Independent University, Bangladesh

Department of Electrical and Electronic Engineering

BAETE Accredited

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Course Title : Digital Signal Processing LAB
Course Code : EEE 321L / ETE 324L (New); ECR 305L (Old)
Instructor : Dr. Kh Shahriya Zaman
Experiment No. : **02**
Experiment Name : **Study on discrete signals and systems.**

Objectives:

1. To understand discrete signals and systems.
2. To make the MATLAB functions so that discrete signals, such as unit impulse, unit step function etc., can be generated using MATLAB.
3. To understand discrete signal plotting using MATLAB.

Theory:

Unit Impulse Response:

In this system, output response will get only when sample number is zero (n=0) otherwise response will be zero.

$$\delta(n) = \begin{cases} 1, & n=0 \\ 0, & n\neq 0 \end{cases}$$

$$\boldsymbol{or}\ \boldsymbol{\delta(n)} = \begin{cases} 1, & n=n_o \\ 0, & n\neq n_0 \end{cases} \ ; \ n_1 = n_o = n_2$$

Unit step response:

The response of a system to the unit step input is called the unit step response. If output response is always 1 for n is greater than zero this is called unit step response.

$$u(n) = \begin{cases} 1, & n\geq 0 \\ 0, & n<0 \end{cases} = \{\underset{\uparrow}{\ldots\ldots 0,0,1,1,1,1,1,\ldots\ldots}$$

Unit ramp response:

The ramp function is a one-dimensional unary real function with a ramp-like graph. It can be defined in a variety of ways, such as "0 for negative inputs, output equals input for non-negative inputs."

$$x(n) = \begin{cases} n, & for\ n\geq 0 \\ 0, & for\ n<0 \end{cases}$$

Lab work:

1. Develop a MATLAB function named "impseq" that has a form:
   "function [x,n] = impseq (n0, n1, n2)"

```
%Name: Hemal Sharma
%ID: 2221855
function [x,n] = impseq(n0, n1, n2)
    n = n1:n2
    x = (n==n0)
    stem(n,x)

end
```

2. Develop a MATLAB function named "stepseq" that has a form:
   "function [x,n] = stepseq (n0, n1, n2)"

```
%Name: Hemal Sharma
%ID: 2221855

function [x,n] = stepseq(n0, n1, n2)
    n = n1:n2
    x = (n>=n0)
    stem(n,x)

end
```

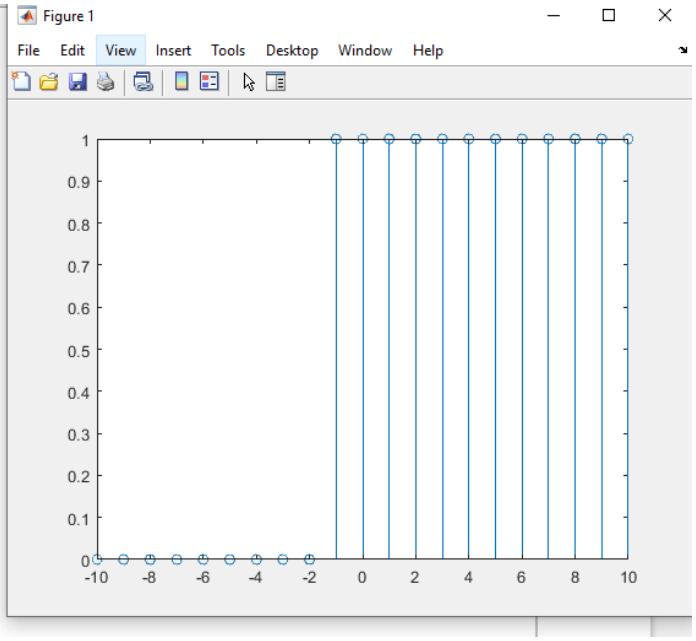
3. **(i) Generate the following signals**:
   a. x[n] = u(n+1) where $-10 \leq n \leq 10$

Here, the unit step function is shifted 1 unit toward the left.

```
% Name: Hemal Sharma
%ID: 2221855

%x[n] = u(n+1) where -10 ≤ n ≤ 10

n = -10:10
x = stepseq(-1,-10,10)
stem(n,x)
```



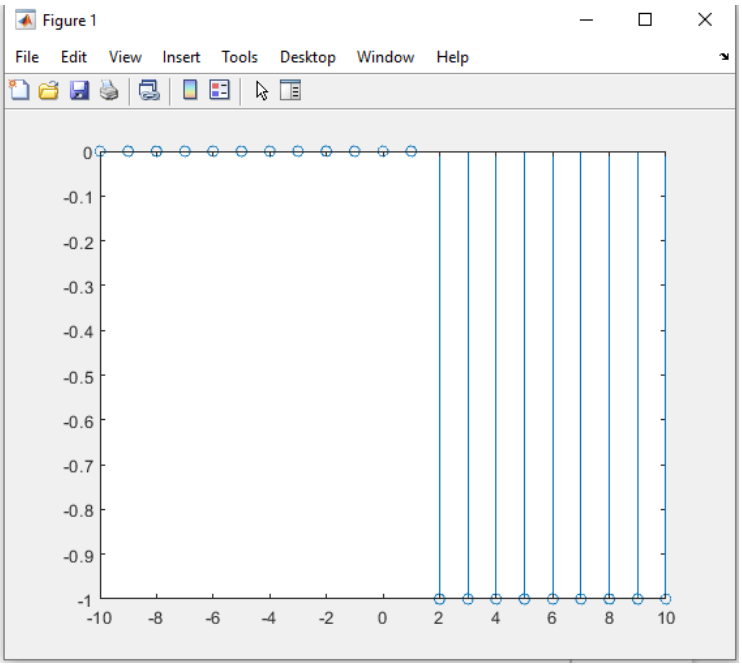
   b. x[n] = -u(n-2) where $-10 \leq n \leq 10$

Here, the unit step function is shifted 2 units towards the right and is reflected on the x axis.

```
% Name: Hemal Sharma
%ID: 2221855

%x[n] = -u(n-2) where -10 ≤ n ≤ 10

n = -10:10
x = -1*stepseq(2,-10,10)
stem(n,x)
```



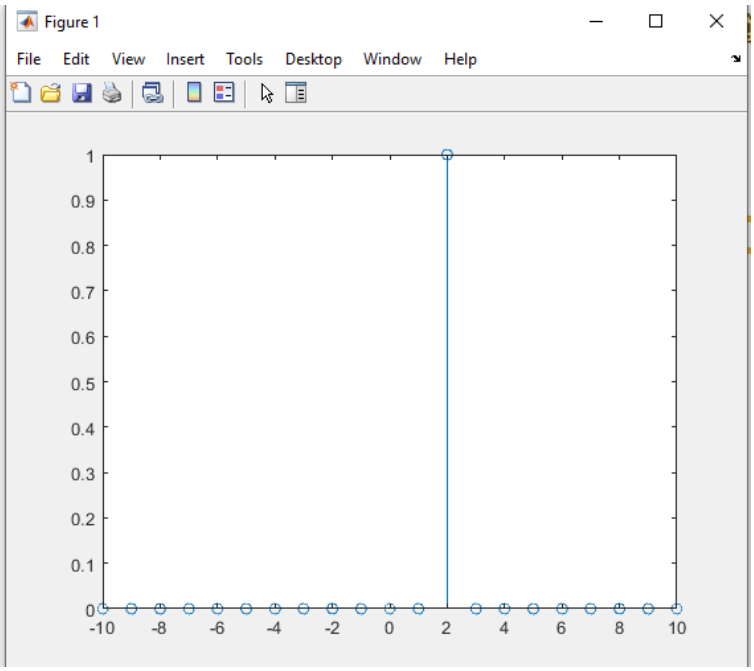
c. $x[n] = \delta(n-2)$ where $-10 \leq n \leq 10$

Here, the unit impulse function is shifted 2 units toward the right.

```
% Name: Hemal Sharma
%ID: 2221855

%x[n] = δ(n-2) where -10 ≤ n ≤ 10

n = -10:10
x = impseq(2,-10,10)
stem(n,x)
```



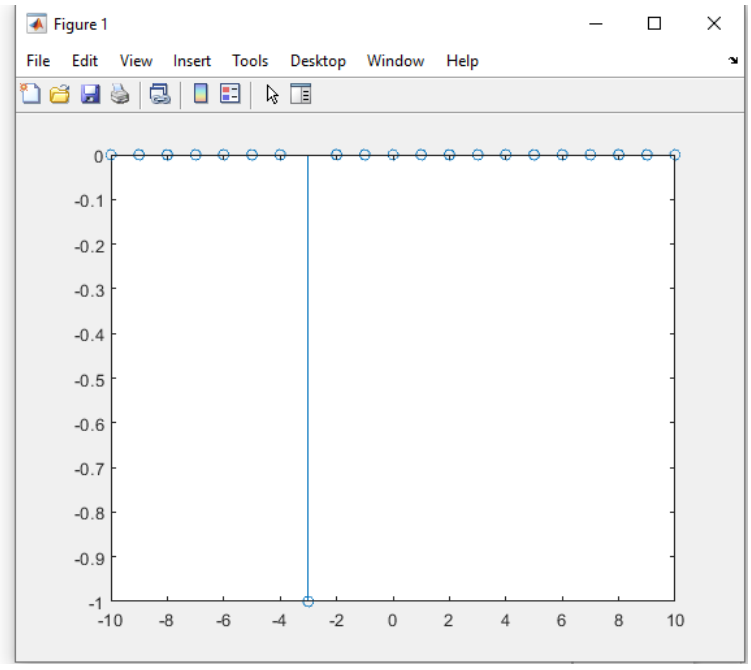
d. $x[n] = -\delta(n+3))$ where $-10 \leq n \leq 10$

Here the impulse function is shifted 3 units toward the left and reversed on the x axis.

```
% Name: Hemal Sharma
%ID: 2221855

%x[n] = -δ(n+3) where -10 ≤ n ≤ 10

n = -10:10
x = -1*impseq(-3,-10,10)
stem(n,x)
```



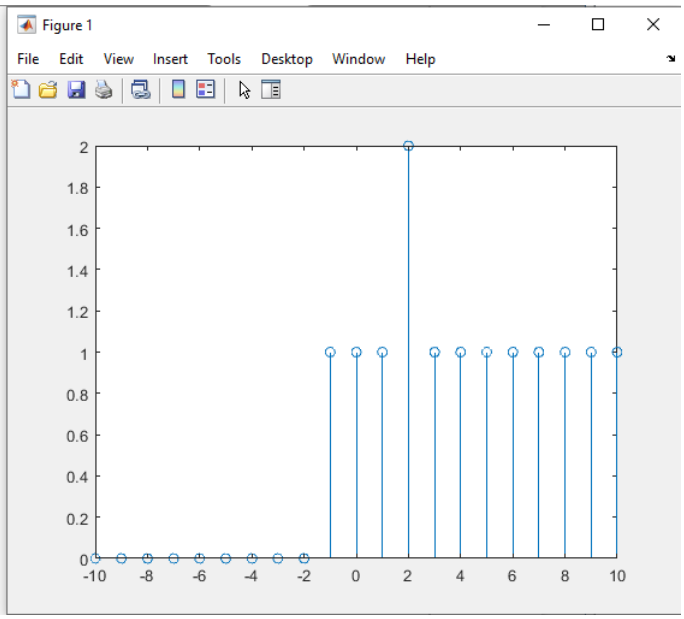
e. $x[n] = u(n+1) + \delta(n-2)$ where $-10 \leq n \leq 10$

Here, we have summed up the unit step function and the unit impulse function. However, the unit step function is shifted 1 unit toward the left and the unit impulse function is shifted 2 unit toward the right.

```
% Name: Hemal Sharma
%ID: 2221855

%x[n] = u(n+1) + δ(n-2) where -10 ≤ n ≤ 10

n = -10:10
x = stepseq(-1,-10,10) + impseq(2,-10,10)
stem(n,x)
```



(ii) Use stem function to plot x[n] and comment on the results in each case.

Lab Assignment-2: Develop a MATLAB function that will produce a RAMP signal.

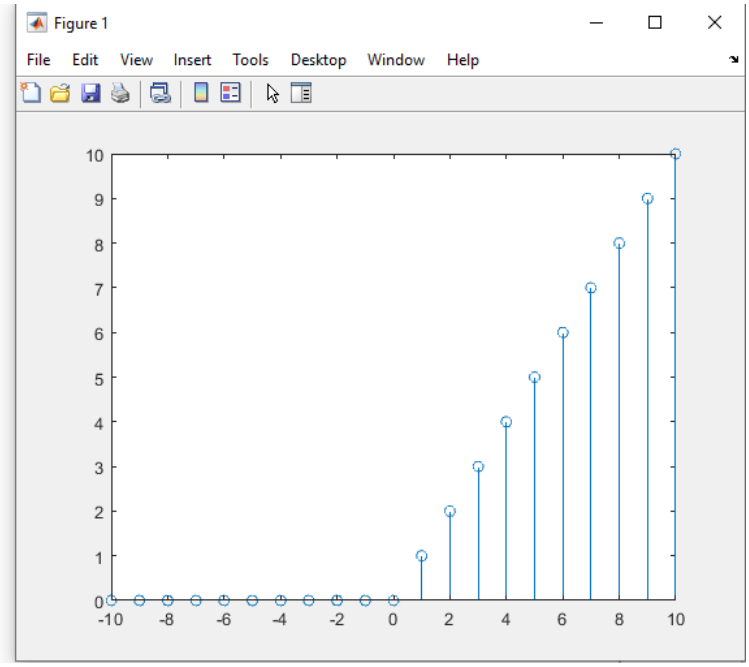
```
% Name: Hemal Sharma
%ID: 2221855
% function to generate a ramp signal
function [x, n] = rampseq(n0, n1, n2)
n = n1:n2;
x = (n-n0).*((n-n0) >= 0);
stem(n,x)

end
```

Examples:

```
% Name: Hemal Sharma
%ID: 2221855

% x(n) = ramp(n) for -10:10
[x, n] = rampseq(0, -10, 10);
stem(n, x)
```




```
% Name: Hemal Sharma
%ID: 2221855

% x(n) = ramp(n-4) for -10:10
[x, n] = rampseq(4, -10, 10);
stem(n, x)
```