EXPERIMENT NO. 4

AIM

To perform correlation of two set of sequences.

THEORY

A correlation function is the correlation between random variables at two different points in space or time, usually as a function of the spatial or temporal distance between the points. If one considers the correlation function between random variables representing the same quantity measured at two different points then this is often referred to as an autocorrelation function being made up of autocorrelations. Correlation functions of different random variables are sometimes calledcross correlation functions to emphasise that different variables are being considered and because they are made up of cross correlations.

Correlation functions are a useful indicator of dependencies as a function of distance in time or space, and they can be used to assess the distance required between sample points for the values to be effectively uncorrelated. In addition, they can form the basis of rules for interpolating values at points for which there are observations.

Correlation functions used in astronomy, financial analysis, and statistical mechanics differ only in the particular stochastic processes they are applied to. In quantum field theory there are correlation functions over quantum distributions.

Suppose that we have two signal sequences x(n) and y(n) each of which has finite energy.

The cross correlation of x(n) and y(n) is a sequence rxy(l), which is defined as

$r_{xy}(l) = \sum x(n)\, y(n-l)$

or equivalently as

$r_{xy}(l) = \sum x(n+l)\, y(n)$

the index l is the time shift (or lag) parameter and the subscript xy on the cross correlation

sequence $r_{xy}(l)$ indicates the sequence being correlated.

For random variables $X(s)$ and $X(t)$ at different points s and t of some space, the correlation function is

$$C(s,t) = \operatorname{corr}(X(s), X(t)),$$

where corr is described in the article on correlation

MATLAB CODE

```
clc;
clear all;
x=[1,2,3,4];
y=[2,3,4,5];
n=length(x);
for i= 1:n
    sum=0;
    m=1;
    for j= i:n
        product = x(j)*y(m);
        sum=sum+product;
        m=m+1;
    end;
    rxy(i)=sum;
end;
for i = 1:n-1
    sum=0;
    for j=1: n-i
        product = x(j)*y(i+j);
        sum=sum+product;
    end;
    nrxy(i)= sum;
end;
newrxy=fliplr(nrxy);
z(1:n-1)=newrxy;
z(n:(2*n-1))=rxy(1:n);
y1=xcorr(x,y);
figure();
subplot(2,2,1);
```

```
stem(x);
title('x(n)');
subplot(2,2,2);
stem(y);
title('y(n)');
subplot(2,2,3);
stem(-(n-1):(n-1),z);
title('carry for loops');
subplot(2,2,4);
stem(-(n-1):(n-1),y1);
title('direct cross relation');
```

OUTPUT