Heaven's Light is Our Guide

Rajshahi University of Engineering& Technology

Department of Electrical & Computer Engineering

Course No: ECE 4123
Course Name: Digital Signal Processing

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Experiment No: 03

Experiment Date: 08.05.2023

Experiment Name: Study and implementation of cross correlation and auto correlation using xcorr function.

Study and implementation of cross correlation and auto correlation without using function.

Theory: Cross-correlation is a measurement that tracks the movements of two or more sets of time series data relative to one another. It is used to compare multiple time series and objectively determine how well they match up with each other and, in particular, at what point the best match occurs. Autocorrelation is the correlation of a time series and its lagged version over time. Although similar to correlation, autocorrelation uses the same time series twice. Financial analysts and traders use autocorrelation to examine historical price movements and predict future ones.

Required software: Matlab

1. Cross correlation and auto correlation with function:

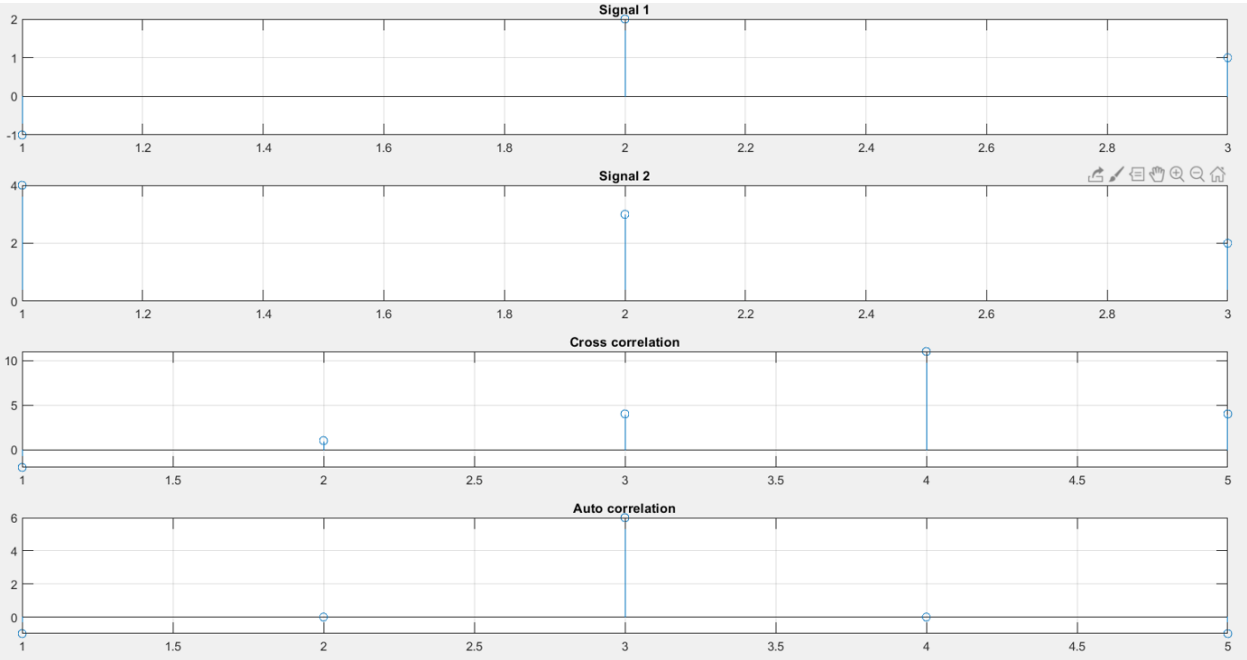
Code:

```
clc;
clear all;
close all;
x = input('Enter x: ');
y = input('Enter y: ');
c = xcorr(x,y)
a = xcorr(x,x)
subplot(4,1,1);
stem(x)
title('Signal 1');
grid on;
subplot(4,1,2);
stem(y)
title('Signal 2');
grid on;

subplot(4,1,3);
stem(c)
title('Cross correlation');
grid on;
subplot(4,1,4);
stem(a)
title('Auto correlation');
grid on;
```

Output:

```
Enter x: [-1 2 1]
Enter y: [4 3 2]

c =

   -2.0000    1.0000    4.0000   11.0000    4.0000


a =

    -1     0     6     0    -1
```

Figure:



2. Cross correlation and auto correlation without function:

Code:

```
clc;
clear all;
close all;
x = input('Enter x:');
y = input('Enter y:');
y = fliplr(y);
l1 = length(x);
l2 = length(y);
tot = l1+l2-1;
for i= 1:tot
    z(i) = 0;
    for k = 1:l1
        if(i>l1)
            y(i) = 0;
        end
        if(i-k+1>0)
            z(i) = z(i)+x(k)*y(i-k+1);
        else
        end
    end
end
```

```
z
subplot(3,1,1);
stem(x)
title('Signal 1');
grid on;

subplot(3,1,2);
stem(y)
title('Signal 2');
grid on;

subplot(3,1,3);
stem(z)
title('Correlation');
grid on;
```

Output:

Cross correlation:

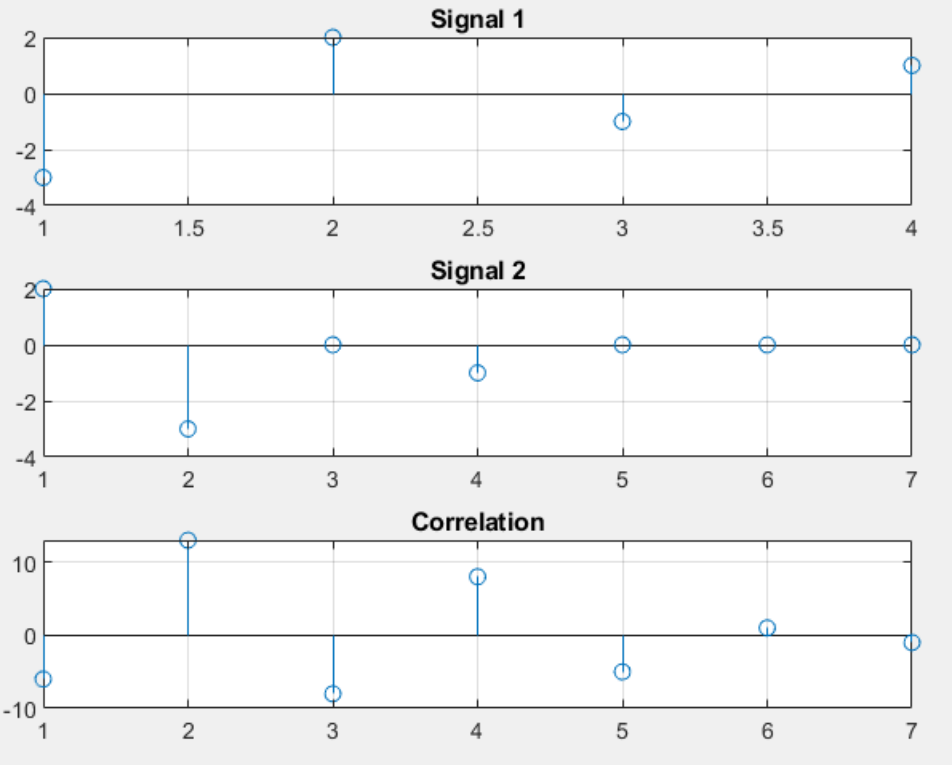
```
Enter x:[-3 2 -1 1]
Enter y:[-1 0 -3 2]

z =

    -6    13    -8     8    -5     1    -1
```

Auto correlation:

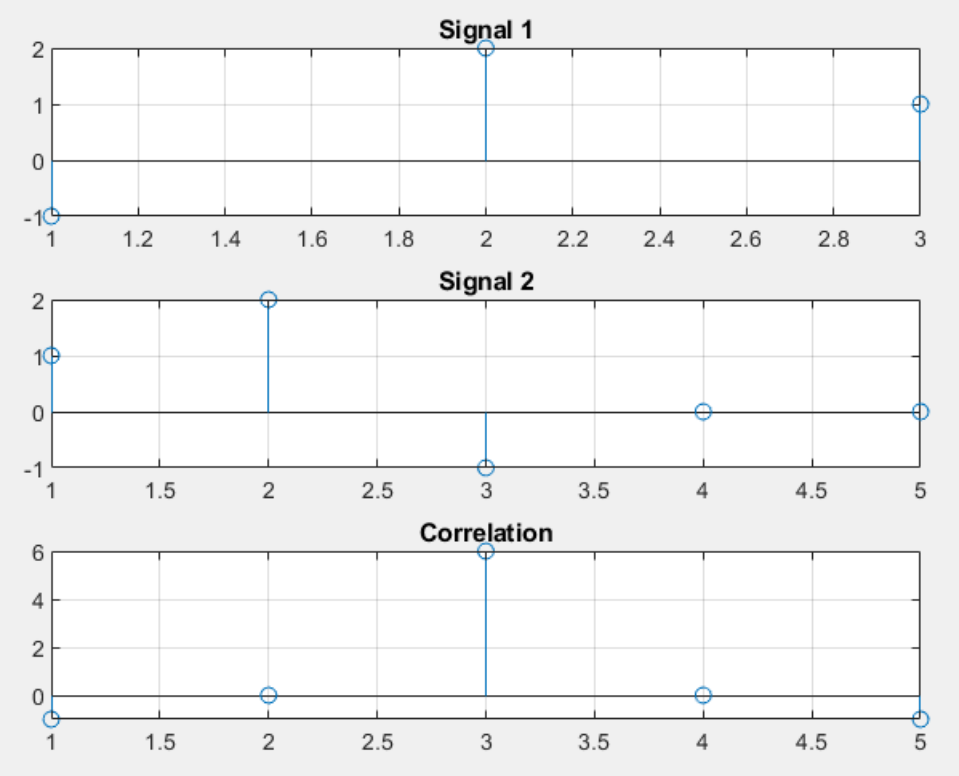
```
Enter x:[-1 2 1]
Enter y:[-1 2 1]

z =

    -1     0     6     0    -1
```

Figure:

Cross correlation:



Auto correlation:



Conclusion:

The experiment was done successfully as we have achieved the expected output which matches theoretical analysis.