

## Experiment No.: 03

### Experiment Name: Generation and Plotting of Unit Ramp Sequence using MATLAB

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#### Description of the Problem:

The purpose of this experiment is to generate and plot a **Unit Ramp Sequence** using MATLAB. In **Digital Signal Processing (DSP)**, the ramp sequence is an important basic discrete-time signal that represents a linearly increasing function with respect to the time index. It is often used to model linearly growing systems or to test the response of digital systems to a gradually increasing input.

This experiment aims to:

- Understand the concept of the **unit ramp function**.
- Generate the signal using basic MATLAB commands.
- Visualize the linearly increasing discrete sequence.

#### Basic Theory:

A **Unit Ramp Sequence**, denoted as  $r[n]$ , is defined as:

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

It can also be expressed as the **product of time index  $n$  and the unit step sequence  $u[n]$** :

$$r[n] = n \cdot u[n]$$

Here, the **unit step sequence  $u[n]$**  activates the ramp from  $n = 0$  onward.

#### Explanation of the Code Logic:

1. The variable  $n$  defines the time index from -10 to +10.
2. The variable  $u$  is a unit step sequence generated by combining zeros and ones:  
3.  $u = [\text{zeros}(1, 10) \text{ ones}(1, 11)];$

This makes  $u[n] = 0$  for negative indices and 1 for non-negative indices.

4. The ramp signal is then obtained using element-wise multiplication:  
5.  $r = n .* u;$

This ensures that all negative values of  $n$  are set to zero, producing the ramp shape.

6. The `stem()` function is used to plot discrete points, showing the linear growth.
  7. Labels, axis limits, and title make the plot clear and academic.
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### 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)];

% Generate unit ramp sequence
r = n .* u;

% Plot the signal
stem(n , r);
axis([-12 12 -5 5]);
xlabel('Time Index');
ylabel('Amplitude');
title('Unit Ramp Sequence');
```

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### Sample Input:

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

No manual input is needed. MATLAB automatically calculates the unit step and ramp sequences using the defined range.

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### Sample Output:

After executing the MATLAB program, a **discrete-time ramp waveform** is displayed:

- For  $n < 0$ , amplitude = 0
- For  $n \geq 0$ , amplitude increases linearly with  $n$

This represents the **Unit Ramp Sequence** which grows linearly from 0 onwards.

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**Screenshot:**

**Figure 3: MATLAB Output Showing the Unit Ramp Sequence**

