Experiment No: 03

Experiment Date: 07.05.23

Experiment Name: Study of autocorrelation and cross-correlation using MATLAB.

Theory: Autocorrelation and cross-correlation are two important concepts in signal processing, time series analysis, and other related fields.

Autocorrelation refers to the correlation of a signal with a delayed version of itself. In other words, it measures how similar a signal is to a version of itself that has been shifted in time. Autocorrelation is useful for detecting repeating patterns or cycles in a signal.

Cross-correlation, on the other hand, measures the similarity between two different signals as a function of the time lag between them. In other words, it quantifies the degree of similarity between two signals at different time offsets.

Cross-correlation is often used for signal alignment, detection of signal echoes or echoes, and for measuring the time delay between two signals.

Required Software: MATLAB

Code:

Autocorrelation:

```
clc
clear all
close all
x=input('Enter the sequence');
subplot(3,1,1)
stem(x)
title('Given Function')
xh=xcorr(x,x)
subplot(3,1,2)
stem(xh)
title('Using Built in Function ')
z=[];
h=fliplr(x);
for i=1:length(x)
    g=h.*x(i);
    z=[z;g];
end
[r c]=size(z);
k=r+c;
t=2;
y=[];
cd=0;
while(t<=k)
    for i=1:r
        for j=1:c
            if((i+j)==t)
               cd=cd+z(i,j);
            end
        end
    end
    t=t+1;
```

```
    y=[y cd];
    cd=0;
end
subplot(3,1,3)
stem(y);
title('Manual')
```

Output:

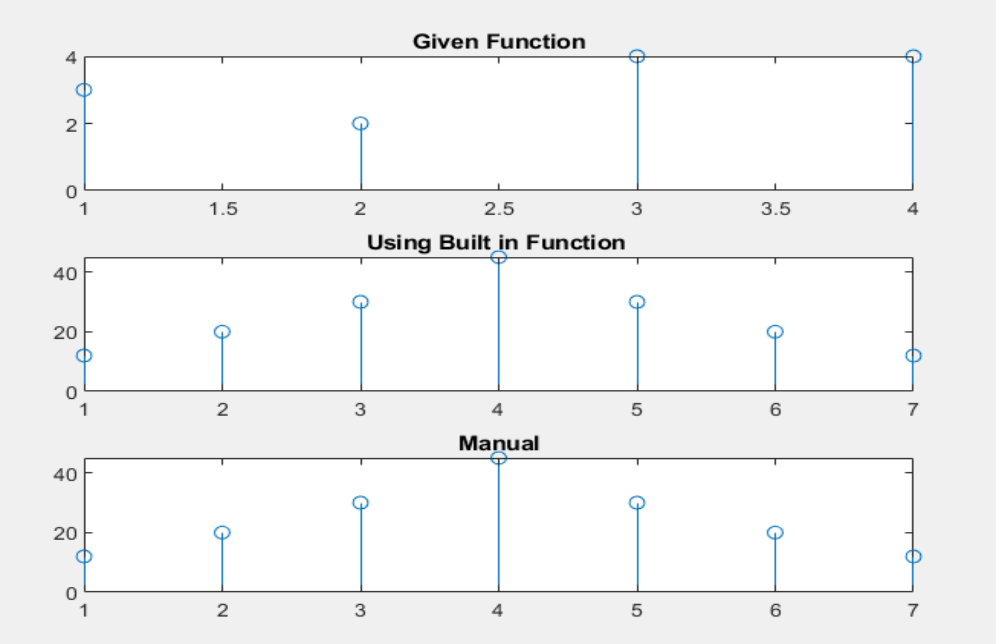

Figure 1: Autocorrelation

Cross-correlation:

```
clc
clear all
close all
x=input('Enter the first sequence');
n1=input('Enter the time sample range:');
h=input('Enter the second sequence');
n2=input('Enter the time sample range:');
subplot(4,1,1)
stem(x)
title('Given First Function')
subplot(4,1,2)
stem(x)
title('Given Second Function')
xh=xcorr(x,h)
subplot(4,1,3)
stem(xh)
title('Using Built in Function ')
n2=-fliplr(n2);
z=[];
h=fliplr(h);
for i=1:length(x)
    g=h.*x(i);
    z=[z;g];
end
[r c]=size(z);
k=r+c;
t=2;
y=[];
```

```
cd=0;
while(t<=k)
    for i=1:r
        for j=1:c
            if((i+j)==t)
               cd=cd+z(i,j);
            end
        end
    end
    t=t+1;
    y=[y cd];
    cd=0;
end
nl=min(n1)+min(n2);
nh=max(n1)+max(n2);
t=nl:1:nh;
subplot(4,1,4)
stem(y);
title('Manual')
```

Output:

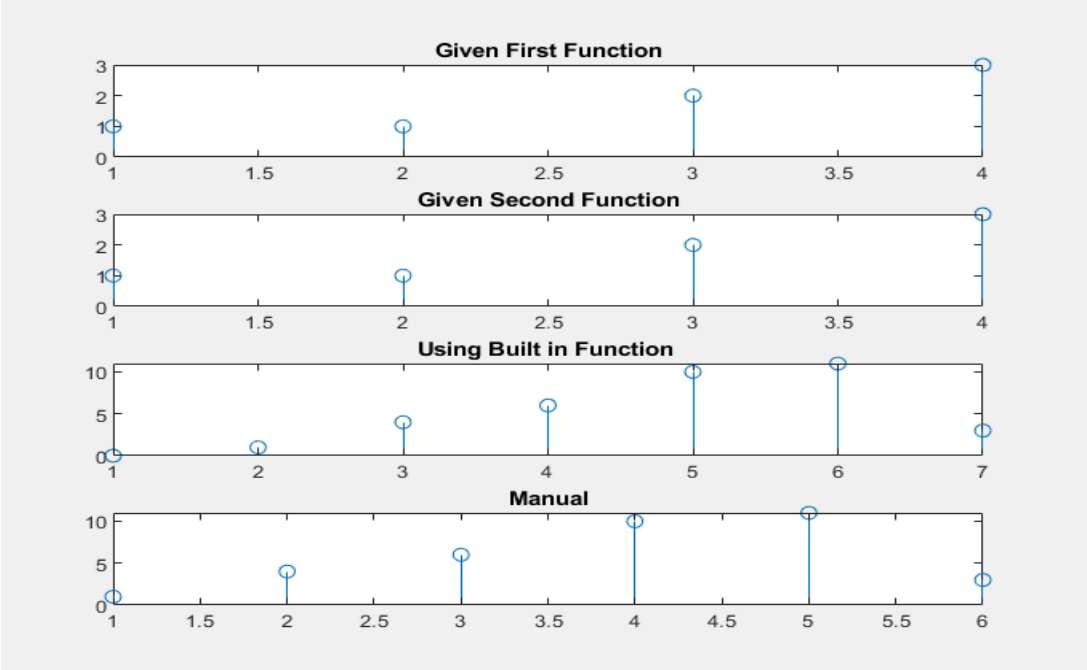

Fig 2: Cross-correlation

Discussion: Autocorrelation and cross-correlation are important concepts in signal processing and time series analysis. Autocorrelation measures how similar a signal is to a delayed version of itself, while cross-correlation measures the similarity between two different signals as a function of the time lag between them. Both autocorrelation and cross-correlation have numerous applications, including detecting repeating patterns, aligning signals, detecting echoes, and measuring time delays. Understanding these concepts is essential for anyone working with signals or time series data.

Conclusion: The experiment was done successfully and expected outcome was found.