

<b>Title</b>	Discrete Correlation
<b>Aim</b>	To study mathematical operation Correlation and measure degree of similarity between two signals
<b>Objective</b>	<ol style="list-style-type: none"><li>1. Write a function to find correlation operation.</li><li>2. Calculate correlation of a DT signals and verify the results using mathematical formulation.</li></ol>
<b>Input Specifications</b>	<ol style="list-style-type: none"><li>1. Length of first Signal L and signal values.</li><li>2. Length of second Signal M and signal values.</li></ol>
<b>Problem Definition</b>	<ol style="list-style-type: none"><li>1. Find auto correlation of input signal. What is the significance of value of output signal value at <math>n=0</math> ?.</li><li>2. Find auto correlation of delayed input signal.</li><li>3. Find cross correlation of input signal and delayed input signal,</li><li>4. Find cross correlation of input signal and scaled delayed input signal.</li><li>5. Compare the resultant signals. Give your conclusion.</li></ol>
<b>Program</b>	<p>Correlation.py</p> <pre>x1=[1,2,3,4] x2=[5,6,7,8]  x2=[0 for i in range(len(x1)-1)]+x2+[0 for i in range(len(x1)-1)] c=-(len(x1)-1) ol=[]</pre>

```

while len(x2)>=len(x1):
    temp=x2[-len(x1):]
    y=0
    for i,j in zip(temp,x1):
        y+=(i*j)
        print(f"{i}*{j}",end=" + ")
    print(f" = {y}")
    c+=1
    ol.append(y)
    x2.pop()

print(ol)

```

#### autocorrelation.py

```

x1=[1,2,3,4]
x2=x1.copy()

x2=[0 for i in range(len(x1)-
1)]+x2+[0 for i in range(len(x1)-1)]
c=-(len(x1)-1)
ol=[]
while len(x2)>=len(x1):
    temp=x2[-len(x1):]
    y=0
    for i,j in zip(temp,x1):
        y+=(i*j)
        print(f"{i}*{j}",end=" + ")
    print(f" = {y}")
    c+=1
    ol.append(y)
    x2.pop()

print(ol)

```

#### correlation with delayed signal

```

x1=[0,1,-2,3,-4]
x2=[0.5,1,2,1,0.5]
sx=0

```

```

sy=2

x2=[0 for i in range(len(x1)-
1)]+x2+[0 for i in range(len(x1)-1)]
c=-(len(x1)-1)
ol=[]
while len(x2)>=len(x1):
    temp=x2[-len(x1):]
    y=0
    for i,j in zip(temp,x1):
        y+=(i*j)
    c+=1
    ol.append(y)
    x2.pop()

print(ol)
print("zeroth positon is at index "+str(sx+sy))

```

## Output

### Autocorrelation.py

Try the new cross-platform Powershell <https://aka.ms/pscore6>

```

PS D:\DSIP\exp3> & C:/Python39/python.exe d:/DSIP/exp3/auto.py
4*1 + 0*2 + 0*3 + 0*4 + = 4
3*1 + 4*2 + 0*3 + 0*4 + = 11
2*1 + 3*2 + 4*3 + 0*4 + = 20
1*1 + 2*2 + 3*3 + 4*4 + = 30
0*1 + 1*2 + 2*3 + 3*4 + = 20
0*1 + 0*2 + 1*3 + 2*4 + = 11
0*1 + 0*2 + 0*3 + 1*4 + = 4
[4, 11, 20, 30, 20, 11, 4]
PS D:\DSIP\exp3>

```

### Correlation.py

```

PS D:\DSIP\exp3> & C:/Python39/python.exe d:/DSIP/exp3/cor.py
8*1 + 0*2 + 0*3 + 0*4 + = 8
7*1 + 8*2 + 0*3 + 0*4 + = 23
6*1 + 7*2 + 8*3 + 0*4 + = 44
5*1 + 6*2 + 7*3 + 8*4 + = 70
0*1 + 5*2 + 6*3 + 7*4 + = 56
0*1 + 0*2 + 5*3 + 6*4 + = 39
0*1 + 0*2 + 0*3 + 5*4 + = 20
[8, 23, 44, 70, 56, 39, 20]
PS D:\DSIP\exp3>

```

Correlation with delayed signal

	<pre> PS D:\DSIP\exp3&gt; &amp; C:/Python39/python.exe d:/DSIP/exp3/temp.py [0.0, 0.5, 0.0, 1.5, -2.0, 0.5, -6.0, -2.5, -2.0] zeroth positon is at index 2 PS D:\DSIP\exp3&gt; </pre>
<b>Outcome</b>	<p>We have successfully implement cross correlation , autocorrelation and correlation with delayed signal.</p> <p>The delayed signal appears left shifted as compared to the one without delayed input. Autocorrelation is the correlation of the signal with itself</p>