Experiment No.: 02

Experiment Name: Generation and Plotting of Unit Step Sequence using MATLAB

Description of the Problem:

The objective of this experiment is to generate and plot a **Unit Step Sequence** using MATLAB. In **Digital Signal Processing (DSP)**, the unit step sequence is a fundamental discrete-time signal that helps in analyzing and constructing other discrete-time systems and responses.

This experiment aims to:

- Understand the concept of the **unit step function**.
- Learn how to represent discrete-time signals in MATLAB using the `stem()` function.
- Visualize the signal behavior in the time domain.

Basic Theory:
A **Unit Step Sequence**, denoted as $u[n]$, is defined as:

$$u[n] = \begin{cases} 1, & n \geq 0 \\ 0, & n < 0 \end{cases}$$

It is used to represent the activation of a signal at $n = 0$.
It can be generated in MATLAB by combining **zeros** (for negative indices) and **ones** (for non-negative indices).

Explanation of the Code Logic:

1. The variable `n` defines the time index ranging from -10 to +10.
2. The signal `u` is constructed using:

```
3. u = [zeros(1,10) ones(1,11)];
```

   This means:

   - For the first 10 samples (n < 0), value = 0
   - For the next 11 samples (n ≥ 0), value = 1

4. The `stem()` function is used to plot discrete points (since this is a discrete signal).
5. `axis()` limits are set to make the plot view clear and centered.
6. Labels and title are added for academic clarity.

Source Code Sample:

```
clc;
close all;
clear all;

% Define time index
n = -10 : 10;

% Generate unit step sequence
u = [zeros(1,10) ones(1,11)];

% Plot the signal
stem(n, u);
axis([-12 12 -1 2]);
xlabel('Time Index');
ylabel('Amplitude');
title('Unit Step Sequence');
```

Sample Input:

```
n = -10 : 10
```

No manual input is required; MATLAB automatically calculates the signal values using the defined range of `n`.

Sample Output:

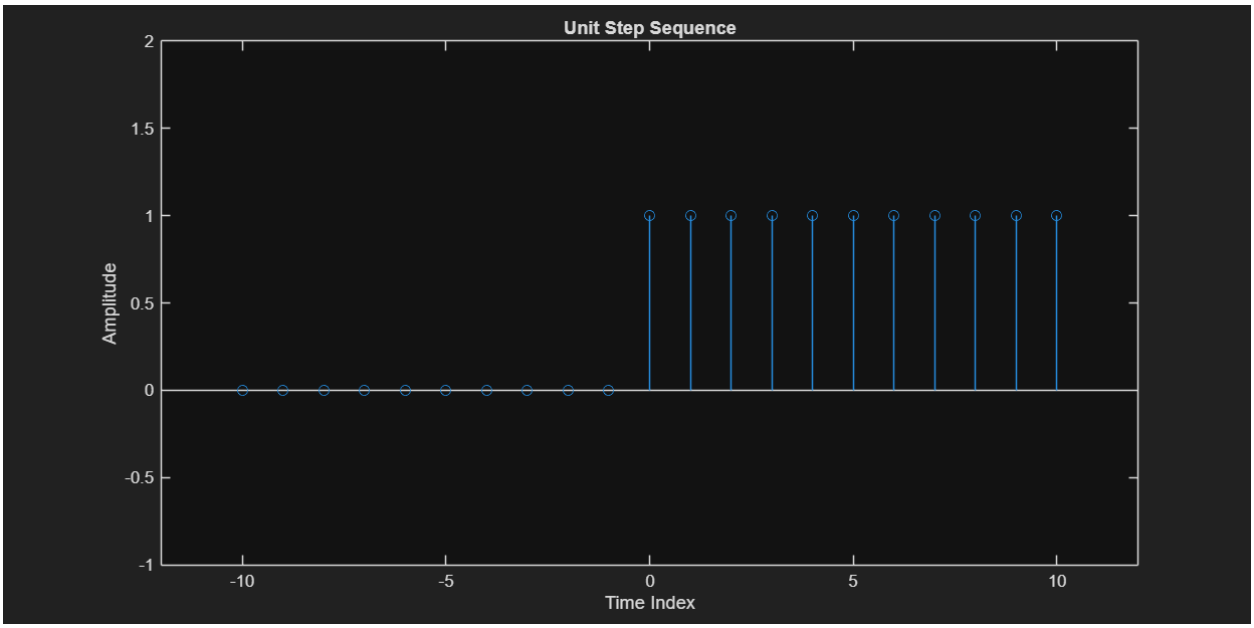
After executing the code, the MATLAB figure window shows a **discrete-time signal** where:

- For $n < 0$, amplitude = 0
- For $n \geq 0$, amplitude = 1

This creates a **step-like waveform** starting from 0 and continuing as 1.

Screenshot:

Figure 2: MATLAB Output Showing the Unit Step Sequence


Unit Step Sequence
Amplitude
Time Index
2
1.5
1
0.5
0
-0.5
-1
-10
-5
0
5
10