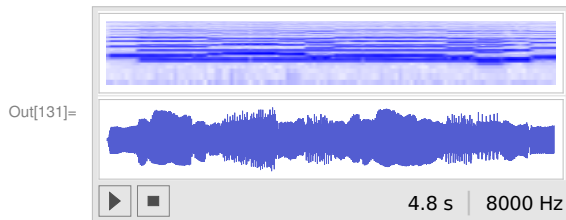
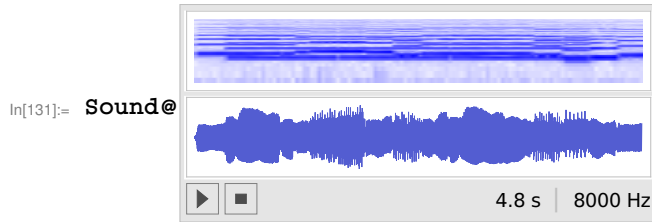


Vectors and Matrices as Data

do as fast as possible to test time taken

■ Question 1



```
x = Import["/home/nathan/QEA-Homework/module 2/day4/hornCSV.csv"];  
x1 = Import["/home/nathan/QEA-Homework/module 2/day4/english_horn.wav", "Data"] // Flatten
```

Out[133]=

```
{0.00466919, 0.010376, 0.00534058, 0.00265503, 0.0039978, 0.00146484,  
-0.00146484, -0.00311279, ... 38 384 ..., -0.00665283, -0.00582886, -0.010498,  
-0.00796509, -0.00369263, -0.000457764, 0.000671387, 0.000396729}
```

large output

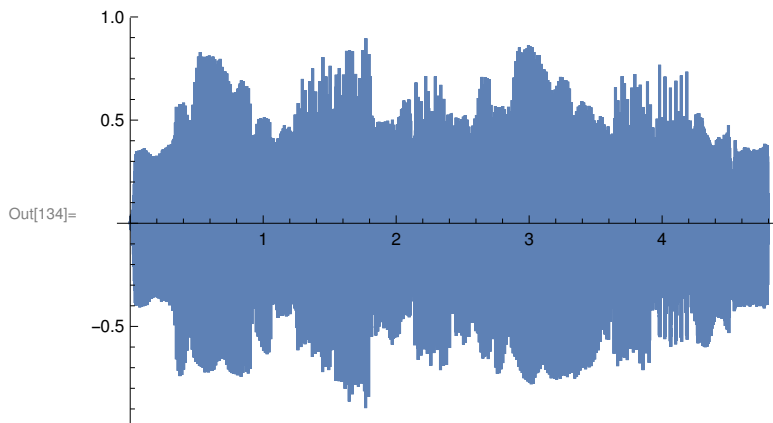
show less

show more

show all

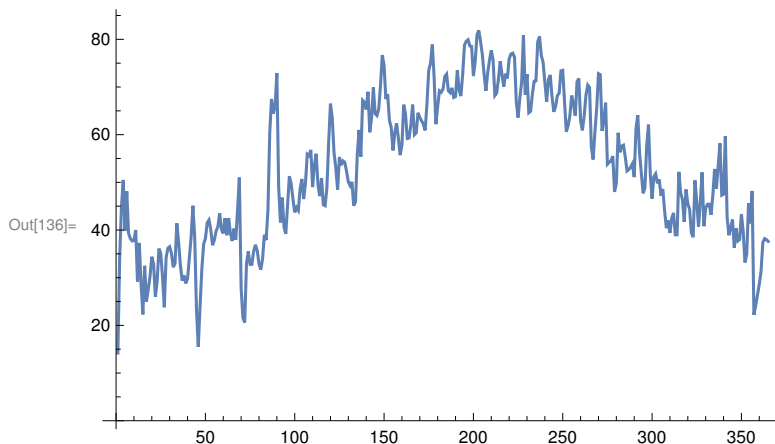
set size limit...

In[134]:= **ListLinePlot[x]**



```
t = Transpose@  
Import["/home/nathan/QEA-Homework/module 2/day4/1998DailyTempBos.csv"];
```

In[136]:= **ListLinePlot**[t]



In[137]:= **2. Transpose**[x1][[1]]

Transpose::nmtx : The first two levels of

{0.00466919, 0.010376, 0.00534058, 0.00265503, 0.0039978, 0.00146484, -0.00146484, -0.00311279, -0.00344849, <<33>>, 0.0155029, 0.0135193, 0.0136414, 0.0169067, 0.0230713, 0.0341797, 0.0192261, 0.025116, <<38350>>} cannot be transposed. >>

Out[137]=

```
{0.00933838, 0.020752, 0.0106812, 0.00531006, 0.00799561, 0.00292969,
-0.00292969, -0.00622559, -0.00689697, ... 38 383 ..., -0.0133057, -0.0116577,
-0.0209961, -0.0159302, -0.00738525, -0.000915527, 0.00134277, 0.000793457}
```

large output

[show less](#)

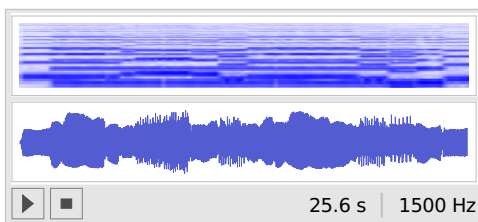
[show more](#)

[show all](#)

[set size limit...](#)

In[138]:= **audio = Sound**[**SampledSoundList**[x1, 1500]]

Out[138]=



In[139]:= **Export**["low.flac", audio]

Out[139]= low.flac

```
in = Import[
  "/home/nathan/QEA-Homework/module 2/day4/english_horn.wav", "Data"] // Flatten
```

Out[140]=

```
{0.00466919, 0.010376, 0.00534058, 0.00265503, 0.0039978, 0.00146484,
-0.00146484, -0.00311279, ... 38 384 ..., -0.00665283, -0.00582886, -0.010498,
-0.00796509, -0.00369263, -0.000457764, 0.000671387, 0.000396729}
```

large output

[show less](#)

[show more](#)

[show all](#)

[set size limit...](#)

■ Question 2

In[141]:=

```

      1
In[142]:= a = 2;
      3
      3
      b = 2;
      1
      3 0 0
      d = 0 2 0;
      0 0 1

```

In[145]:= **b * a**

Out[145]= {{3}, {4}, {3}}

In[146]:= **a.b**

Dot::dotsh : Tensors {{1}, {2}, {3}} and {{3}, {2}, {1}} have incompatible shapes. >>

Out[146]= {{1}, {2}, {3}}.{{3}, {2}, {1}}

In[147]:= **a.Transpose[b]**

Out[147]= {{3, 2, 1}, {6, 4, 2}, {9, 6, 3}}

In[148]:= **d.a**

Out[148]= {{3}, {4}, {3}}

In[149]:= **d.a.Transpose[a]**

Out[149]= {{3, 6, 9}, {4, 8, 12}, {3, 6, 9}}

■ Question 3, 4

In[150]:= **Clear["Global`*"]**

```

In[151]:= d = Join[
  {Join[{1}, Table[0, 364]]},
  Table[Join[Table[0, i - 1], {1/3, 1/3, 1/3}, Table[0, 363 - i]], {i, 363}],
  {Join[Table[0, 364], {1}]}
]

```

Out[151]=

{ ... 1 ... }

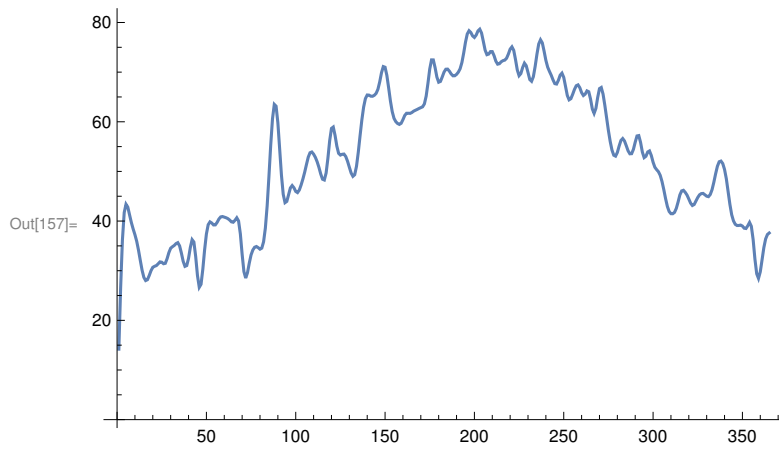
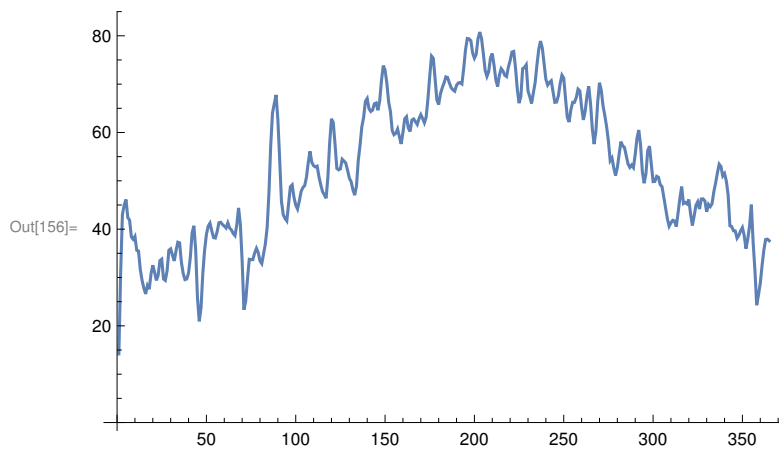
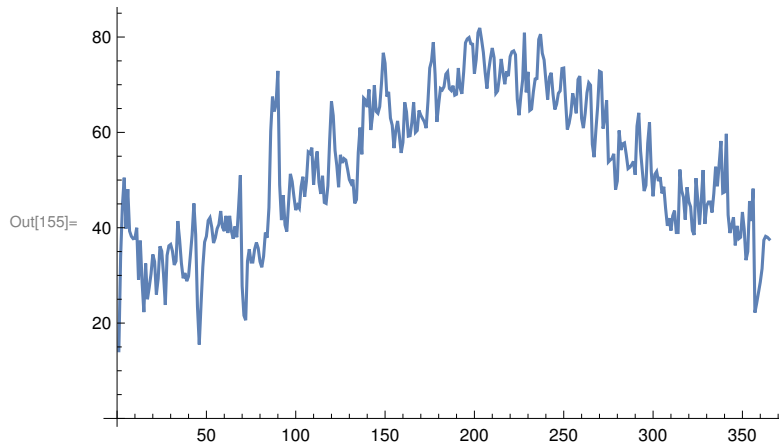
large output

[show less](#)[show more](#)[show all](#)[set size limit...](#)**t = Import["/home/nathan/QEA-Homework/module 2/day4/1998DailyTempBos.csv"];**In[153]:= **Dimensions[t]****Dimensions[d]**

Out[153]= {365, 1}

Out[154]= {365, 365}

```
In[155]:= ListLinePlot[Transpose[t]]  
ListLinePlot[Transpose[d.t]]  
ListLinePlot[Transpose[d.(d.(d.(d.t)))]]
```

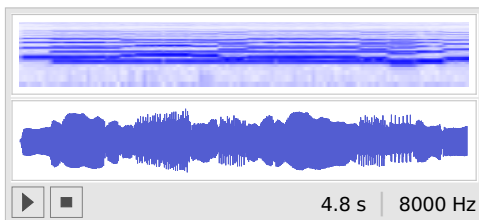


■ Question 7, 8

```

Clear["Global`*"]
soundData = Import[
  "/home/nathan/QEA-Homework/module 2/day4/english_horn.wav", "Data"] // Flatten
Sound[SampledSoundList[soundData, 8000]]
  1 / 3
d = 1 / 3
  1 / 3
soundDatad = ListConvolve[d^T[[1]], soundData]
Sound[SampledSoundList[soundDatad, 8000]]

```



```
ListLinePlot[{soundData, soundDatad}]
```

Question 10

In[369]:=

In[651]:=

```

Clear["Global`*"]
soundData = Import[
  "/home/nathan/QEA-Homework/module 2/day4/english_horn.wav", "Data"] // Flatten
h2 = {1 / 5, 1 / 5, 1 / 5, 1 / 5, 1 / 5}
soundData2 = ListConvolve[h2, soundData]
xhf2 = Table[Cos[1000 t], {t, 0, 10, 10. / 10 000}];
xlf2 = Table[Cos[10 t], {t, 0, 10, 10. / 10 000}];
hfSound2 = ListConvolve[h2, xhf2];
lfSound2 = ListConvolve[h2, xlf2];
"High Frequency + High Pass = " Sound[SampledSoundList[hfSound2, 1000]]
"Low Frequency + High Pass = " Sound[SampledSoundList[lfSound2, 1000]]
ListLinePlot[{hfSound2, lfSound2}, PlotRange -> {{0, 100}, {-1, 1}}]

```

Out[652]=

```

{0.00466919, 0.010376, 0.00534058, 0.00265503, 0.0039978, 0.00146484,
 -0.00146484, -0.00311279, ... 38 384 ..., -0.00665283, -0.00582886, -0.010498,
 -0.00796509, -0.00369263, -0.000457764, 0.000671387, 0.000396729}

```

large output

[show less](#)[show more](#)[show all](#)[set size limit...](#)Out[653]= $\left\{\frac{1}{5}, \frac{1}{5}, \frac{1}{5}, \frac{1}{5}, \frac{1}{5}\right\}$

Out[654]=

```
{0.00540771, 0.00476685, 0.00239868, 0.000708008, -0.000512695,
-0.00227051, -0.00422363, ... 38 382 ... , -0.0150452, -0.0136292,
-0.0103455, -0.00692749, -0.00568848, -0.00438843, -0.00220947}
```

large output

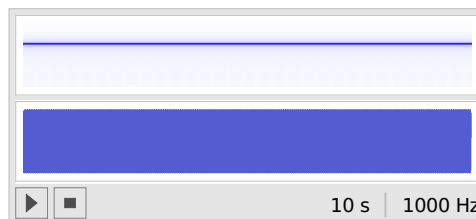
show less

show more

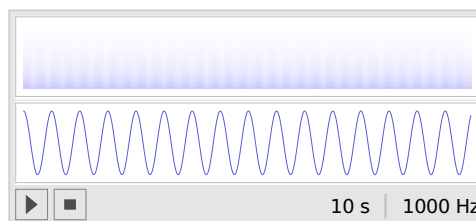
show all

set size limit...

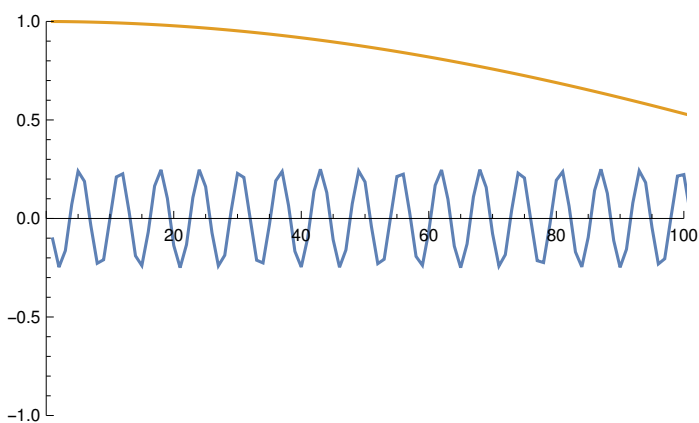
Out[659]= High Frequency + High Pass =



Out[660]= Low Frequency + High Pass =



Out[661]=



■ Question 12

```
Clear["Global`*"]
soundData = Import[
  "/home/nathan/QEA-Homework/module 2/day4/english_horn.wav", "Data"] // Flatten
N@Length[soundData] / 8000
h = Join[{1 / 2}, Table[0, 8000], {1 / 2}];
soundData[[1 ;; 4000]];
soundData[[Length[soundData] - 4000 ;; Length[soundData]]];
SoundDatah = ListConvolve[h, soundData]
soundDataFull = Join[(1 / 2) * soundData[[1 ;; 4000]], ListConvolve[h, soundData],
  (1 / 2) * soundData[[Length[soundData] - 4000 ;; Length[soundData]]];
Sound[SampledSoundList[soundData, 8000]]
Sound[SampledSoundList[SoundDatah, 8000]]
Sound[SampledSoundList[soundDataFull, 8000]]
```

Question 13

```

In[467]:= Clear["Global`*"]

t = Import["/home/nathan/QEA-Homework/module 2/day4/1998DailyTempBos.csv"];

In[469]:= h = Table[1 / 5, 5]
Out[469]= {1/5, 1/5, 1/5, 1/5, 1/5}

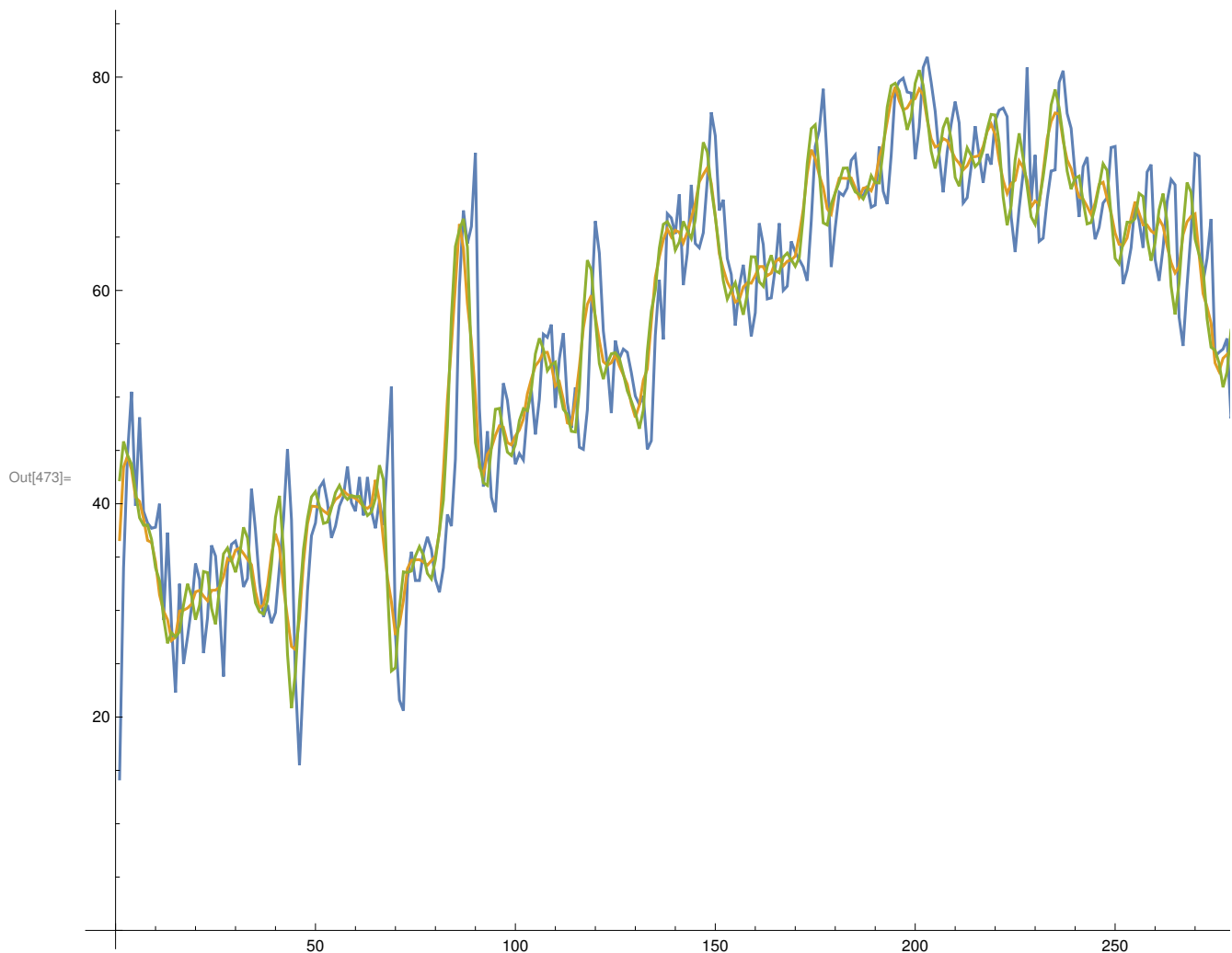
In[470]:= t1 = ListConvolve[h, t^T[[1]]];

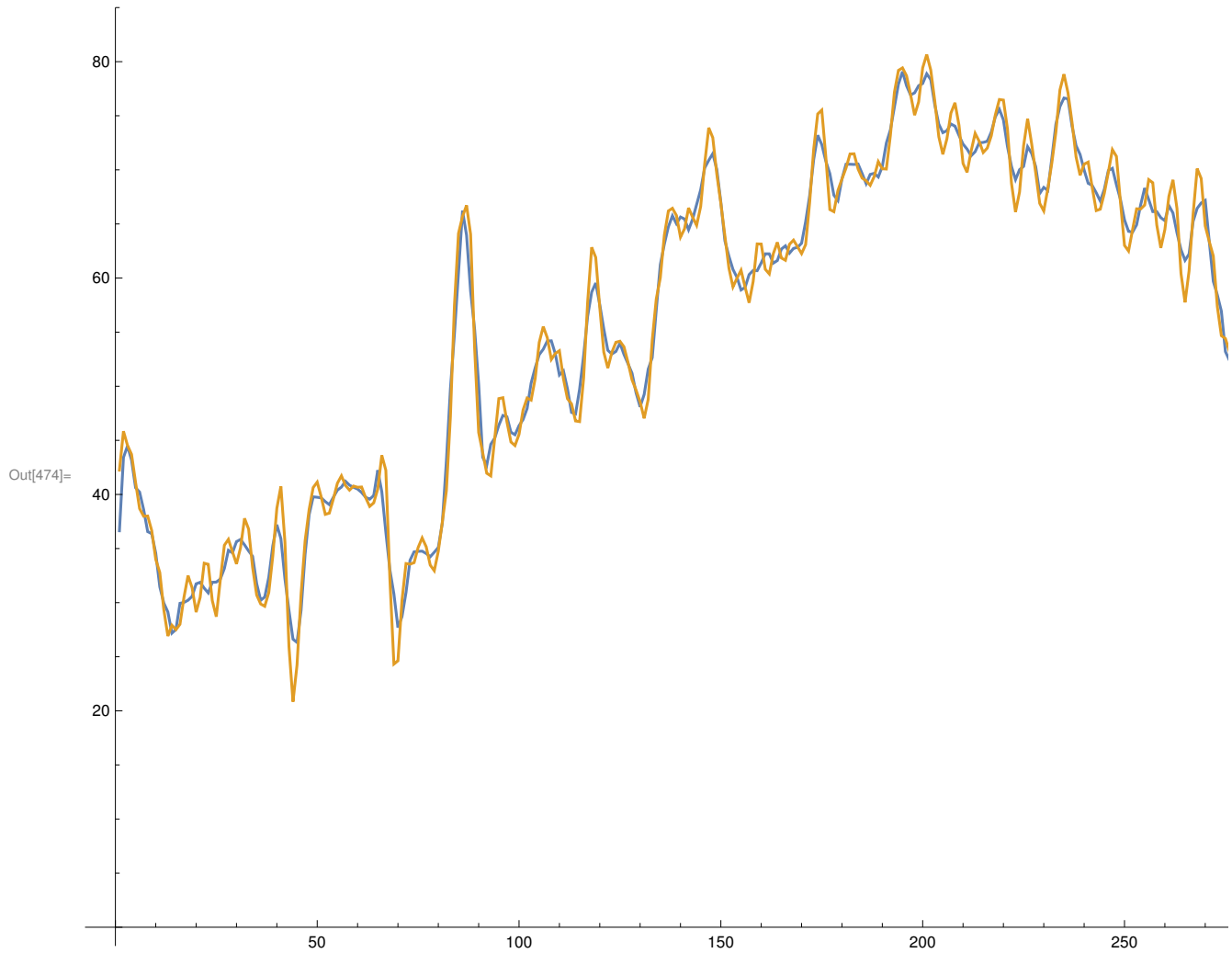
In[471]:= k = {.036, .241, .446, .241, .036}
Out[471]= {0.036, 0.241, 0.446, 0.241, 0.036}

In[472]:= t2 = ListConvolve[k, t^T[[1]]];

In[473]:= ListLinePlot[{t^T[[1]], t1, t2}]
ListLinePlot[{t1, t2}]

```





Question 14

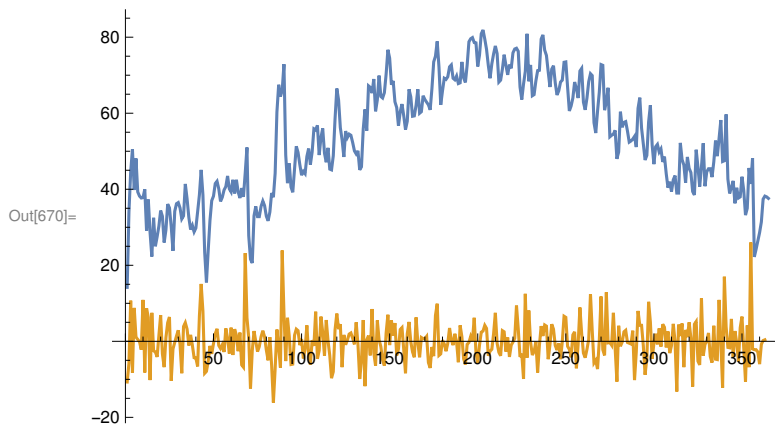
```
In[475]:= Clear["Global`*"]
```

```
In[666]:= t = Import["/home/nathan/QEA-Homework/module 2/day4/1998DailyTempBos.csv"];
h = {-1, 1, 0};
t = t[[1]];
```

```
In[669]:= t1 = ListConvolve[h, t];
```



```
In[670]:= ListLinePlot[{t, t1}]
```



Define Kernal

```
In[584]:= Clear["Global`*"]
```

```
In[626]:= Kernal[vec_, kern_] :=
  Join[{vec[[1]]}, Table[Total[vec[[i ;; i + Length[kern] - 1]] * kern],
    {i, 1, 1 + Length[vec] - Length[kern]}], {vec[[-1]]}]
```

```
In[631]:= Kernal[{1, 3, 2, -1, 3, 1}, {1/2, 1/3, 1/4}]
```

Out[631]= $\left\{1, 2, \frac{23}{12}, \frac{17}{12}, \frac{3}{4}, 1\right\}$

```
In[638]:= t = Import["/home/nathan/QEA-Homework/module 2/day4/1998DailyTempBos.csv"];
k = {0, 1, -1};
t = t^T[[1]];
```

```
In[649]:= tk = Kernal[t, k];
```

```
In[650]:= ListLinePlot[{t, tk}]
```

