Heaven's Light is Our Guide

Rajshahi University of Engineering & Technology

Department of Electrical & Computer Engineering

Course No: ECE 4124

Course Title: Digital Signal Processing Sessional

Submitted By:	**Submitted To:**
Name: Md. Turag Islam **Roll:** 1810020 **Date of Submission:**15/05/2023	Hafsa Binte Kibria Lecturer, ECE RUET

Experiment No: 03

Experiment Date: 08.05.2023

Experiment Name: i) Study of autocorrelation using MATLAB

ii) Study of cross correlation using MATLAB

Theory:

Autocorrelation is a statistical measure used to determine the correlation between a signal and its delayed version over time. It provides information about the similarity or dependence of a signal with itself at different time lags. By studying autocorrelation, we can gain insights into the periodicity, patterns, and underlying characteristics of a signal.

Cross-correlation is a statistical measure used to determine the similarity or correlation between two signals as a function of the time lag between them. It provides information about the relationship and similarity of two signals over time. By studying cross-correlation, we can understand the temporal alignment, patterns, and dependencies between different signals.

Code:

i)

```
clc
clear all

x=input('Enter a sequence');
h=fliplr(x);
a=length(x);
b=length(h);
n=a+b-1;
y=zeros(1,n);
l=1:n;
for i=0:n
 for j=0:n
 if((i-j+1)>0 && (i-j+1)<=b && (j+1)<=a)
 y(i+1)=y(i+1)+x(j+1).*h(i-j+1);
 end
 end
end

b=xcorr(x,x)
disp(y)

subplot(4,1,1)
stem(x)
xlabel('n');
ylabel('x[n]');
title('Sequence1');
```

```
subplot(4,1,2)
stem(h)
xlabel('n');
ylabel('h[n]');
title('Sequence2');


subplot(4,1,3);
stem(l,y)
xlabel('n');
ylabel('y[n]');
title('Autocorrelation Result');

subplot(4,1,4);
stem(b)
xlabel('n');
ylabel('y[n]');
title('Autocorrelation using formula');
```

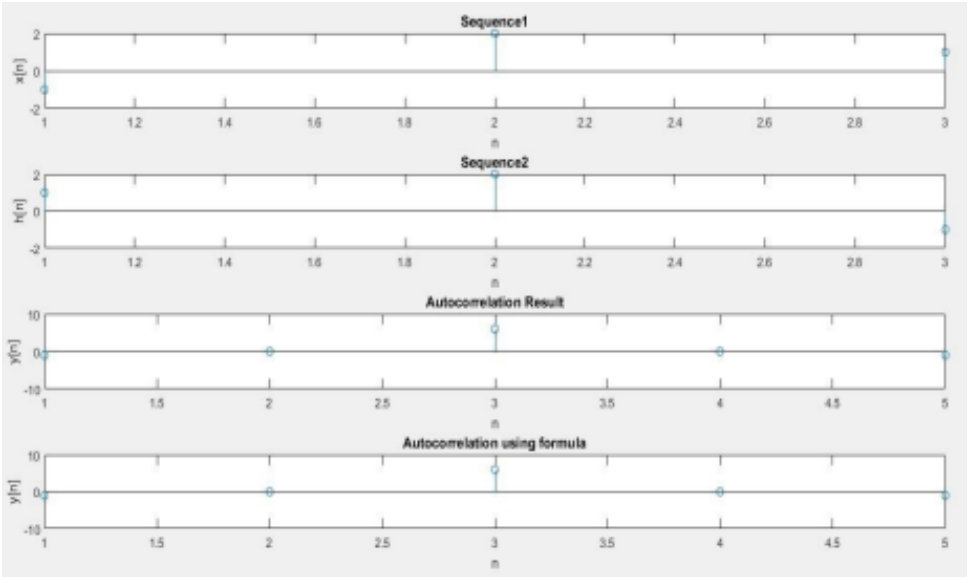
ii)

```
clc
clear all

x=input('Enter a sequence');
h=input('Enter another sequence');
a=length(x);
b=length(h);
n=a+b-1;
y=zeros(1,n);
l=1:n;
for i=0:n
 for j=0:n
 if((i-j+1)>0 && (i-j+1)<=b && (j+1)<=a)
 y(i+1)=y(i+1)+x(j+1).*h(i-j+1);  end
 end
end
b=xcorr(x,h)
disp(y)

subplot(4,1,1)
stem(x)
xlabel('n');
ylabel('x[n]');
title('Sequence 1');

subplot(4,1,2)
stem(h)
xlabel('n');
ylabel('h[n]');
title('Sequence 2');

subplot(4,1,3);
```

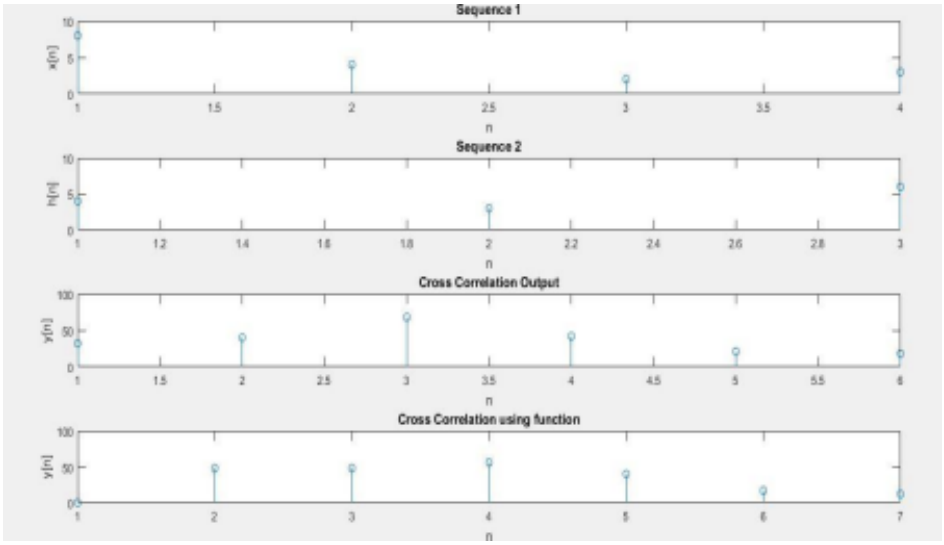
```
stem(l,y)
xlabel('n');
ylabel('y[n]');
title('Cross Correlation Output');

subplot(4,1,4);
stem(b)
xlabel('n');
ylabel('y[n]');
title('Cross Correlation using formula');
```

Output:

i)



ii)



Discussion:

The study of autocorrelation and cross-correlation using MATLAB provided insights into the periodicity, patterns, and relationships between signals. Autocorrelation helped identify repeating patterns and dependencies within a signal, while cross-correlation analyzed the similarity and alignment between two signals. These techniques have applications in signal processing, time series analysis, and communication systems.

Conclusion:

By utilizing autocorrelation and cross-correlation analysis in MATLAB, we gained a deeper understanding of signal characteristics and temporal relationships. These techniques offer valuable insights for various applications, enhancing decision-making and problem-solving in fields that rely on signal analysis.