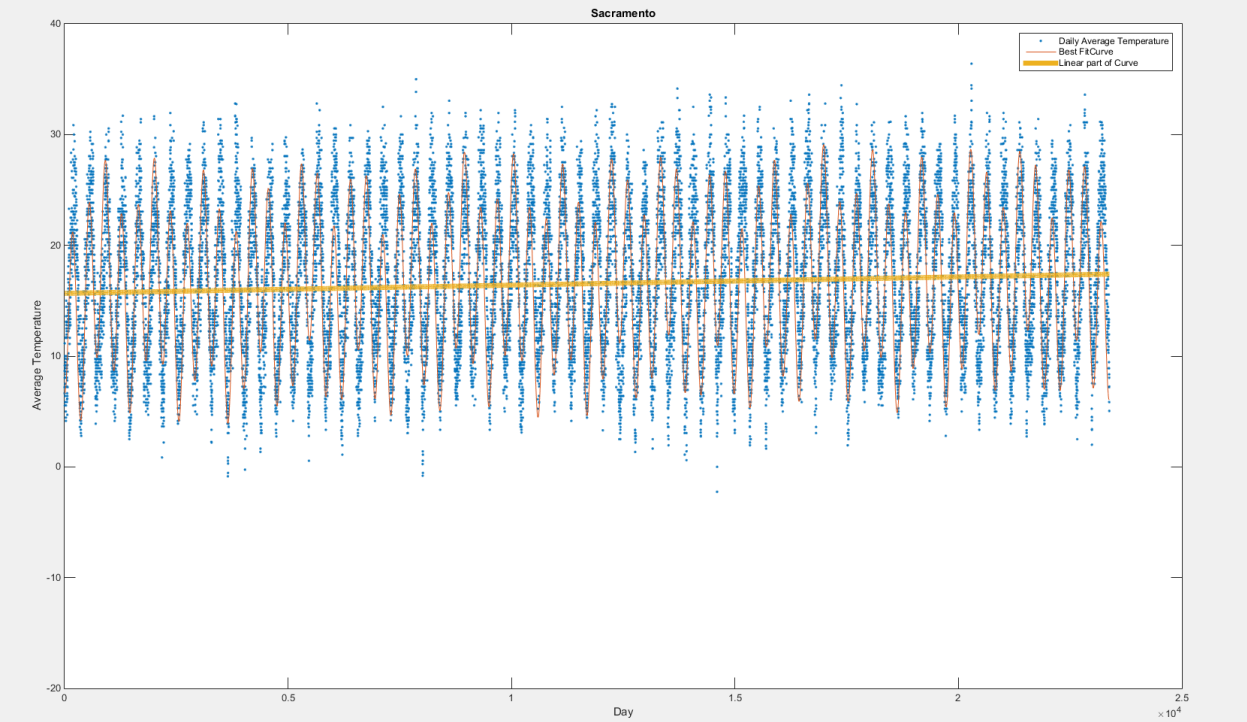
2. The values of all of the variables to your linear program in the optimal solution that your linear program solver finds for the Changsha data:

```
>> temperature
Optimization terminated.

x =

   10.8108
   15.6664
    0.0001
   -8.4852
   -3.1596
   -0.4813
    0.4956
```

x0 = 15.6664
x1 = 0.0001
x2 = -8.4852
x3 = -3.1596
x4 = -0.4813
x5 = 0.4956

min t = 10.8108

3. Sacramento Plot



4. Based on the value x1 how many degrees Celsius per century is Sacramento changing and is it a warming or cooling trend?

According to x1, we know that a century has one hundred years, that means a century has 36500 days, so we can know that:

$$T(d) = x0 + x1*d$$

$$\Rightarrow T(d) = 15.6664 + 0.0001*d$$

here $d = 36500$

$$T(d) = 15.6664 + 3.65$$

So Sacramento changing 3.65 degrees per century, and due to it is a positive number, so it is warming trend.