|  |  |
| --- | --- |
| **Name** | Adwait Purao |
| **UID no.** | 2021300101 |

|  |  |
| --- | --- |
| **Experiment 2** | |
| **AIM :** | The aim of this experiment is to study mathematical operation Correlation and measure degree of similarity between two signals. |
| **OBJECTIVE:** | 1. Write a function to find Correlation Operation  2. Calculate correlation of a DT signals and verify the results using mathematical formula. |
| **PROBLEM DEFINITION:** | 1. Find auto correlation of input signal and find the significance of value of output signal at n=0.  Let y[n] = x[n] O x[n]  Classify the resultant signal( Even / Odd ). Calculate the energy of the signal .  Q. What is the significance of value of y[0].    2. Find auto correlation of delayed input signal.  Let p[n]= x[n-1] O x[n-1].  Compare the resultant signal p[n] with y[n]. Give your conclusion.    3. Find cross correlation of input signal and delayed input signal  q[n] = x[n] 0 x[n-1].  Compare the resultant signal q[n] with p[n] and y[n]  Give your conclusion.    4. Find cross correlation of input signal and scaled input signal.  Let s[n] = x[n] O a x[n-2] where “a” is any constant.  Compare the resultant signals.  Give your conclusion |
| **INPUT SPECIFICATION:** | 1. Length of first Signal L and signal values.  2. Length of second Signal M and signal values. |
| **RESULT:** | **Case 1: To find y[n] = x[n] O x[n]**  Input: x[n] = {1,2,3,4}  Output: y[n] = {4,11,20,30,20,11,4}    Here, y[n] = y[-n]  That means, autocorrelation output signal y[n] is an even signal  At n=0, y [0] is Maximum value y[0] = Σ|x(n)|^2 i.e. Energy of Signal x[n]  **Case 2 : To find p[n] = x[n-1] O x[n-1]**  Input: x[n-1] = {0, 1,2,3,4}  Output: p[n] = {4,11,20,30,20,11,4}    By comparing p[n] with y[n] we get, p[n] = y[n]  That means auto correlation of x[n 1] is same as auto correlation of x[n]  **Case 3 : To find q[n] = x[n] O x[n-1]**  Input: x[n] = {1,2,3,4,0}  x[n-1] ={0,1,2,3,4}  Output: q[n] = {4,11,20,30,20,11,4}    By comparing q[n] with y[n] we get, q[n] = y[n+1] <--- Advanced y[n]  **Case 4: To find r[n] = x[n] O x[n-2]**  Input: x[n] = {1,2,3,4,0,0}  x[n-2] ={0,0,1,2,3,4}  Output: r[n] = {4,11,20,30,20,11,4}    By comparing r[n] with y[n]  We get, r[n] = y[n+2] <--- Advanced y[n]  **Case 5: To find s[n] = x[n] O a x[n-2]**  Input: x[n] = {1,2,3,4,0,0}  2x[n-2] ={0,0,2,4,6,8}  Output: s[n] = {8,22,40,60,40,22,8}    By comparing s[n] with y[n]  We get, s[n] = 2 y[n+2] <--- Scaled & Advanced y[n] |
| **CONCLUSION:**   1. **Autocorrelation Signal Symmetry**: An autocorrelation signal is symmetric, meaning y[n] equals y[-n], which characterizes it as an EVEN signal. 2. **Autocorrelation and Delayed Inputs**: If the input signals are subjected to delay, the autocorrelation of the delayed input signal remains identical to the autocorrelation of the original, undelayed signal. 3. **Cross-Correlation and Signal Delay**: The cross-correlation of an input signal with its delayed version is equivalent to an advanced version of the autocorrelated input signal. | |