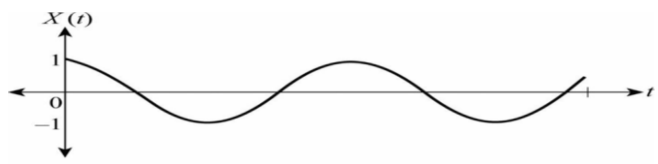
Experiment No: 01

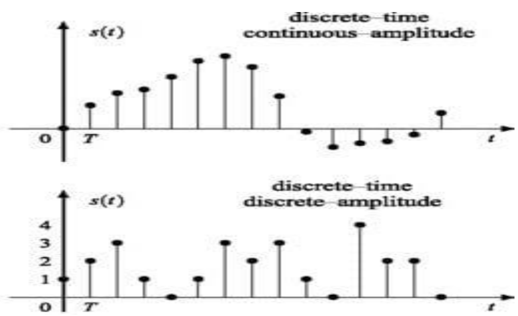
Name of the Experiment:

i) Plot unit step, unit ramp, unit impulse signal using MATLAB.
ii) Plot discrete signal using MATLAB.
iii) Plot two different discrete signal and show their addition and subtraction using MATLAB.
iv) Plot two different continuous signal using MATALB.

Theory: A continuous signal or a continuous-time signal is a varying quantity whose domain, which is often time, is a continuum. That is, the function's domain is an uncountable set. The function itself need not to be continuous.

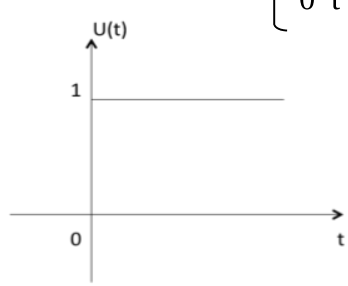


A discrete signal or discrete-time signal is a time series consisting of a sequence of quantities. Unlike a continuous-time signal, a discrete-time signal is not a function of a continuous argument; however, it may have been obtained by sampling from a continuous-time signal.



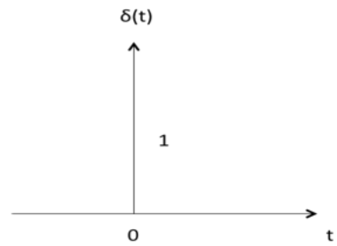
The step signal or step function is that type of standard signal which exists only for positive time and it is zero for negative time. In other words, a signal x(t) is said to be step signal if and only if it exists for t > 0 and zero for t < 0. The step signal is an important signal used for analysis of many systems.

Unit step function is denoted by u(t). It is defined as $u(t) = \begin{cases} 1 & t \geq 0 \\ 0 & t < 0 \end{cases}$



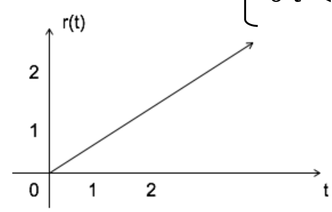
An ideal impulse signal is a signal that is zero everywhere but at the origin (t = 0), it is infinitely high. Although, the area of the impulse is finite. The unit impulse signal is the most widely used standard signal used in the analysis of signals and systems.

Impulse function is denoted by δ(t). and it is defined as $\delta(t) = \begin{cases} 1 & t = 0 \\ 0 & t \neq 0 \end{cases}$



A ramp function or ramp signal is a type of standard signal which starts at $t = 0$ and increases linearly with time. The unit ramp function has unit slop.

Ramp signal is denoted by r(t), and it is defined as $r(t) = \begin{cases} t & t \geq 0 \\ 0 & t < 0 \end{cases}$



<u>Code:</u>

Code for plotting unit step, unit ramp, unit impulse signal:

```
clc
clear all
close all
t = -10:0.01:10
step = t>=0
subplot(3,1,1);
plot(t,step);
xlabel('time');
ylabel('amplitude');
title('unit step');
ramp = t.*step
subplot(3,1,2);
plot(t,ramp);
xlabel('time');
ylabel('amplitude');
title('unit ramp');
impulse = t==0
subplot(3,1,3);
plot(t,impulse);
xlabel('time');
ylabel('amplitude');
title('unit impulse');
```

Code for plotting discrete signal:

```
x = -4:3
y = [1,2,3,3,2,-1,-4,-3]
```

```
stem(x,y);
```

Code for plotting two different discrete signal and show their addition and subtraction:

```
clc
clear all
close all
t = -10:2:20
n1 = t>=0 & t<=10
subplot(4,1,1);
stem(t,n1);
xlabel('time');
ylabel('amplitude');
title('1st Signal');
n2 = t>=5 & t<=15
subplot(4,1,2);
stem(t,n2);
xlabel('time');
ylabel('amplitude');
title('2nd Signal');
add = n1+n2
subplot(4,1,3);
stem(t,add);
xlabel('time');
ylabel('amplitude');
title('Addition');
sub = n1-n2
subplot(4,1,4);
stem(t,sub);
xlabel('time');
ylabel('amplitude');
title('Subtraction');
```

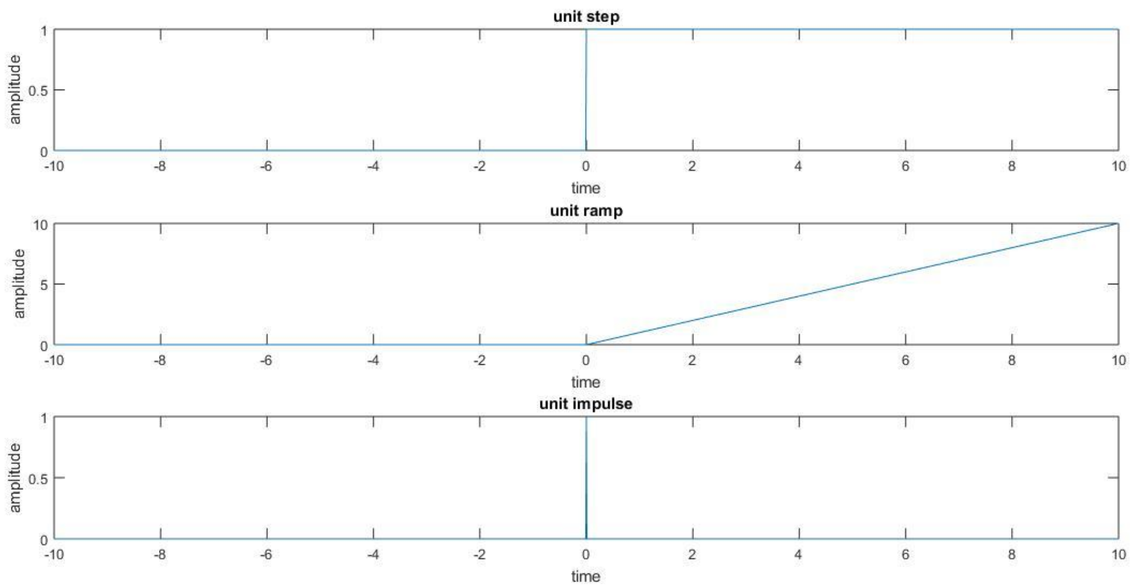
Code for plotting two different continuous signal:

```
clc
clear all
close all
t = -10:0.01:20
n1 = t>=0 & t<=7
n2 = t>=1 & t<=6
n3 = t>=2 & t<=5
s1 = n1+n2+2*n3;
subplot(4,1,1);
plot(t,s1);
xlabel('time');
ylabel('amplitude');
```

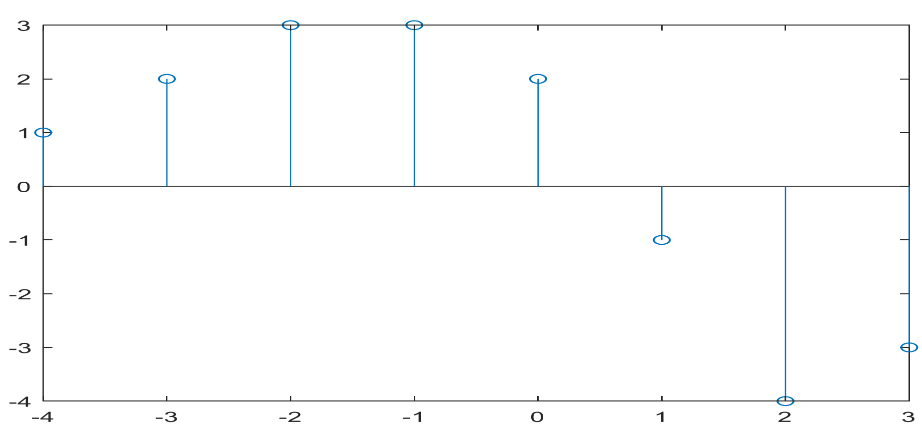
```
title('1st signal');
t1 = -3:0.01:3
impulse = t1>=0
n11 = t1.*impulse
n22 = t1>=3 & t1<=5
s2 = n11+n22;
subplot(4,1,2);
plot(t1,s2);
xlabel('time');
ylabel('amplitude');
title('2nd signal');
```

Output:

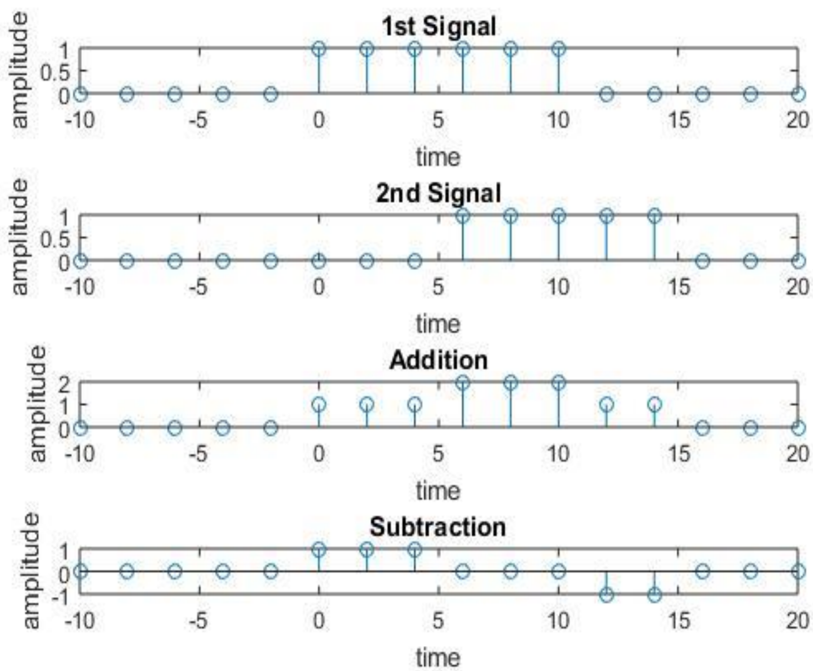
Output for plotting unit step, unit ramp, unit impulse signal:



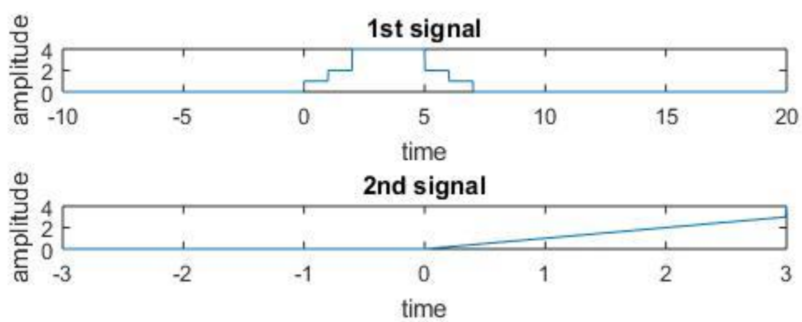
Output for discrete signal:



Output for plotting two different discrete signal by showing their addition and subtraction:



Output for plotting two different continuous signal:



<u>Discussion:</u> For plotting unit step signal a range t was declared. At first I defined the range of t as

-10:0.1:10,which is -10 to 10 and they were 0.1 unit apart.So I did not get the perfect impulse signal.Because the signal was getting 0 for -0.1 and 0.1.When I make the range -10:0.01:10 then I get a perfect impulse signal.In this case the impulse signal was perfect.The condition for unit step signal was t>0 ,for ramp condition was t*step and for impulse signal condition is impulse=t= =0.Then plot and subplot was used to show the unit step signal.

For plotting discrete signal, a range was declared in x and value was declared in y. “stem” function was used to show the discrete signal.

For addition and subtraction of two signal, at first a range t was declared. Then the signal was plotted using plot and subplot according to the condition. Similarly, the second signal was plotted. For addition of two signal, the signals were added and for subtraction, the signals were subtracted. The final signal was shown using plot and subplot.

In the last two signal the condition was n1 = t>=0 & t<=7 n2 = t>=1 & t<=6 n3 = t>=2 & t<=5 s1 = n1+n2+2*n3 and for last signal condition was n11 = t1.*impulse n22 = t1>=3 & t1<=5 s2 = n11+n22.This second figure couldnot be completed fully,I was able to plot only the ramp signal.This condition is given inside the matlab code.

<u>Conclusion:</u> The code was executed successfully and no errors were found. Form this experiment, we had learned about different types of signal and how to plot them using MATALB.

<u>References:</u>

[1]Continuous Signal
Available: https://www.chegg.com/homework-help/definitions/continuous-and-discrete-signals-4
[2]Discrete Signal
Available: https://www.sciencedirect.com/topics/engineering/discrete-signal
[3]Unit Step Function
Available: https://www.tutorialspoint.com/signals_and_systems/signals_basic_types.html
[4]Unit Impulse Function
Available: https://www.tutorialspoint.com/signals_and_systems/signals_basic_types.html
[5]Ramp Signal
Available: https://www.tutorialspoint.com/signals_and_systems/signals_basic_types.html

Heaven's Light is Our Guide

Rajshahi University of Engineering & Technology, Rajshahi

Lab report

Course No: ECE 4124

Course Title: Digital Signal Processing Sessional

Date of submission:30.04.23

Submitted By :	**Submitted To:**
Name: Ahmad Nafi **Roll:** 1810058	Hafsa Binte Kibria
	Lecturer Department of ECE