RAJSHAHI UNIVERSITY OF ENGINEERING AND TECHNOLOGY

LAB REPORT

Dept: Electrical and Computer Engineering

SUBMITTED BY:

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Course name : Digital Signal Processing
Course no : ECE 4124

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Experiment no: 04

Experiment Name : Study of time delay of a signal and cross correlation of the given signal and the delayed signal

Objective : Study of time delay of a signal and cross correlation of the given signal and the delayed signal using MATLAB

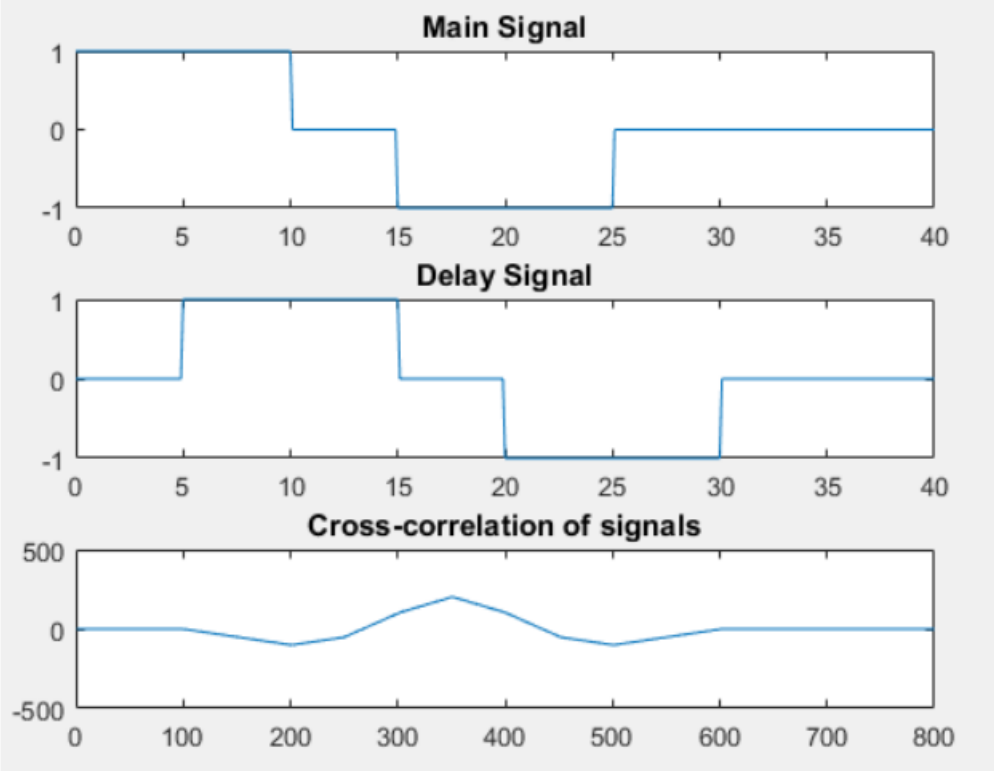
Theory :

Correlation refers to a process for establishing the relationships between two variables. Time delay is a property of correlation. Time delay means the amount of time a signal takes to propagate itself through a system or under specified processing conditions. Time delay can occur in the various stages of signal processing such as filtering, signal transformation. It is important to consider and account for time delays in DSP applications where precise timing is important Cross correlation is a mathematical operation used in signal processing and statistics to find out the similarity between two signals. It provides a measure of the correlation between two signals as a function of time or lag between them.

Code:

```
1. clc
2. clear all
3. t=0:0.1:40
4. x1=(t>=0 & t<=10);
5. x2=(t>=10 & t<=15);
6. x3=(t>=15 & t<=25);
7. x4=(t>=25 & t<=40);
8. signal1 = 1*x1+0*x2-1*x3+0*x4;
9. subplot(3,1,1); 10. plot(t,signal1);
11. title('Main Signal');
12. delay = 5;
13. x5=(t>=0+delay & t<=10+delay);
14. x6=(t>=10+delay & t<=15+delay);
15. x7=(t>=15+delay & t<=25+delay);
16.x8=(t>=25+delay&t<=40+delay)
17. signal2 = 1*x5+0*x6-1*x7+0*x8;
18. subplot(3,1,2);
19. plot(t,signal2);
20. title('Delay Signal');
21. signal3 = xcorr(signal1,signal2);
22. subplot(3,1,3);          23. plot(signal3);
24. xlim([0 800]);
25. title('Cross-correlation of signals');
26. [~, max_index] = max(signal3);
27. delay_time =(length(signal1)-max_index);
28. disp('Delay Time: ');
29. disp(delay_time*0.1);
```

Output :




```
Delay Time:
     5
```

Discussion :

In the experiment utilizing MATLAB, main signal is firstly plotted .The a 5 sec delay signal is plotted. Cross correlation is used in the experiment. The output is according to the theory .The experiment is done successfully.