Experiment No.: 08

Experiment Name: Time Shifting (Delay) of a Discrete-Time Signal using MATLAB

Description of the Problem:

The objective of this experiment is to **perform time shifting (delay)** of a discrete-time signal $x[n]$.

In **Digital Signal Processing (DSP)**, **time shifting** is an essential operation where a signal is shifted to the left or right along the time axis:

- For a delay of n_0 samples, the signal is represented as $x[n - n_0]$.
- For an advance of n_0 samples, the signal is represented as $x[n + n_0]$.

This experiment allows students to understand how signals can be delayed or advanced, which is fundamental in **system response analysis** and **convolution operations**.

Source Code Sample:

```
clc;
clear all;
close all;

% Input for shift, time indices, and signal
n1 = input('Enter the required amount of shift: ');
n = input('Enter time indices: ');
x = input('Enter the signal sequence: ');

% Plot original signal
subplot(2,1,1);
stem(n, x);
axis([-6 6 -6 6]);
xlabel('Time sample');
ylabel('Amplitude');
title('Original Signal');
grid on;

% Compute delayed signal
m = n + n1;

% Plot delayed signal
subplot(2,1,2);
stem(m, x);
axis([-6 6 -6 6]);
```

```
xlabel('Time sample');
ylabel('Amplitude');
title('Delayed Signal');
grid on;
```

Sample Input:

Since this code uses `input()`, provide:

Example:

```
Enter the required amount of shift: 2
Enter time indices: [-3 -2 -1 0 1 2 3]
Enter the signal sequence: [1 2 3 4 5 6 7]
```

- `n1` → Amount of shift (positive → delay, negative → advance)
- `n` → Original time indices
- `x` → Original signal sequence

Sample Output:

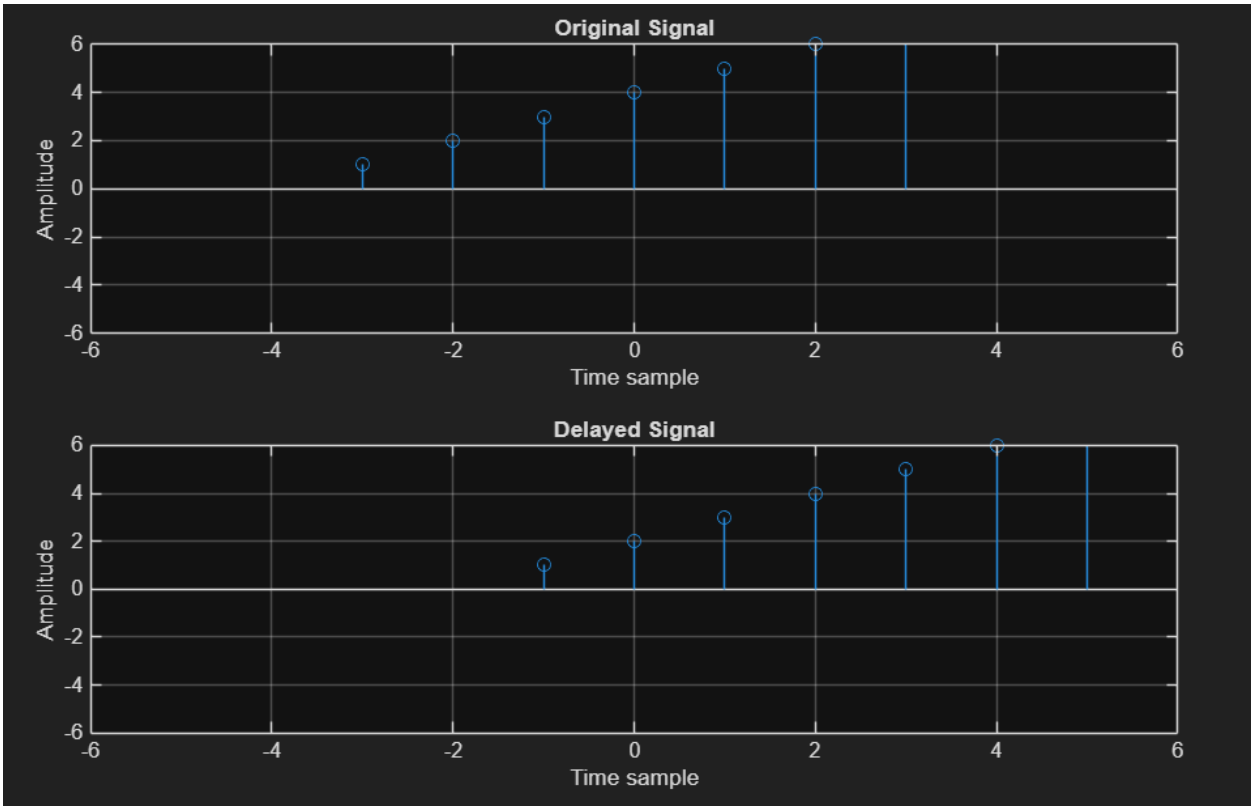
After running the code:

1. **Original Signal** $x[n]$→ first subplot
2. **Delayed Signal** $x[n - n_0]$→ second subplot

- The delayed signal is shifted along the time axis by the specified amount.
- This demonstrates the concept of time shifting clearly.

Screenshot:

Figure 8.1: Original and Delayed Signal in MATLAB


Original Signal
Amplitude
Time sample
Delayed Signal
Amplitude
Time sample