```
load('djia.mat')
```

(g) Compute the maximum gain possible over all of the data. That is if you knew what the DJIA was going to do each week, and you had the option of making (1 + 0.03152) in the bank, or the weekly gain in the DJIA, how much could you make over all 4861 weeks? You may be motivated now to look for additional prediction strategies that could come closer to this maximum gain than the simple linear prediction scheme developed in previous parts. For example, you might try updating your predictor coefficients based on the most recent decade before making each prediction. There are several fast algorithms for doing exactly this, like the recursive least squares (RLS) algorithm.

```
%(G)
Tgain = (djia(end)-djia(1))/djia(1);
txt1 = ['Maximum gain over all the data is ',num2str(Tgain*100),'% in ',...
    num2str(length(djia)),' weeks.'];
disp(txt1)
```

```
Maximum gain over all the data is 6339.4904% in 4861 weeks.
```

```
TgainAPR =  (1+0.03/52)^length(djia);
txt2 = ['with APR 3%, compounded weekly, total gain would be ',num2str(TgainAPR*100),'% in ',..
    num2str(length(djia)),' weeks.'];
disp(txt2)
```

```
with APR 3%, compounded weekly, total gain would be 1650.4192% in 4861 weeks.
```

Part G Analysis:

Looking at the maximum gain over all the data, we can say that so far the linear prediction provides the best results. The results we got just now has a higher maximum gain and yield among all the data in DJIA. It also have a higher total gain when looking at the APR rate at 3%. Looking at these predictions, linear prediction so far provides the best result.

(h) Show that the linear predictor can be used to model the DTFT of the sequence x[n] by analytically demonstrating (using Parseval's relation) that the coefficients ak are chosen to minimize. Plot the DTFT of the DJIA sequence and the frequency response of the linear predictor on the same set of axes. Since it is not the difference, but rather the ratio, that is minimized, you should see that x(ejw) has the proper shape, but is off by a scale factor G. Scale x(ejw)b y G = Ce2[n]a nd re-plot the two DTFTs. Can you figure out why this value of G was chosen?

```
%(H)
p = 3;
NN = 520;

% Define X
for i = 1:NN-p
    for j = 1:p
        X(i,j) = djia(i+j-1);
    end
end
% Define x
```

```
for i = p+1:NN
    x(i-p,1) = djia(i);
end
% Solve for coefficients using X and x
a = -X\x;

syms w f(w)
for  k = 1:p
    denominator(k) = a(k)*exp(-j*w*k);

end

f(w) = sum(denominator);
v = linspace(-pi,pi,100);
y = vpa(f(v),3);

plot(y)
```