

Digital Signal Processing

Assignment 2

Name: Aman Kumar

Reg no. : ECE/22118/972

Problem 1:

Program

```
x_samples = input('Enter the samples of x[n] as a vector (e.g., [1 2 3 4]): ');
n_zero_index = input('Enter the position of n=0 for x[n] (index): ');
time_shift = input('Enter the time delay/advance (positive for delay, negative for advance): ');
```

```
n_original = (1:length(x_samples)) - n_zero_index;
n_shifted = n_original - time_shift;
```

```
figure;
```

```
subplot(2,1,1);
stem(n_original, x_samples, 'r', 'LineWidth', 1.5); grid on;
xlabel('TIME INDEX'); ylabel('x[n]');
title('Original Sequence x[n]');
```

```
subplot(2,1,2);
stem(n_shifted, x_samples, 'b', 'LineWidth', 1.5); grid on;
xlabel('TIME INDEX'); ylabel('y[n]');
title(['Shifted Sequence y[n]']);
```

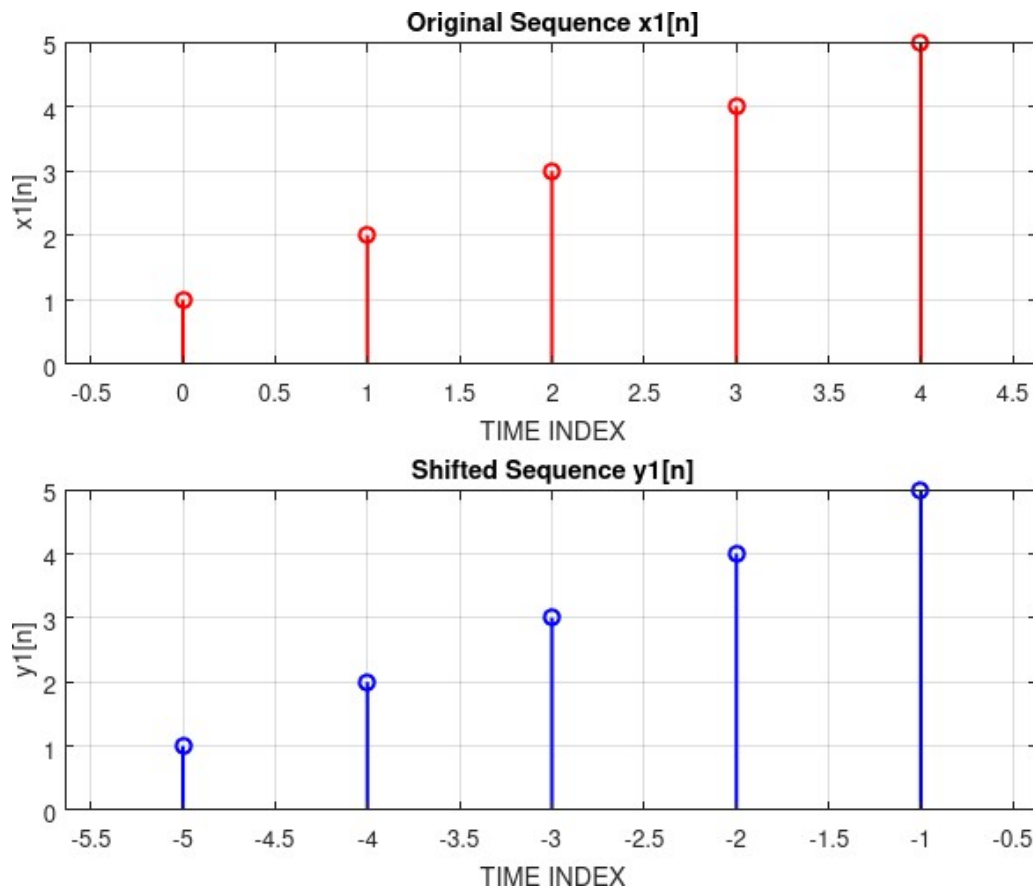
Plots

Below are plot with input :

Samples of $x_1[n]$: [1,2,3,4,5]

Position of $n=0$ for $x_1[n]$ (index): 1

Time delay/advance (positive for delay, negative for advance): 5



Problem 2:

Program

% Input the first sequence and its time index reference

```
x_samples = input('Enter the samples of x[n] as a vector (e.g., [1 2 3 4]): ');
```

```
x_n0_index = input('Enter the position of n=0 for x[n] (index): ');
```

% Input the second sequence and its time index reference

```
h_samples = input('Enter the samples of h[n] as a vector (e.g., [1 2 3 4]): ');
```

```
h_n0_index = input('Enter the position of n=0 for h[n] (index): ');
```

% Define time indices for both sequences

```
x_time_indices = (0:length(x_samples)-1) - x_n0_index;
```

```
h_time_indices = (0:length(h_samples)-1) - h_n0_index;
```

% Define time indices for the convolution result

```
conv_time_indices = (0:(length(x_samples) + length(h_samples) - 2)) -  
(x_n0_index + h_n0_index);
```

```

conv_result = zeros(1, length(conv_time_indices));

% Perform manual convolution
for x_index = 1:length(x_samples)
    for h_index = 1:length(h_samples)
        conv_result(x_index + h_index - 1) = conv_result(x_index + h_index - 1) +
x_samples(x_index) * h_samples(h_index);
    end
end

% Plot the original sequences and the convolution result
figure;

subplot(3,1,1);
stem(x_time_indices, x_samples, 'r', 'LineWidth', 1.5); grid on;
xlabel('TIME INDEX'); ylabel('x[n]');
title('Original Sequence x[n]');

subplot(3,1,2);
stem(h_time_indices, h_samples, 'r', 'LineWidth', 1.5); grid on;
xlabel('TIME INDEX'); ylabel('h[n]');
title('Original Sequence h[n]');

subplot(3,1,3);
stem(conv_time_indices, conv_result, 'r', 'LineWidth', 1.5); grid on;
xlabel('TIME INDEX'); ylabel('y[n]');
title('Convolved Sequence y[n] (Manual Calculation)');

```

Plots

Input :

Samples of $x[n]$: [1,0,1]

Position of $n=0$ for $x[n]$ (index):2

Samples of $h[n]$: [2,7]

Position of $n=0$ for $h[n]$ (index):1

Output = [2,7,2,7] (Convolved Sequence)

