Lesson 1 : MATLab-এ তিনটি কোড অবশ্যই প্রথমে লিখবো।

```
clc;
clear all;
close all;
```

"**clc**" clears all the text from the Command Window, resulting in a clear screen.

To "**clear all**" variables from the current workspace, use clear or clearvars . To clear all global variables, use "**clear global**" or "**clearvars -global**" . To clear a particular class, use "**clear myClass**" . To clear a particular function or script, use "**clear functionName**" .

Use "**close all**" to clean up any open windows (e.g. plots) before running a script.

Lesson 2 : MATLab-এ Semicolon এর ব্যবহার ।

Semicolon (;) indicates end of statement. However, if you want to suppress and hide the MATLAB output for an expression, add a semicolon after the expression.

অর্থাৎ , সেমিকোলন ব্যবহার না করলে Output কমান্ড উইনডোতে দেখাবে। আর সেমিকোলন দিলে Output কমান্ড উইনডোতে দেখাবে না।

Lesson 3 : MATLab-এ Sample নেওয়া ।

পদ্ধতি ১ঃ t = start range : end Range ;
পদ্ধতি ২ঃ t = start range : difference : end Range ;

১ম পদ্ধতিতে by default difference থাকে 1 ।
২য় পদ্ধতিতে difference এর মান বলে দিতে হয়।

উদাহরণঃ

t = 0 : 10 ; => এখানে 11 টি sample তৈরি হবে ।

t = 0 : 2 : 10 ; => এখানে 6 টি sample তৈরি হবে ।

Lesson 4 : MATLab-এ Input and Output প্রদর্শন ।

```
var = input("Your Message") ;
 var = input('Your Message' , 's') ;
```

"var" এ যে কোনো data নিতে পারবে।

"input" একটি MATLab এর ইনপুট ফাংশন ।

"Your Message" এটা দিয়ে user কে দিক নির্দেশনা দিতে পারবে।

এখানে Single quote বা Double quote ব্যবহার করতে পারবে।

যদি ইনপুট স্ট্রিং টাইপ হলে , ডাটা টাইপ বলে দিতে হয়। এখানে 's' স্ট্রিং ডাটা টাইপ নির্দেশ করছে।

```
disp('Your Answer : ') ;
disp(var) ;
```

"disp" একটি MATLab এর আউটপুট ফাংশন ।

Lesson 5 : MATLab-এ Plot প্রদর্শন ।

```
subplot(m , n , l) ;
plot(x,y) ;
title('  ') ;
xlable('  ') ;
ylable('  ') ;
```

plot(x,y) creates a 2-D line plot of the data in "y" versus the corresponding values in "x" .

xlabel(' ') labels the x-axis of the current axes or standalone visualization.

ylabel(' ') labels the y-axis of the current axes or standalone visualization.

subplot(m , n , l) divides the current figure into an m -by- n grid and l is the linear index number.

m = row

n = column

l = linear index

Add a title to the chart by using the **title(' ')** function.

Lesson 6 : MATLab-এ Comment ।

"%" লিখে কমেন্ট করা যায়।

উদাহরণঃ

```
% This is the 1st comment line
% This is the 2nd Comment line
```

Lesson 7 : MATLab-এ Mathematical Operation ।

Symbol	Role	More Information
+	Addition	plus
+	Unary plus	uplus
-	Subtraction	minus
-	Unary minus	uminus
.*	Element-wise multiplication	times
*	Matrix multiplication	mtimes
./	Element-wise right division	rdivide
/	Matrix right division	mrdivide
.\	Element-wise left division	ldivide
\	Matrix left division (also known as backslash)	mldivide
.^	Element-wise power	power
^	Matrix power	mpower

.'	Transpose	transpose
'	Complex conjugate transpose	ctranspose

Lesson 8 : MATLab-এ zeros এবং ones ফাংশন ।

zeros (row , column) ;

ones (row , column) ;

উদাহরণঃ

zeros (2 , 10) ; => দুটা row ও দশটা column এ টোটাল ২০ টি শুন্য বসবে।

ones (2 , 3) ; => দুটা row ও তিনটা column এ টোটাল ৬ টি এক বসবে।

Lesson 9 : MATLab-এ plot এবং stem ফাংশন এ পার্থক্য ।

```
plot(x , y , 'color' )
stem(x , y , 'color' , 'line')
```

plot displays the continuous values for the curve.

stem displays the discrete values of the points on the curve.

উদাহরণঃ

plot(x,y,'g') ; => Here 'g' is green color

stem(x,y,'r' , '--') ; => Here 'r' is red color

Lesson 10 : MATLab-এ axis ফাংশন এ পার্থক্য ।

axis([-x x -y y]) ;

উদাহরণঃ

axis([-7 12 -2 2]) ;

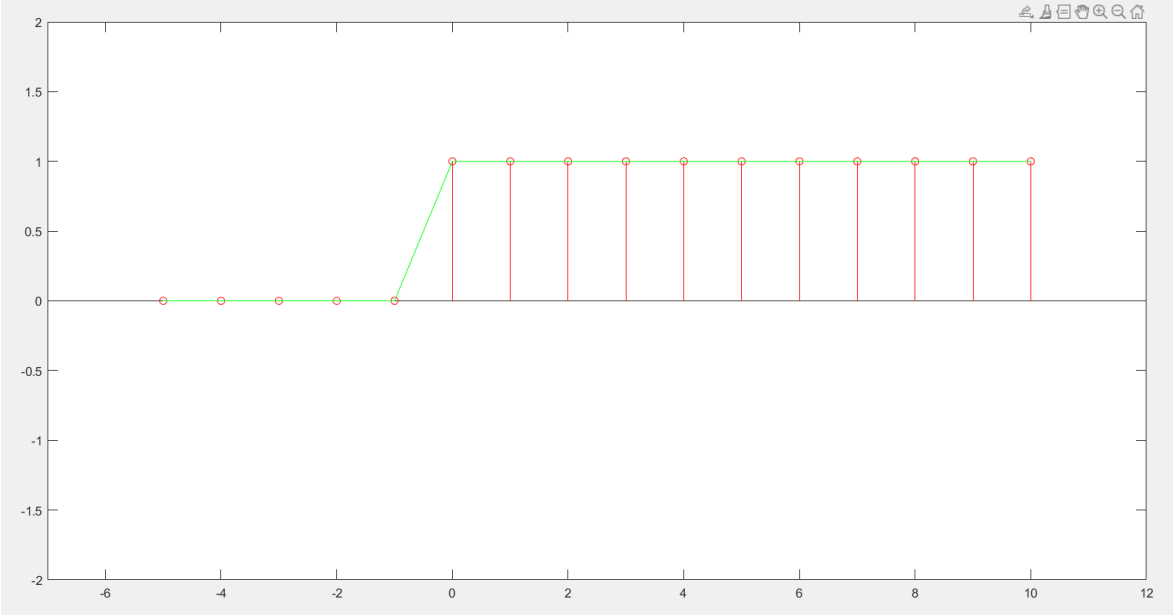
Lesson 11 : MATLab-এ hold ফাংশন এর বৈশিষ্ট্য ।

```
hold on ;
```

hold on করা থাকলে , আগের ছবিটা ধরে থাকে।

উদাহরণঃ

```
clc;
clear all;
close all ;

t = -5 : 1 : 10;

u = [ zeros(1,5) ones(1,11) ];

stem(t,u , 'r');
hold on ;
plot(t,u , 'g');
axis([ -7 12 -2 2 ]);
```



Lesson 12 : MATLab-এ Random Signal ।

Random সিগ্নাল এর ফাংশন rand() .

rand(row , column) ;

rand(n) ; => Create an nxn matrix

randi([f t] , row , column) ; => "f" is Range from, "t" is Range to

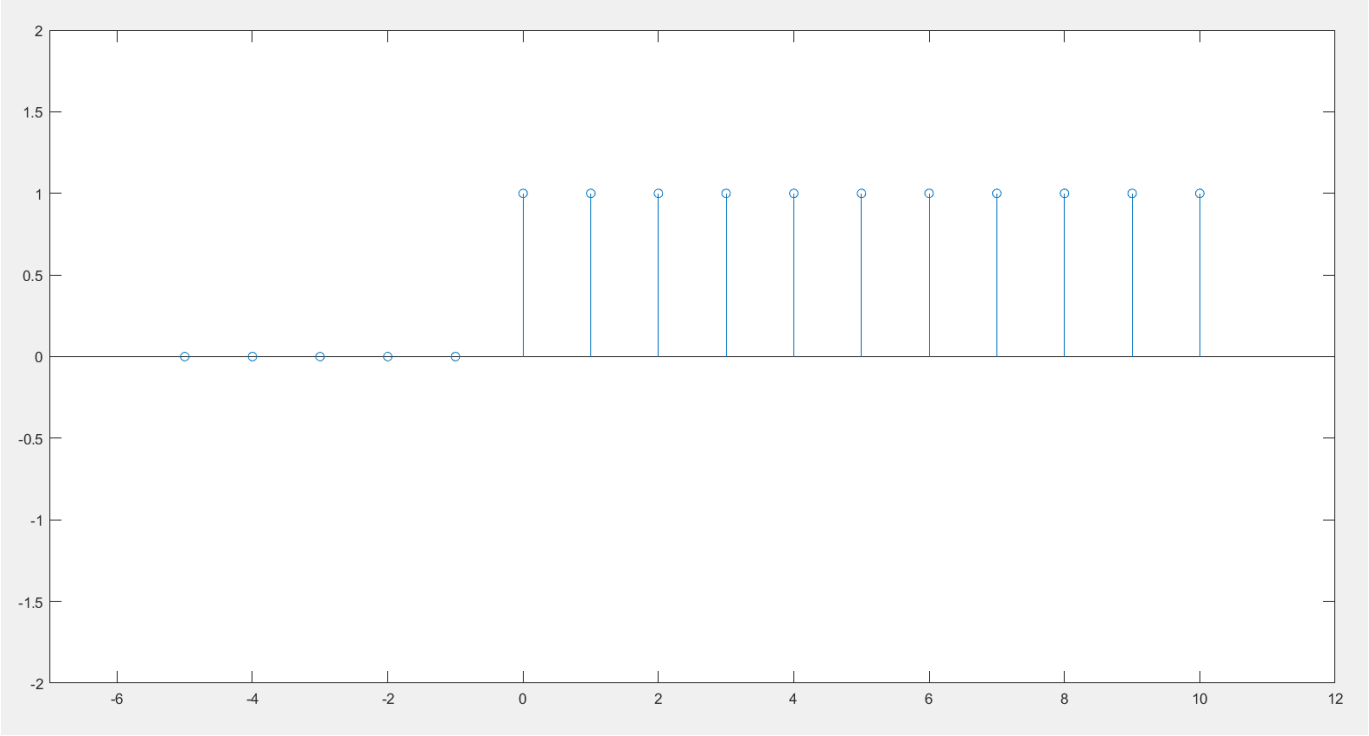
Exp-1 : To develop programs for generating elementary signal functions like unit sample, unit step , ramp sequences , exponential , sinusoidal , random and periodic signal.

u(t) = 1 ; t>= 0

0 ; t < 0

Unit Sample and Unit Step

```
clc;
clear all;
close all ;

t = -5 : 1 : 10;

u = [ zeros(1,5) ones(1,11) ];

stem(t,u);
axis([ -7 12 -2 2 ]);
```



Exp-02 : Write a MATLab code to generate a sine wave, when signal frequency is 8Hz.

Sine wave এর সূত্র হচ্ছে,

$x(t) = A \sin(2*\pi*f*t)$

এখানে,

A = Amplitude / বিস্তার

f = frequency

t = independent variable time

frequency বলতে কোনো একটি কোণা এক সেকেন্ডে কতটি পূর্ণ স্পন্দন দিচ্ছে। তা বুঝায়।

"t" এর যত বেশি sample নিতে পারবো ততই সুন্দর আউটপুট দেখা যাবে ।

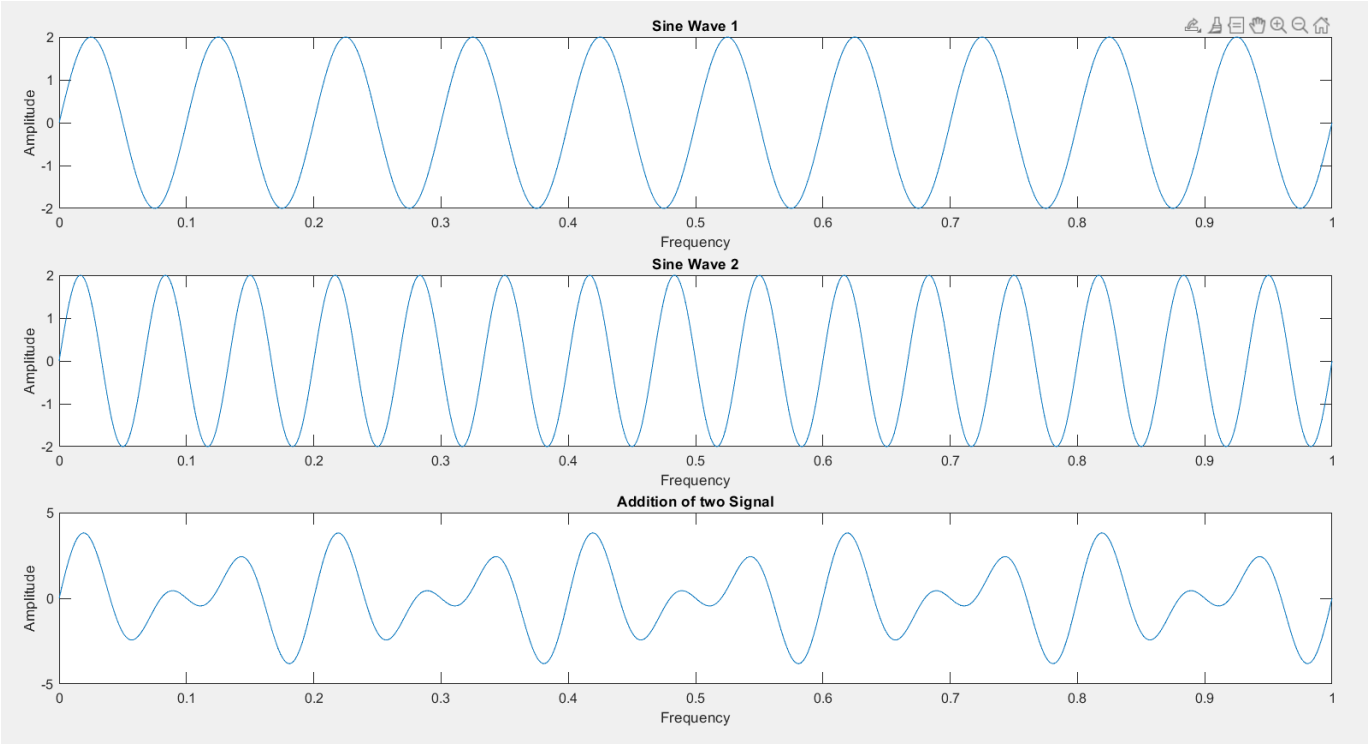
```
clc;
clear all;
close all;

A = 2;
f = 8 ;
t = 0:0.001:1 ;

x = A * sin(2*pi*f*t);

plot(t,x);
```

Exp-3 : Write a MATLab code to generate addition and multiplication of two sine waves when two signals are of same length.

Addition of two sine wave

```
clc ;
close all ;
clear all;
%------------------------------
t = 0: 0.001 : 1 ;
f1 = 10 ;
f2 = 15 ;
A = 2 ;
w1 = 2 * pi * f1 * t ;
w2 = 2 * pi * f2 * t ;
%------------------------------
x1 = A * sin(w1);
subplot(3,1,1);
plot(t,x1);
title('Sine Wave');
xlabel('Frequency');
ylabel('Amplitude');
%------------------------------
x2 = A*sin(w2);
subplot(3,1,2);
plot(t,x2);
title('Cosine Wave');
xlabel('Frequency');
ylabel('Amplitude');
%------------------------------
y = x1 + x2 ;
```

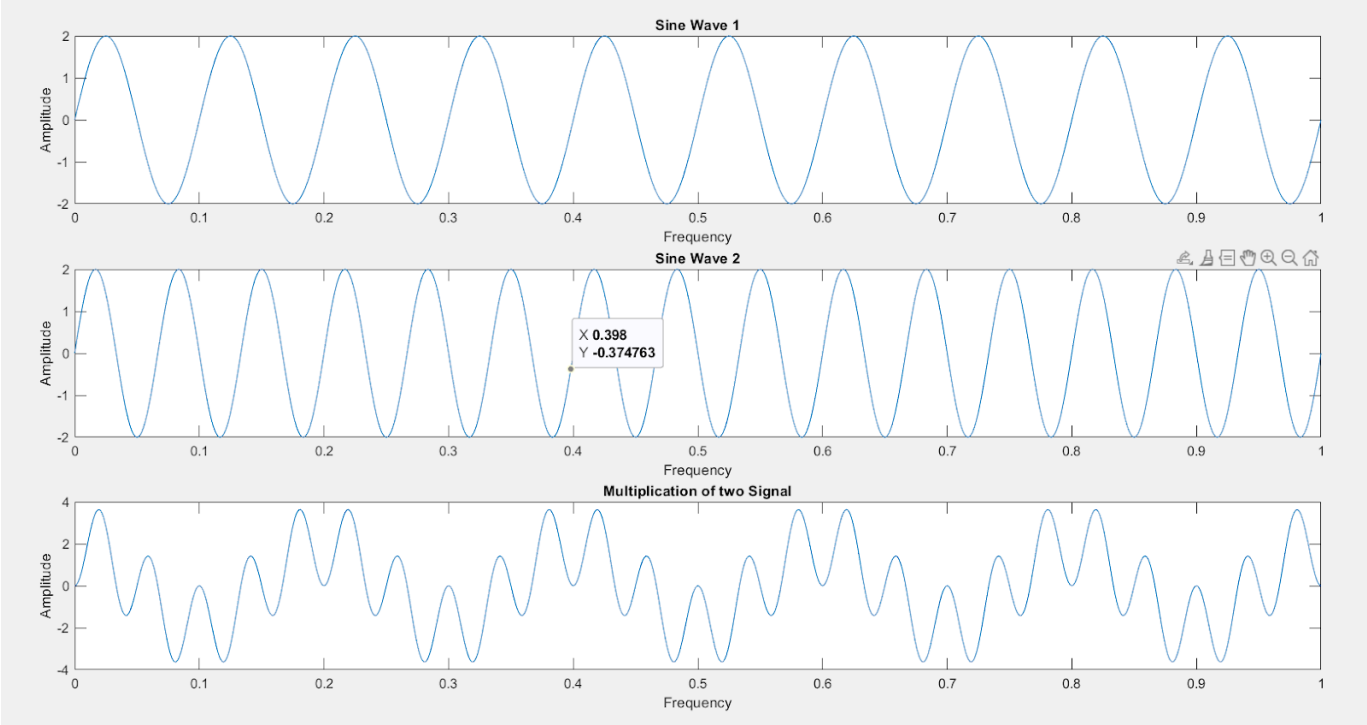
```
subplot(3,1,3);
plot(t,y);
title('Addition of two Signal');
xlabel('Frequency');
ylabel('Amplitude');


%-----------------------------
```



Multiplication of two sine wave

```
clc ;
close all ;
clear all;


%-----------------------------
t = 0: 0.001 : 1 ;
f1 = 10 ;
f2 = 15 ;
A = 2 ;
w1 = 2 * pi * f1 * t ;
w2 = 2 * pi * f2 * t ;
```

```
%-----------------------------
x1 = A * sin(w1);
subplot(3,1,1);
plot(t,x1);
title('Sine Wave 1');
xlabel('Frequency');
ylabel('Amplitude');


%-----------------------------
x2 = A*sin(w2);
subplot(3,1,2);
plot(t,x2);
title('Sine Wave 2');
xlabel('Frequency');
ylabel('Amplitude');


%-----------------------------
y = x1 .* x2 ;
subplot(3,1,3);
plot(t,y);
title('Multiplication of two Signal');
xlabel('Frequency');
ylabel('Amplitude');


%-----------------------------
```



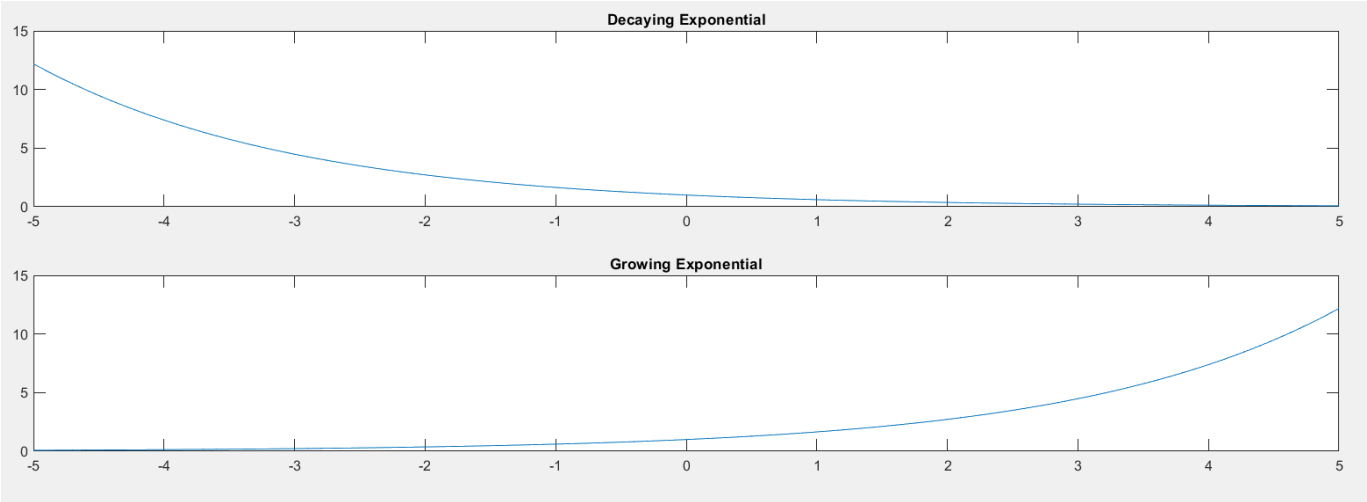
Exp-04 : Write a MATLab code to generate an Exponential curve in growing and decaying form .

$$y = e^{\frac{x}{2}}$$

$$y = 5\, e^{-2t}$$

```
clc ;
close all ;
clear all;


%----------------------------------------
t= -5:.1:5 ;


%----------------------------------------
x = exp(-t/2);
subplot(3, 1 , 1);
plot(t,x);
title('Decaying Exponential');
```

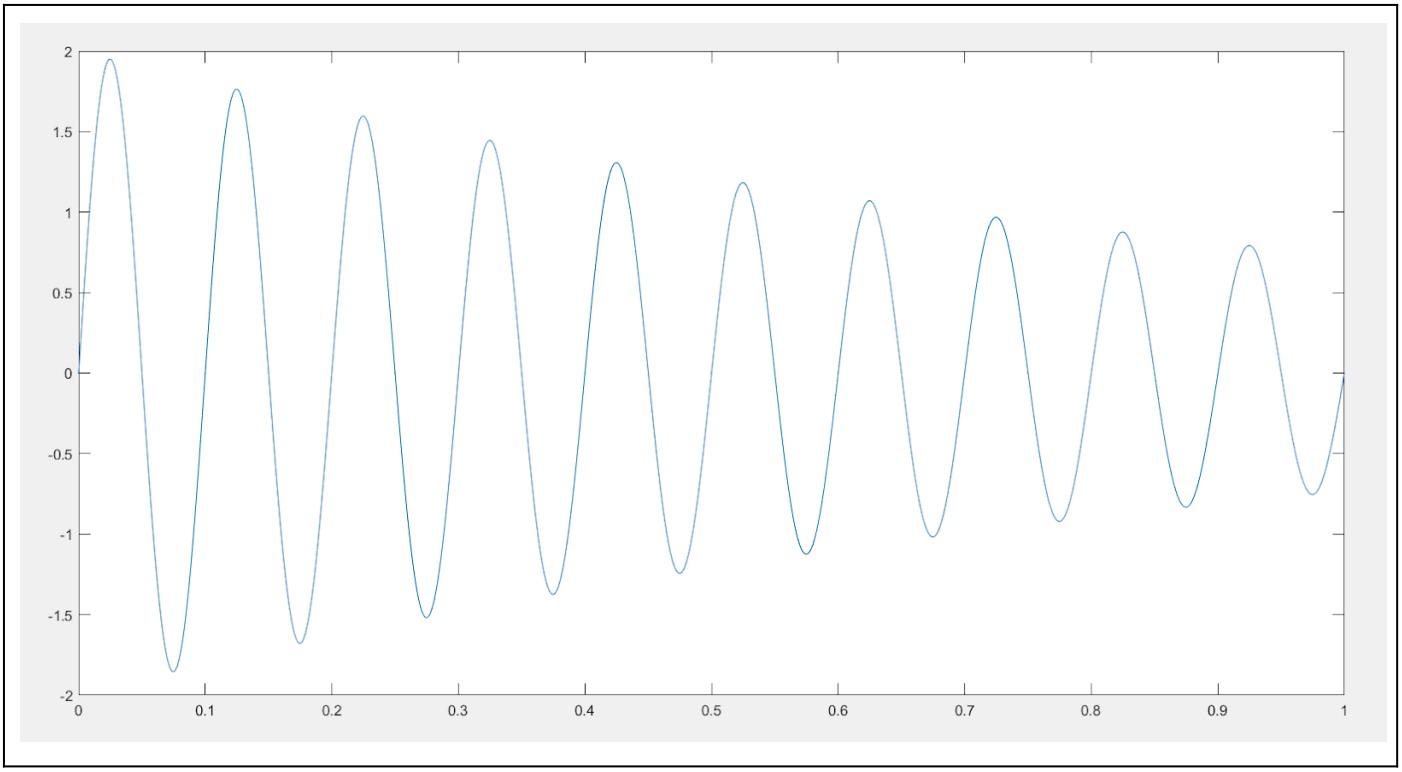
```
%----------------------------------------
x = exp(t/2);
subplot(3, 1 , 2);
plot(t,x);
title('Growing Exponential');
%----------------------------------------
```



Exp-05 : Write a MATLab code to generate a damped sinusoidal signal.

$$y = A * e^{-t} \sin (2*pi*f*t)$$

```
clc;
clear all;
close all ;


t = 0: 0.001 : 1 ;
f = 10 ;
A = 2 ;
w = 2 * pi * f * t ;

y = A * exp( - t ) .* sin(w) ;

plot(t,y);
```



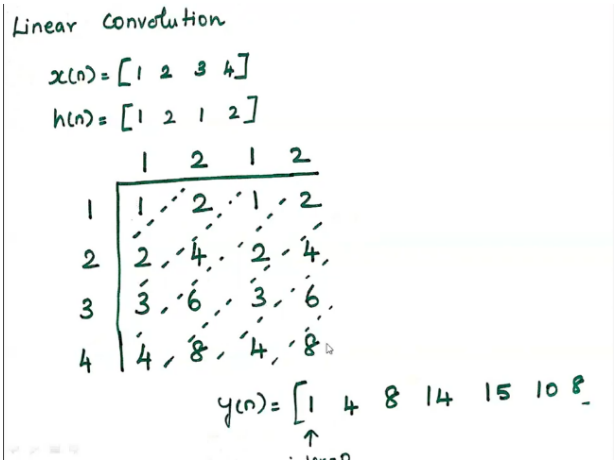
Exp-06 : Write a MATLab code to decompose a signal x(n) = A * sin(2 * pi * (f/f_c) * t + θ) into its even and odd part.

Even Signal => $x_e(-n) = x_e(n)$

ODD Signal => $x_O(-n) = -x_O(n)$

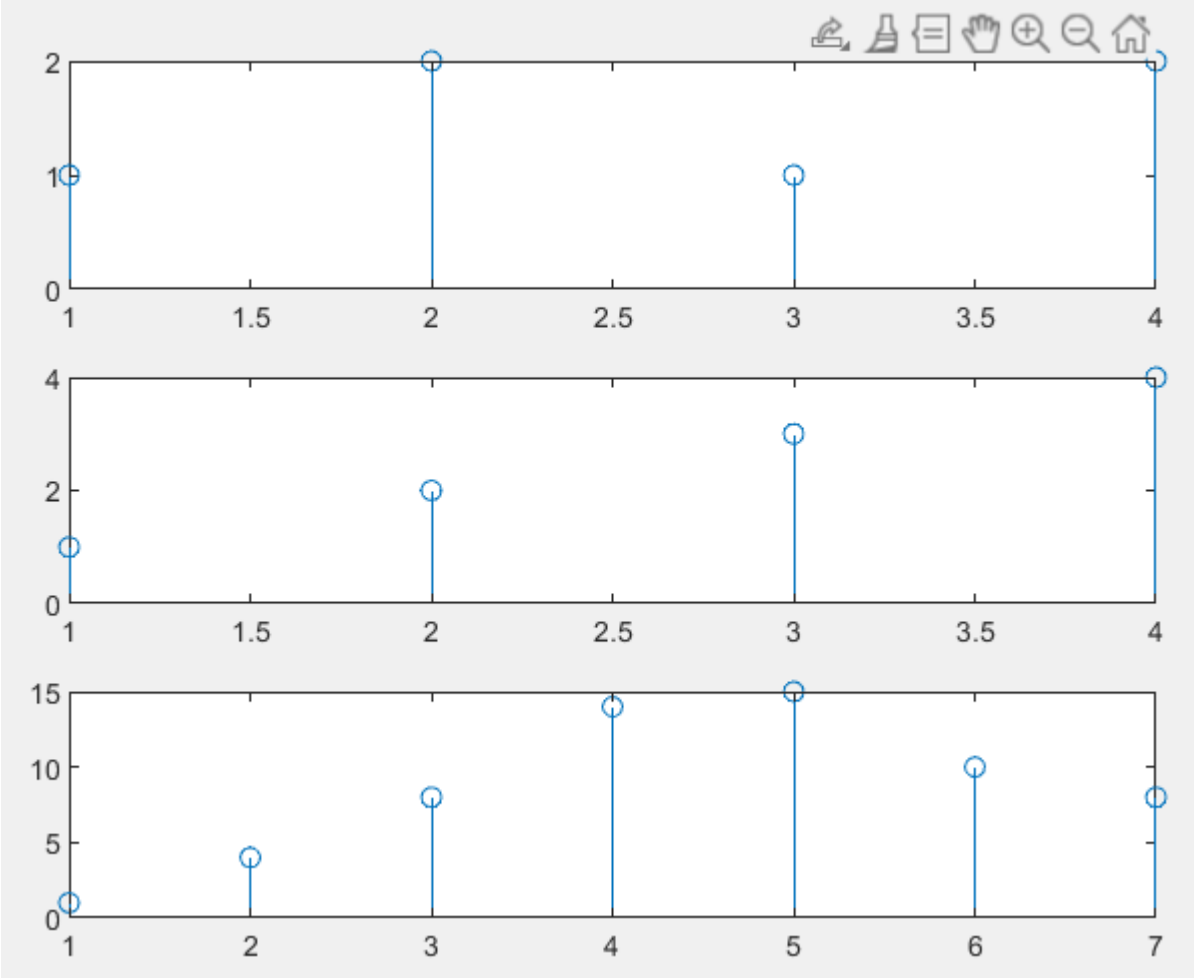
Exp - 07 : Write a MATLab code to develop the program for finding the convolution between two sequences .

$$y[n] = \sum_{k=-\infty}^{\infty} x[k] \, . \, h[n-k]$$



With conv() Function

```
clc ;
close all;
clear all;

t = 1 : 4 ;

x = [1 2 1 2];
h = [ 1 2 3 4 ] ;

y = conv(x,h) ;

t2 = 1:7 ;

subplot(3,1,1) ;
stem(t , x);

subplot(3,1,2) ;
stem(t , h);

subplot(3,1,3) ;
stem(t2 , y);
```



Without conv() Function

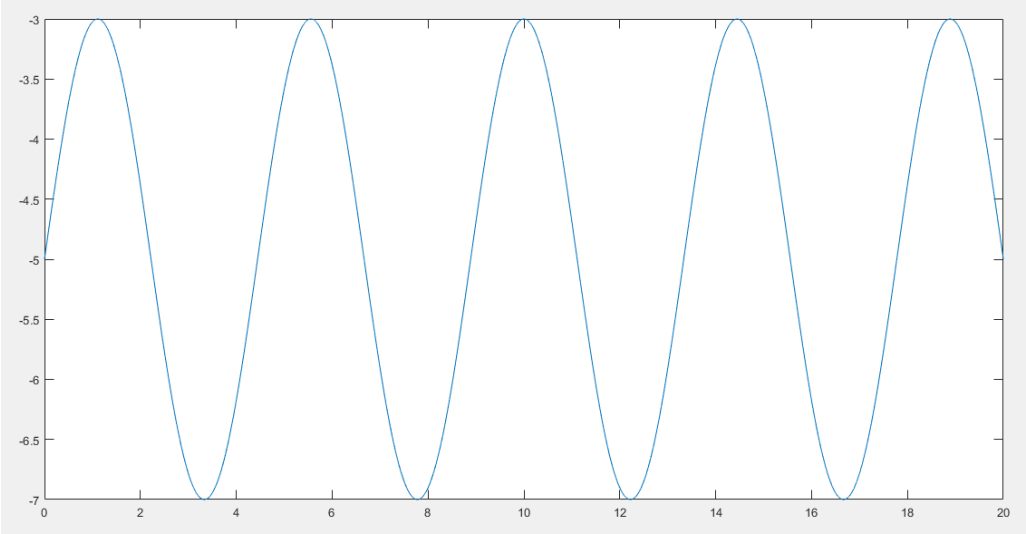
```
clc ;
close all;
clear all;

xn = input ('enter the sequence 1 : ');     %[ 1 2 3]
lx = length(xn);

hn = input ('enter the sequence 2 : ');     %[ 2 3 4]
lh = length(hn);

s = lx + lh - 1 ;                          % Taking sample

z = zeros(1,s);
z = conv(xn , hn);                          % With function
z1 = zeros(1,s);
```

```
disp(z);

xn11= [ xn , zeros( 1, (lh-1) ) ] ;
disp(xn11);

hn11= [ hn , zeros( 1, (lx-1) ) ] ;
disp(hn11);


for i=1:s
   for j = 1 : i
      z1(i) = z1(i) + xn11(j) * hn11(i-j+1) ;
   end ;
end ;

disp(z1);
```

Link : https://www.youtube.com/watch?v=Mz9W_1LRGJI
https://www.youtube.com/watch?v=E3633vpoCGQ

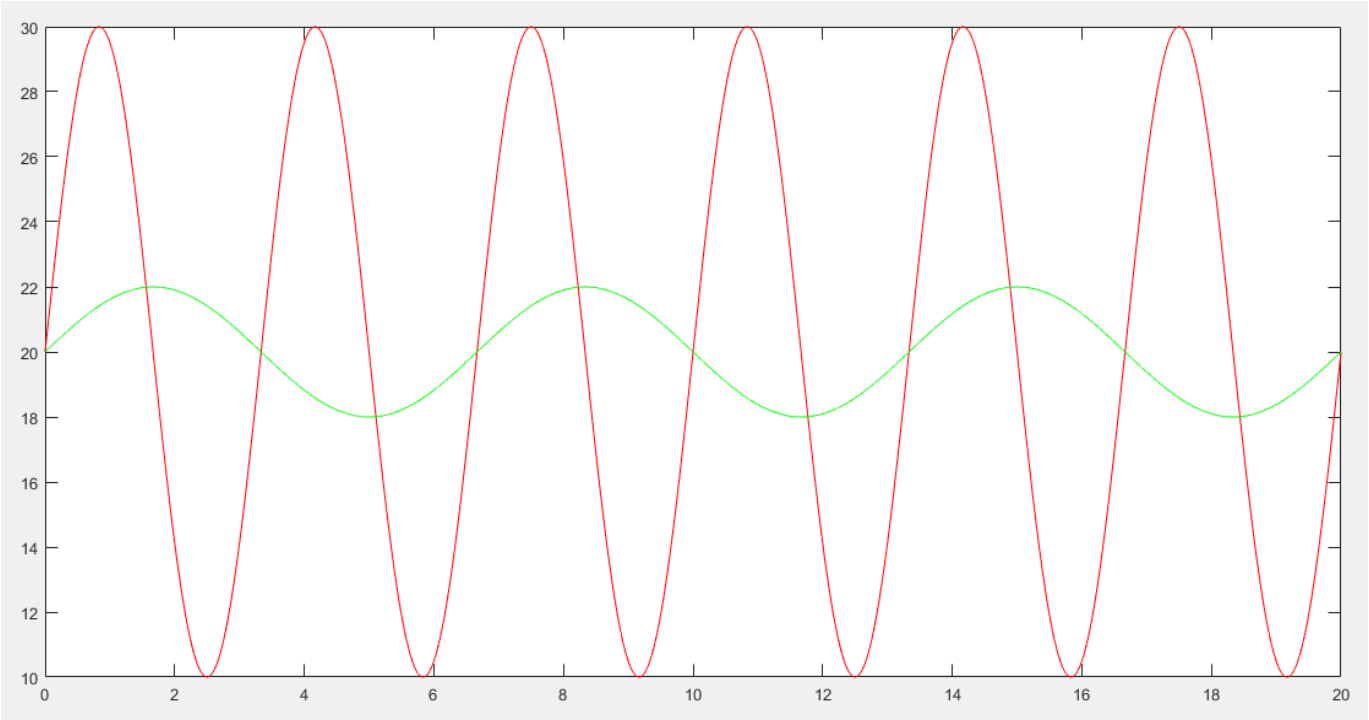
Exp-08 : Problem for computing Discrete Fourier Transform (DFT).
X could be any arbitrary sequence calculated in range [2*PI] at 501 equispaced points plot the real part , Imaginary part , Angle and Magnitude.

Home Work : 1



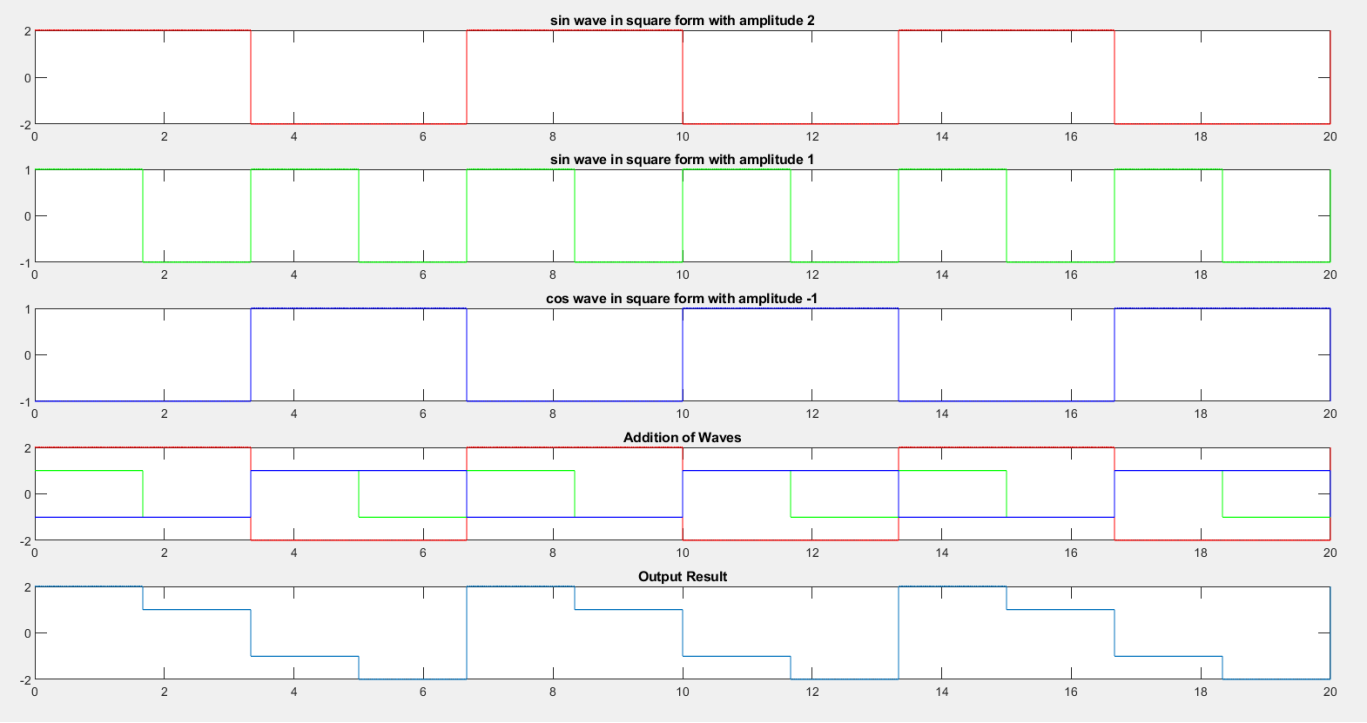

```
clc ;
clear all ;
close all ;

t = [ 0 : 0.001 : 20 ];

y = - 5 + 2 * sin(2* pi * (4.5 /20) * t ) ;

plot (t , y);
```

Home Work : 2




```
clc ;
clear all ;
close all ;

t = [ 0 : 0.001 : 20 ];

y1 = 20 + 10 * sin(2* pi * (6/20) * t ) ;

y2 = 20 + 2 * sin(2* pi * (3/20) * t ) ;


plot (t , y1 , 'r');
hold on ;
plot (t , y2 , 'g');
```

Home Work :3




```
clc;
close all;
clear all;

t = [0 : .0001  : 20];

y1 = 2 * square(2 * pi * (3/20) * t);
y2 = 1 * square(2 * pi * (6/20) * t);
y3 = -1 * square(2 * pi * (3/20) * t);

y = y1 + .5 *(y2+y3);


subplot(5,1,1);
plot(t,y1 ,'r');
title('sin wave in square form with amplitude 2');


subplot(5,1,2);
plot(t,y2 ,'g');
title('sin wave in square form with amplitude 1');
```

```
subplot(5,1,3);
plot(t,y3 ,'b');
title('cos wave in square form with amplitude -1');

subplot(5,1,4);
plot(t,y1 ,'r');
hold on;
plot(t,y2 , 'g');
hold on;
plot(t,y3 , 'b');
hold on;
title('Addition of Waves');


subplot(5,1,5);
plot(t,y);
title('Output Result');
```

```
clc;
close all;
clear all;
t=0:.002: 30;
y1 = 2 * square(2 * pi * (5/20) * t);
y2 = 1 * square(2 * pi * (10/20) * t);
y3 = -1 * square(2 * pi*(5/20)*t);
y= y1+.5*(y2+y3);
plot(t,y);
grid on;
```

Lesson 13 :

$$Y = A * square(2 * pi * \frac{f}{f_s} * t \pm H, D) \pm V$$

A = Amplitude

f = frequency

f_s = sample frequency

t = Interval range

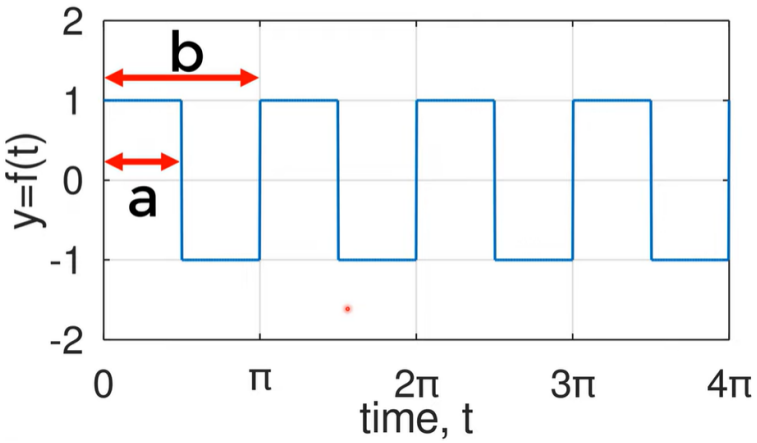
H = Horizontal shift

D = Duty cycle

V = Vertical Shift

Duty Cycle :

Duty cycle: a/b



Horizontal Shift , H:

(-ve) হলে Right Shift হবে ।

(+ve) হলে Left Shift হবে ।

লক্ষণীয় বিষয় হলো যে, sin , cos , square wave এর জন্য pi এর গুণিতক আকারে shift হবে।

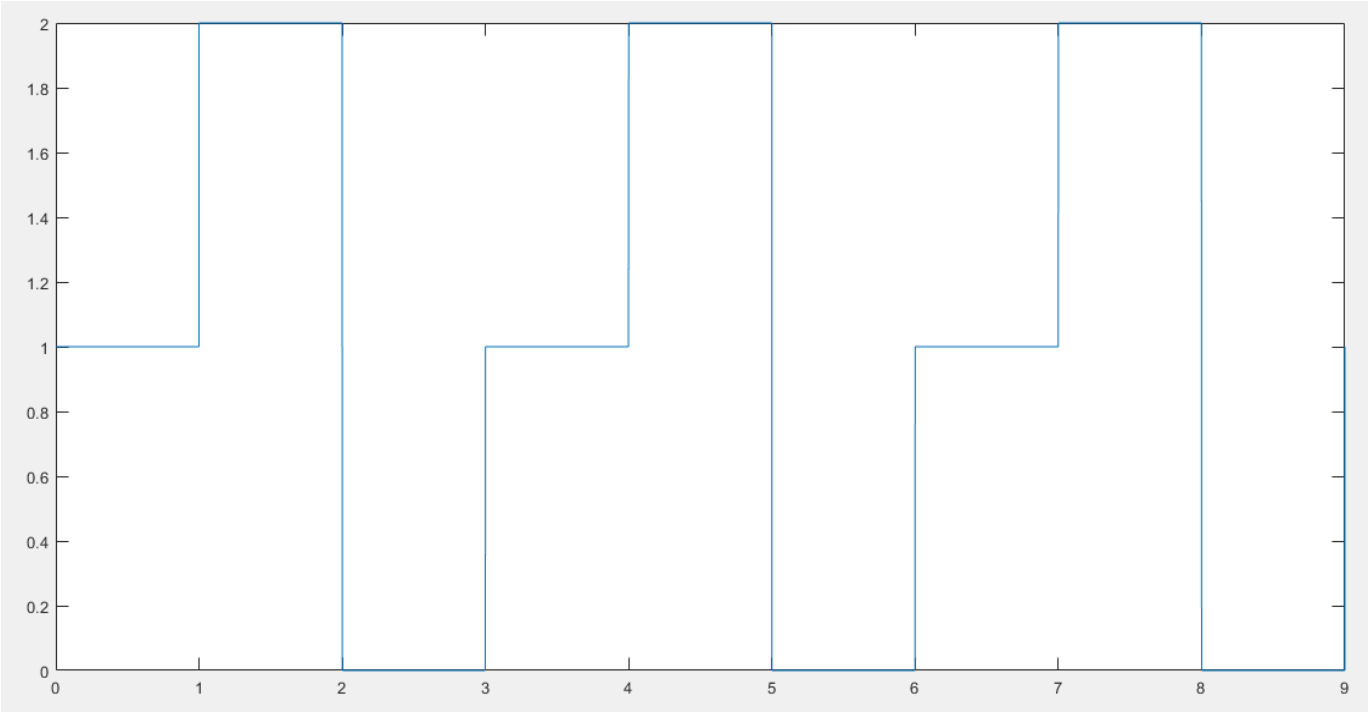
Vertical Shift , V:

(-ve) হলে Down Shift হবে ।

(+ve) হলে Upper Shift হবে ।

Want to know about Duty Cycle , Click the LINK .

Home Work 4 :




```
clc;
clear all;
close all;
t=0:.0001:9;

y1= .5 * square(2*pi* (3/9) * t , 200/3) + .5;

y2= .5 * square(2*pi* (3/9) * t  - 2*pi/3 , 100/3) + .5;

y = y1 + y2 ;
plot(t, y) ;
```

Home Work 5: