Experiment No.: 07

Experiment Name: Time Folding of a Discrete-Time Signal using MATLAB

Description of the Problem:

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

In **Digital Signal Processing (DSP)**, **time folding** or **time reversal** is an important operation where the signal is reflected about the vertical axis (n = 0).

- For a given signal $x[n]$, the **folded signal** is denoted as $x[-n]$.

Mathematical Explanation:

$x[-n]$ is obtained by reversing the order of samples of $x[n]$ and changing the sign of the time index.

This experiment helps students understand how signals behave under time reversal, which is fundamental for convolution, correlation, and system analysis in DSP.

Source Code Sample:

```
clc;
clear;
close all;

% Step 1: Take user input for signal and index
n = input('Enter the time indices (e.g., -2:2): ');
x = input('Enter the signal values (same length as indices): ');

% Step 2: Fold (time-reverse) the signal
x_folded = fliplr(x);        % reverses signal values
n_folded = -fliplr(n);       % reverses and negates indices

% Step 3: Plot the original signal
subplot(2,1,1);
stem(n, x, 'b', 'filled');
title('Original Signal x(n)');
xlabel('n');
ylabel('Amplitude');
grid on;

% Step 4: Plot the folded signal
subplot(2,1,2);
```

```
stem(n_folded, x_folded, 'r', 'filled');
title('Folded Signal x(-n)');
xlabel('n');
ylabel('Amplitude');
grid on;
```

Sample Input:

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

Example:

```
Enter the time indices: [-3 -2 -1 0 1 2 3]
Enter the signal values: [1 2 3 4 5 6 7]
```

- n $\rightarrow$ Time indices
- x $\rightarrow$ Original signal values

Sample Output:

After running the code:

1. **Original Signal** $x[n] \rightarrow$ displayed in first subplot (blue)
2. **Folded Signal** $x[-n] \rightarrow$ displayed in second subplot (red)

This visually shows the time-reversed (folded) version of the original signal.

Screenshot:

Figure 7.1: Original and Folded Signal in MATLAB