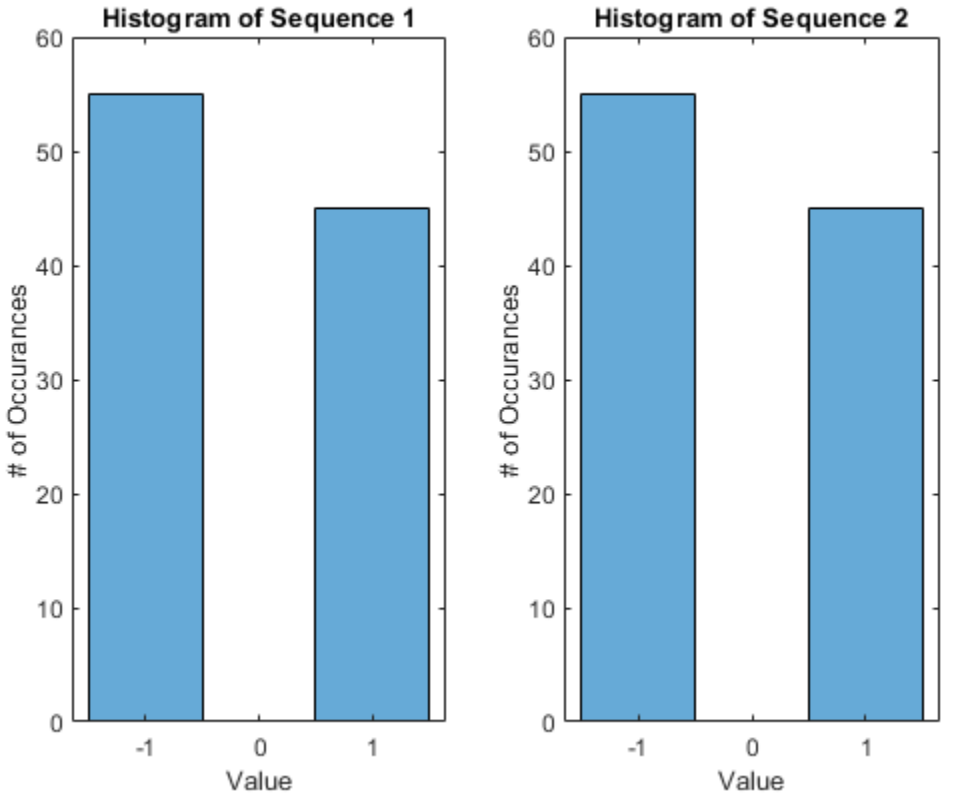
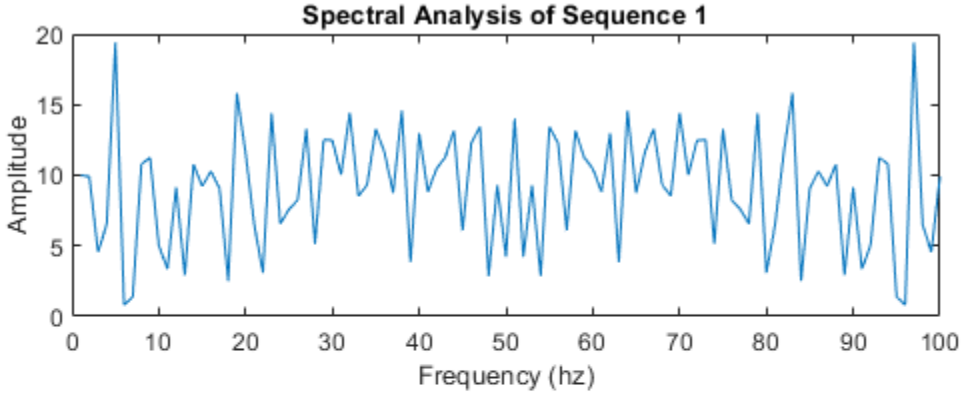
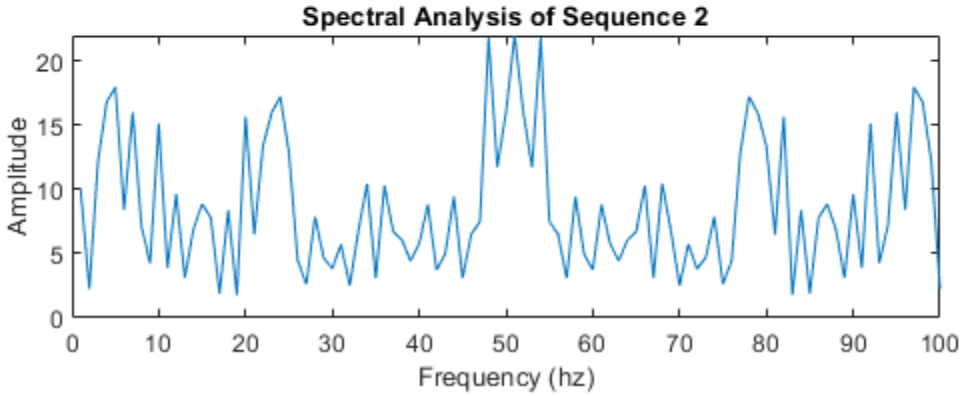
Problem 2

```
seq1 = 2*ceil((rand(100,1)-.5))-1;
seq2 = 2*ceil((rand(100,1)-.5))-1;

% Part A - Plot Histogram of Each Sequence

figure
subplot(1,2,1)
histogram(seq1)
title("Histogram of Sequence 1")
xlabel("Value")
ylabel("# of Occurances")
subplot(1,2,2)
histogram(seq2)
title("Histogram of Sequence 2")
xlabel("Value")
ylabel("# of Occurances")

% Part B - Plot Spectral Analysis of Each Sequence

figure
subplot(2,1,1)
plot(abs(fft(seq1)))
title("Spectral Analysis of Sequence 1")
xlabel("Frequency (hz)")
ylabel("Amplitude")
subplot(2,1,2)
plot(abs(fft(seq2)))
title("Spectral Analysis of Sequence 2")
xlabel("Frequency (hz)")
ylabel("Amplitude")

% Part C - Plot Autocorrelation for Each Sequence

aCorr1 = autoCorrelation(seq1);
aCorr2 = autoCorrelation(seq2);

figure
subplot(2,1,1)
plot(aCorr1)
title("Autocorrelation of Sequence 1")
xlabel("Shift")
ylabel("Correlation")
subplot(2,1,2)
plot(aCorr2)
title("Autocorrelation of Sequence 2")
xlabel("Shift")
ylabel("Correlation")

function aCorr = autoCorrelation(seq)
```

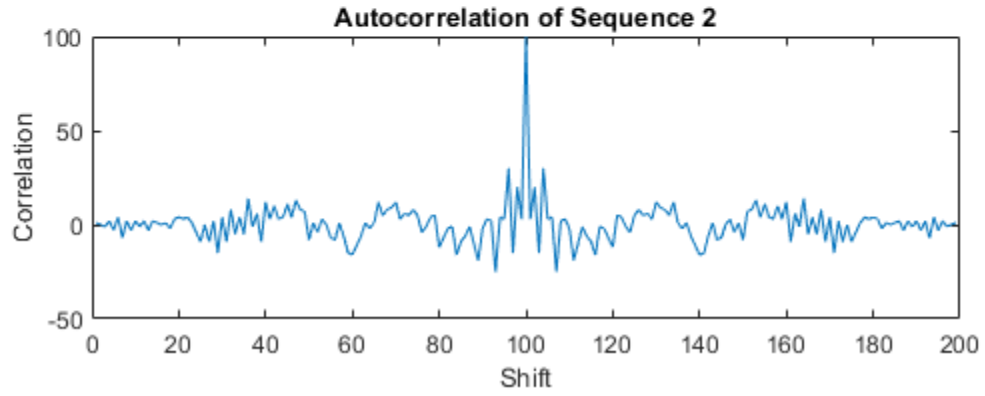
```
    n = length(seq);
    m = 2*n-1;
    for i = 1 : n
        aCorr(i) = sum(seq(n-i+1:n) .* seq(1:i));
        aCorr(m+1-i) = aCorr(i); % autocorrelation is symmetric
    end
end

% Part D - Plot Cross Correaltion Between the Two Sequences

xCorr = crossCorr(seq1,seq2);
figure
plot(xCorr)
title("Cross Correlation of Sequence 1 & 2")
xlabel("Shift")
ylabel("Correlation")

function xCorr = crossCorr(seq1,seq2)

    n = length(seq1);
    for i = -n : n
        if i < 0
            xCorr(i+n+1) = sum(seq1(1:end+i) .* seq2(-i+1:end));
        elseif i > 0
            xCorr(i+n+1) = sum(seq1(1:end-i) .* seq2(i+1:end));
        else
            xCorr(i+n+1) = sum(seq1 .* seq2);
        end
    end
end
```

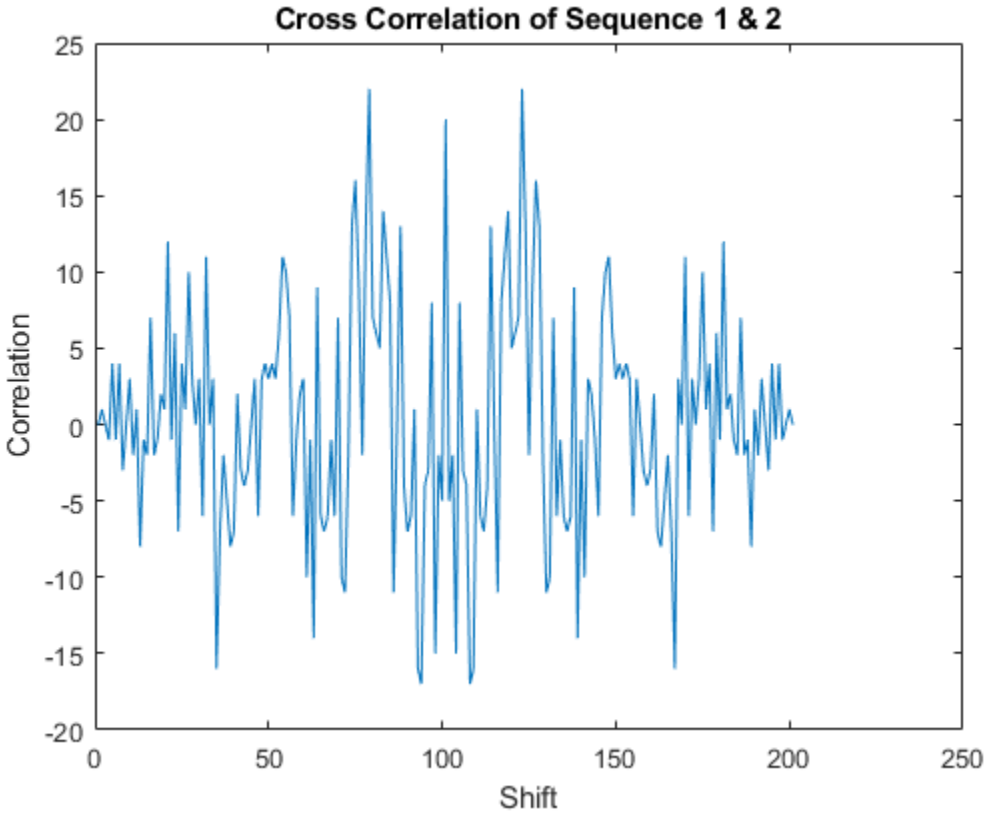

Histogram of Sequence 1
# of Occurances
Value
Histogram of Sequence 2
# of Occurances
Value


Spectral Analysis of Sequence 1
Amplitude
Frequency (hz)


Spectral Analysis of Sequence 2
Amplitude
Frequency (hz)


Autocorrelation of Sequence 1
Correlation
Shift
100
50
0
0
20
40
60
80
100
120
140
160
180
200

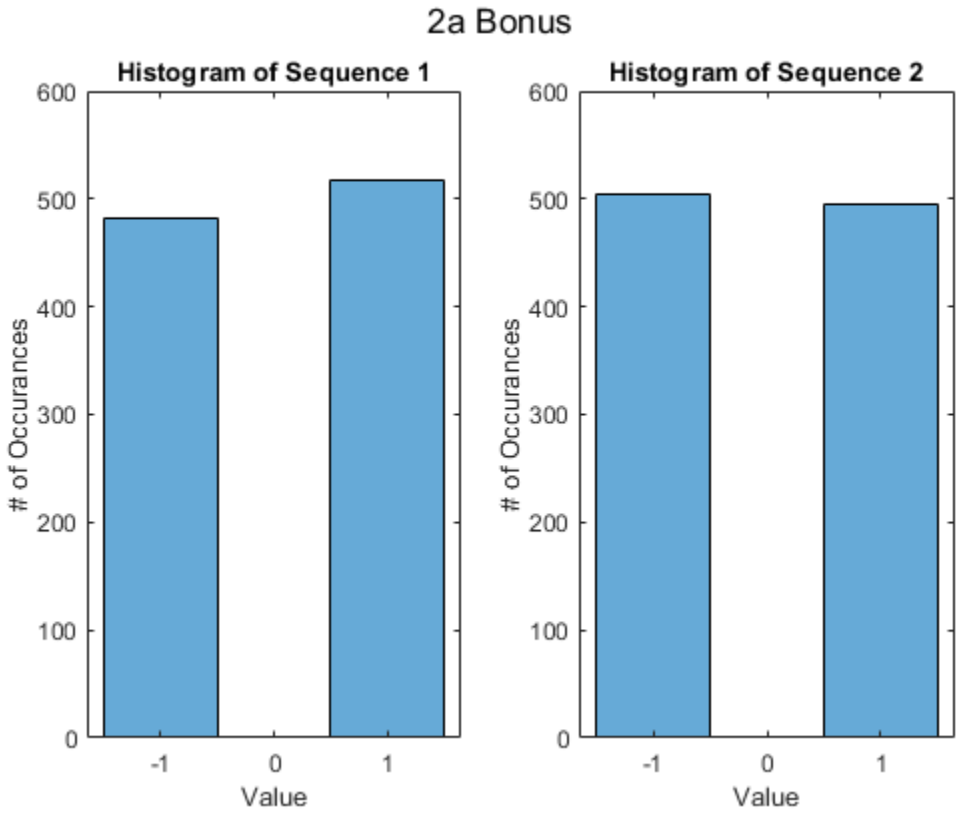

Autocorrelation of Sequence 2
Correlation
Shift
100
50
0
-50
0
20
40
60
80
100
120
140
160
180
200


Cross Correlation of Sequence 1 & 2
Correlation
Shift
25
20
15
10
5
0
-5
-10
-15
-20
0
50
100
150
200
250

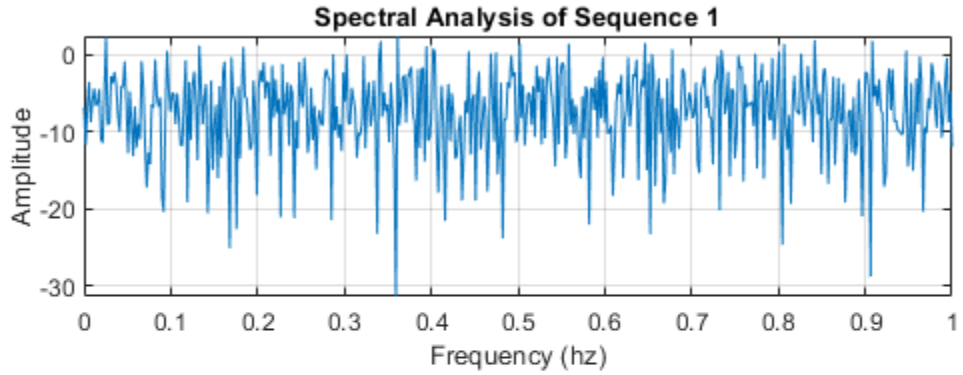
Problem 2 Bonus

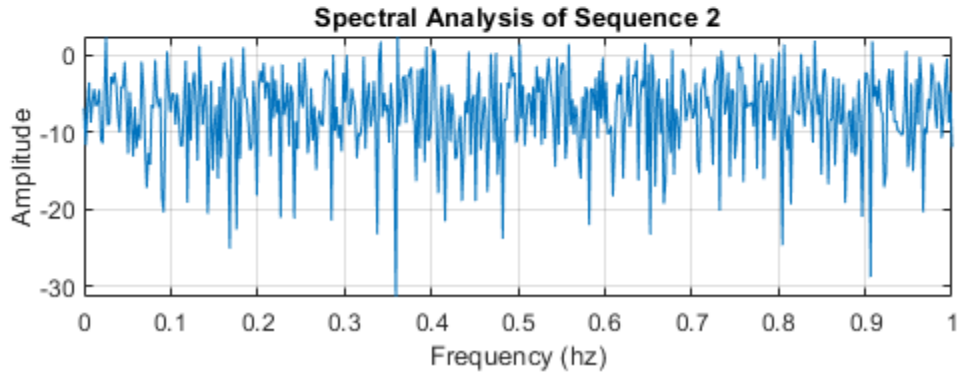
```
seq1 = 2*ceil((rand(1000,1)-.5))-1;
seq2 = 2*ceil((rand(1000,1)-.5))-1;

% Part A - Plot Histogram of Each Sequence

subplot(1,2,1)
histogram(seq1)
title("Histogram of Sequence 1")
xlabel("Value")
ylabel("# of Occurances")
subplot(1,2,2)
histogram(seq2)
title("Histogram of Sequence 2")
xlabel("Value")
ylabel("# of Occurances")
sgtitle('2a Bonus')

% Part B - Plot Spectral Analysis of Each Sequence

figure
subplot(2,1,1)
periodogram(seq1)
title("Spectral Analysis of Sequence 1")
xlabel("Frequency (hz)")
ylabel("Amplitude")
subplot(2,1,2)
periodogram(seq1)
title("Spectral Analysis of Sequence 2")
xlabel("Frequency (hz)")
ylabel("Amplitude")
sgtitle('2b Bonus')

% Part C - Plot Autocorrelation for Each Sequence

aCorr1 = xcorr(seq1,seq1);
aCorr2 = xcorr(seq2,seq2);

figure
subplot(2,1,1)
plot(aCorr1)
title("Autocorrelation of Sequence 1")
xlabel("Shift")
ylabel("Correlation")
subplot(2,1,2)
plot(aCorr2)
title("Autocorrelation of Sequence 2")
xlabel("Shift")
ylabel("Correlation")
sgtitle('2c Bonus')

% Part D - Plot Cross Correaltion Between the Two Sequences
```

```
xCorr = xcorr(seq1,seq2);
figure
plot(xCorr)
title("Bonus - Cross Correlation of Sequence 1 & 2")
xlabel("Shift")
ylabel("Correlation")
```

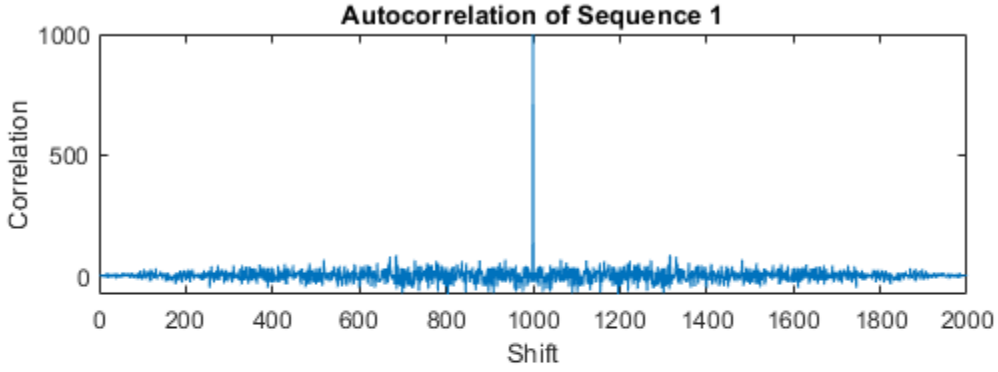


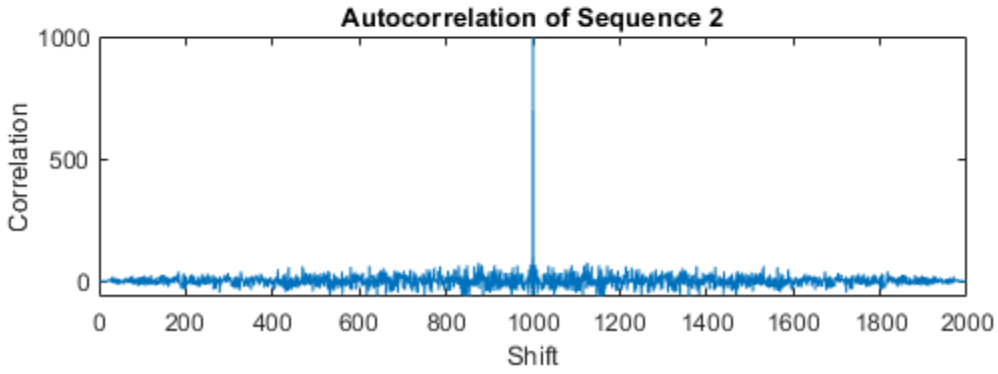
2b Bonus

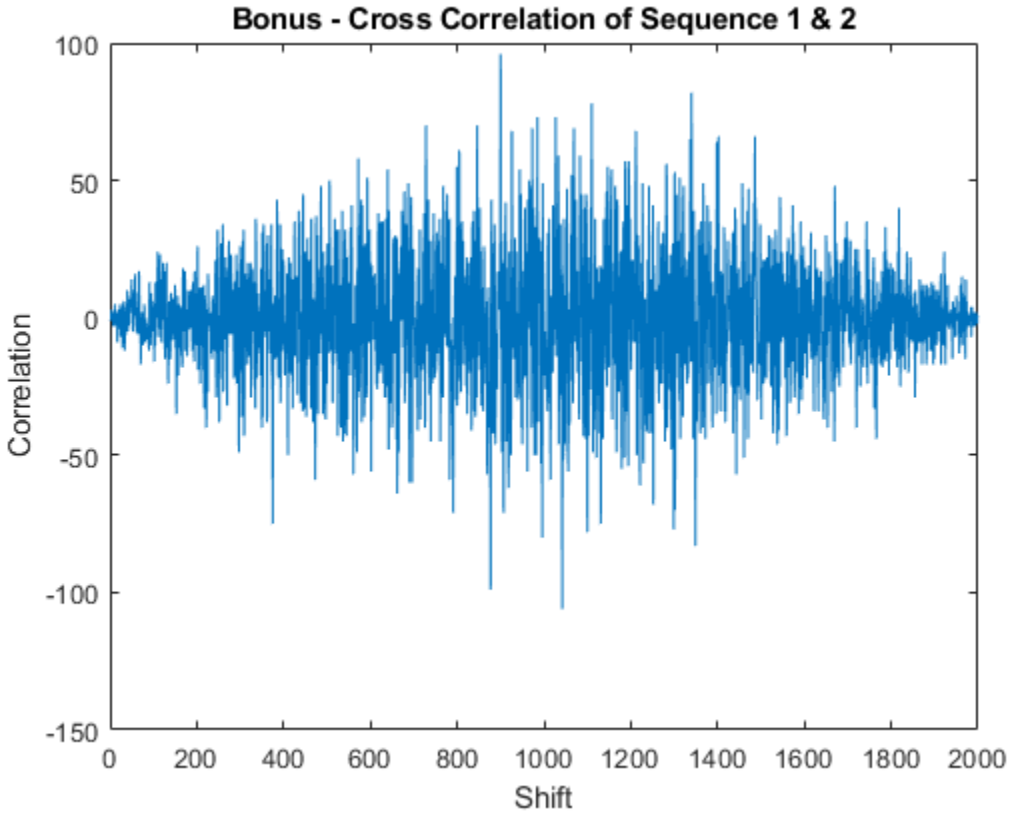




2c Bonus







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