Experiment No.: 06

Experiment Name: Signal Reversal and Odd Component Extraction using MATLAB

Description of the Problem:

The objective of this experiment is to:

1. Reverse a discrete-time signal $x[n]$ to obtain $x[-n]$.
2. Extract the **odd component** of the signal $x_o[n]$.

In **Digital Signal Processing (DSP)**, any discrete-time signal $x[n]$ can be decomposed into **even** and **odd** components:

$$x[n] = x_e[n] + x_o[n]$$

Where:

$$x_o[n] = \frac{x[n] - x[-n]}{2} \text{(Odd component)}$$

This experiment allows students to visualize signal symmetry and the behavior of odd signals, which is fundamental for system analysis and Fourier-based decomposition.

Source Code Sample:

```
clc;
clear all;
close all;

% Input from user
n = input('Enter the range of n  ');       % Time indices
x = input('Enter the signal values  ');    % Signal values

% Compute reversed signal
x_rev = fliplr(x);

% Compute odd component
x_odd = (x - x_rev) / 2;

% Plot original signal
```

```
subplot(3,1,1);
stem(n, x, 'filled');
axis([-12 12 -1 2]);
title('Original Signal x[n]');
xlabel('n');
ylabel('Amplitude');
grid on;

% Plot reversed signal
subplot(3,1,2);
stem(n, x_rev, 'filled');
axis([-12 12 -1 2]);
title('Reversed Signal x[-n]');
xlabel('n');
ylabel('Amplitude');
grid on;

% Plot odd component
subplot(3,1,3);
stem(n, x_odd, 'filled');
axis([-12 12 -1 2]);
title('Odd Signal x_o[n]');
xlabel('n');
ylabel('Amplitude');
grid on;
```

Sample Input:

Since this code uses `input()`, you need to provide:

Example:

```
Enter the range of n: [-3 -2 -1 0 1 2 3]
Enter the signal values: [1 2 3 4 5 6 7]
```

- `n` → Time indices
- `x` → Original signal values

Sample Output:

After entering the inputs:

1. **Original Signal** $x[n] \rightarrow$ first subplot
2. **Reversed Signal** $x[-n] \rightarrow$ second subplot
3. **Odd Component** $x_o[n] = (x[n] - x[-n])/2 \rightarrow$ third subplot

All three discrete signals are plotted with stem, showing amplitude vs. time index.

Screenshot:

Figure 6.1: Original, Reversed, and Odd Signal Components in MATLAB