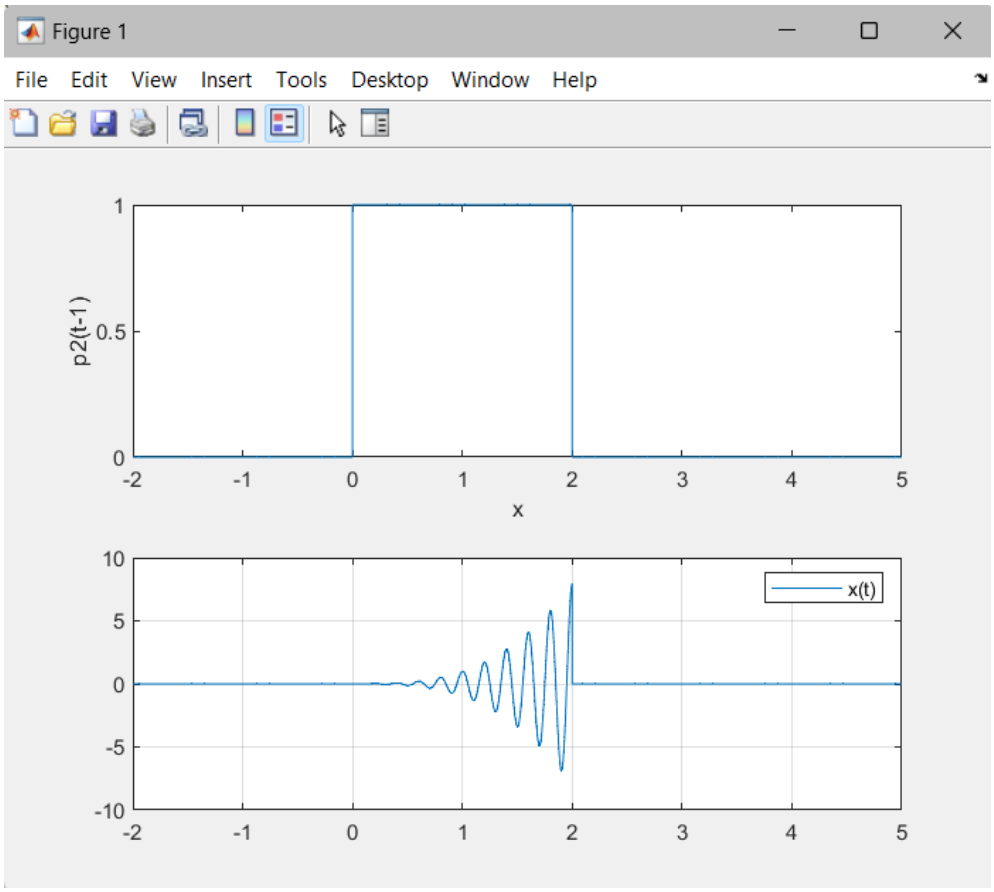
Lab 4: Signal Transformations (Scaling, Shifting and Reversal)

Name	**DANISH ZULFIQAR**
Registration Number	**FA21-BEE-042**
Class/section	**4-A**
Instructor's Name	**DR. BILAL TARIQ**

Task 1:

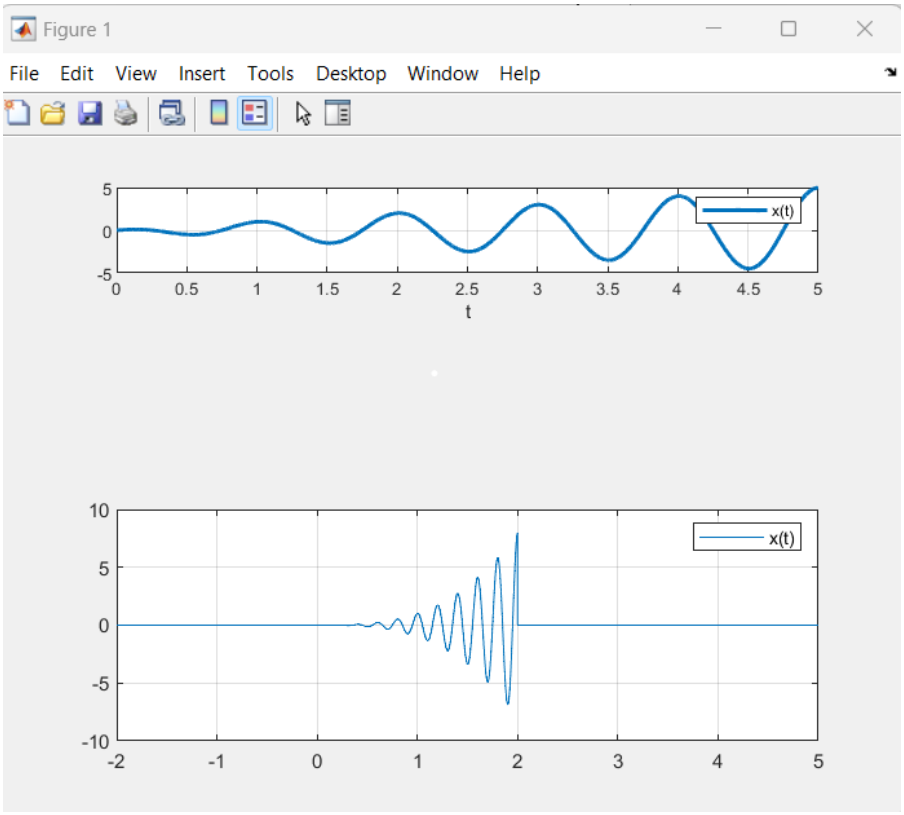
```
>> t = -2:0.001:5;
u1(t>=0) = 1;
u2(t>=2) = 1;
u = u1 - u2;
subplot(2,1,1)
plot(t,u)
xlabel('x');
ylabel('p2(t-1)');
x = t.^3.*cos(10*pi*t).*u;
subplot(2,1,2)
plot(t,x)
legend('x(t)');
grid on
```



Task 2:

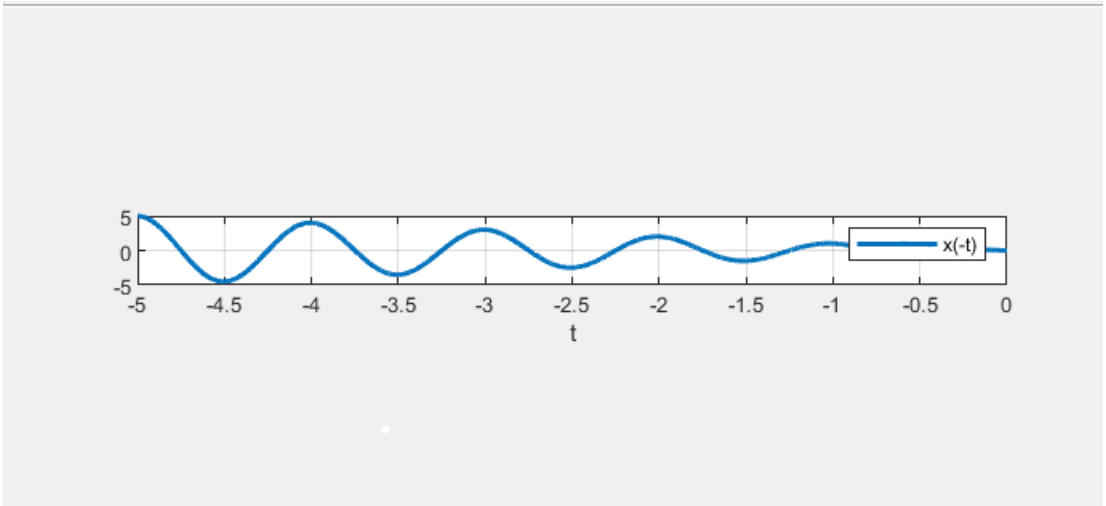
a)

```
>> t=0:0.001:5;
>> x=t.*cos(2*pi*t);
>> subplot(5,1,1)
plot(t,x,'LineWidth',2)
grid on
xlabel('t');
legend('x(t)')
```



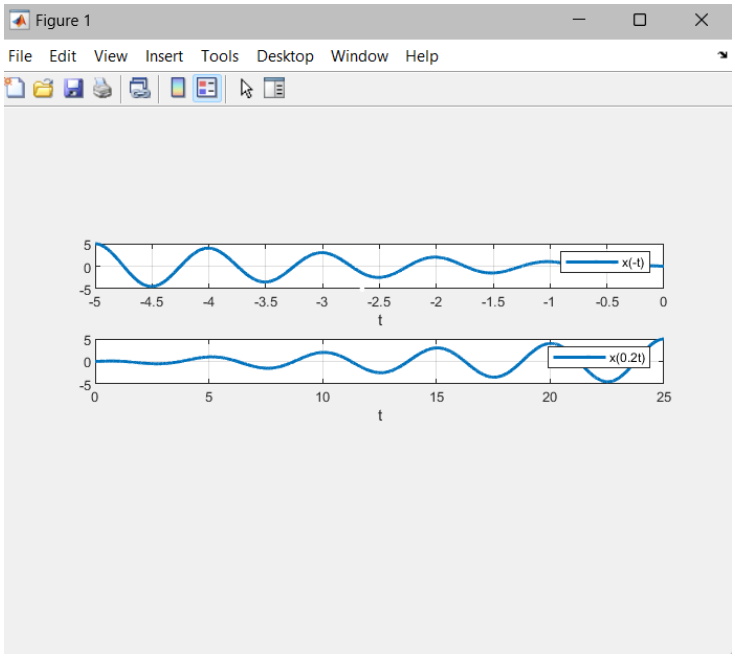
b)

```
>> subplot(5,1,2)
plot(-t,x,'LineWidth',2)
grid on
xlabel('t');
legend('x(-t)')
```



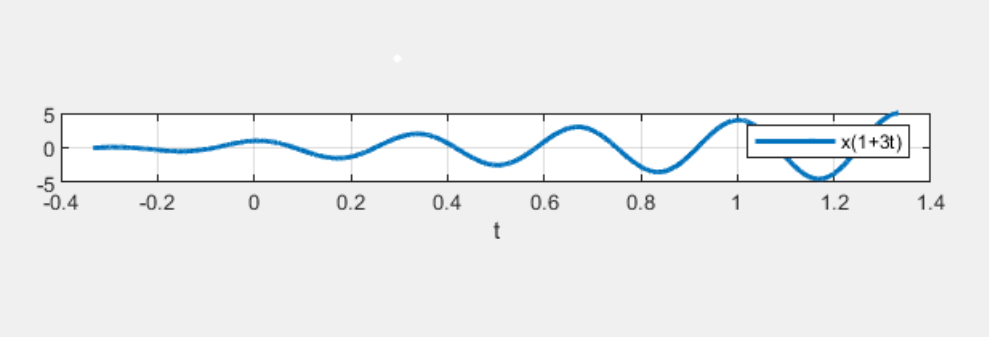
c)

```
>> a = 1/5;
subplot(5,1,3)
plot((1./a).*t,x,'LineWidth',2)
grid on
xlabel('t');
legend('x(0.2t)')
```



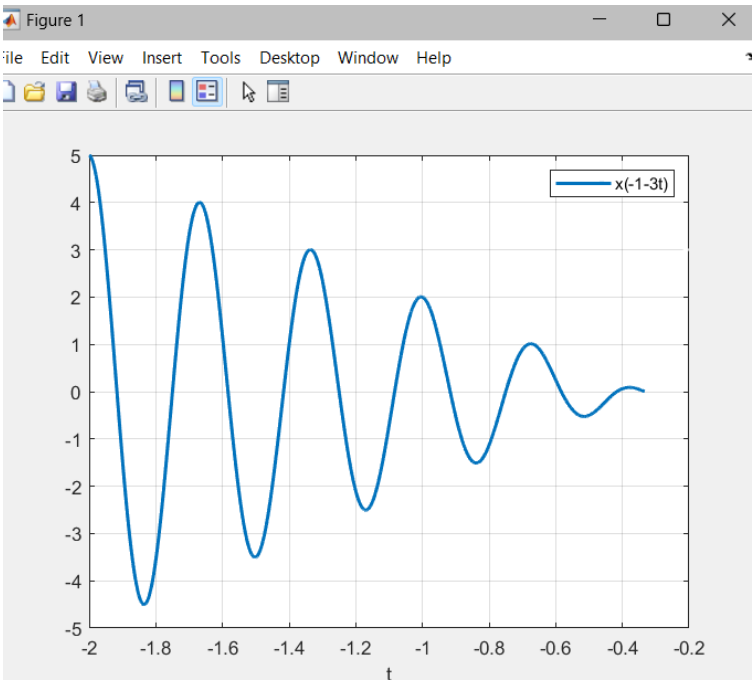
d)

```
>> subplot(5,1,4);
>> plot((1/3).*(t-1),x,'LineWidth',2);
>> grid on
>> xlabel('t');
>> legend('x(1+3t)')
```



e)

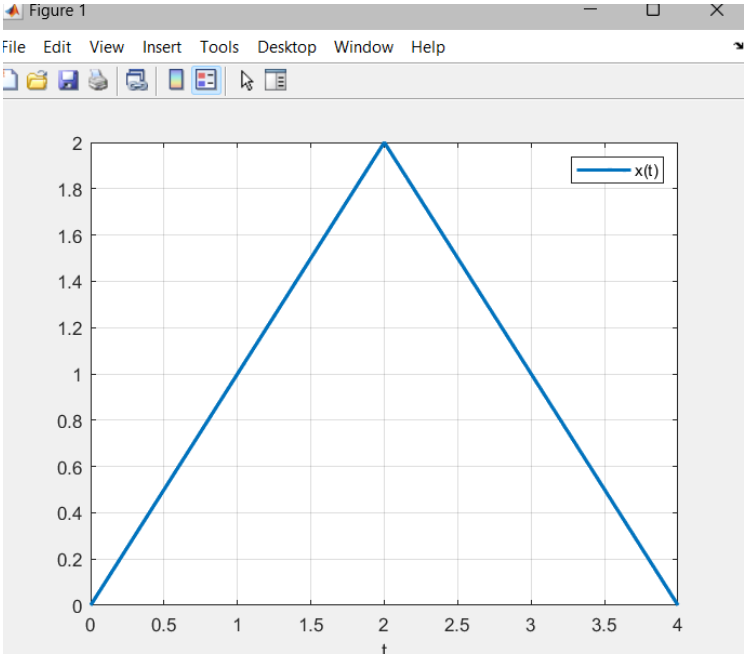
```
>> subplot(5,1,5);
>> plot(-(1/3).*(1+t),x,'LineWidth',2);
>> grid on
>> xlebel('t')
Undefined function 'xlebel' for input arguments of type 'char'.

>> xlabel('t')
>> legend('x(-1-3t)')
```



Task 3:

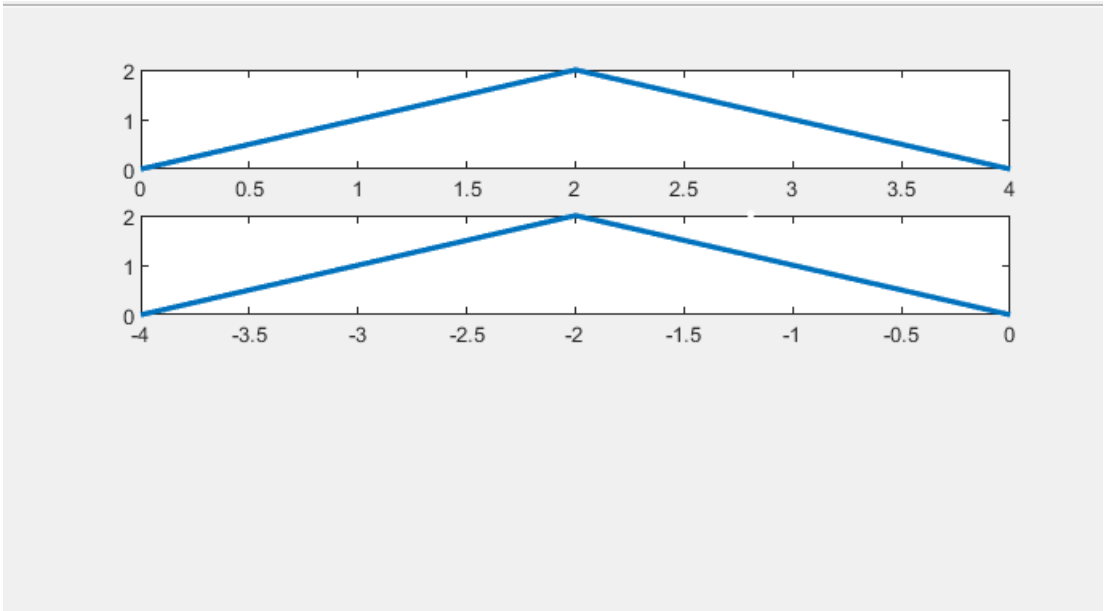
a)

```
>> t=0:0.01:4;
>> X = t.*(t<=2) + (4-t).*(t>2);
>> plot(t,X,'LineWidth',2)
>> grid on
>> xlabel('t');
>> legend('x(t)')
```



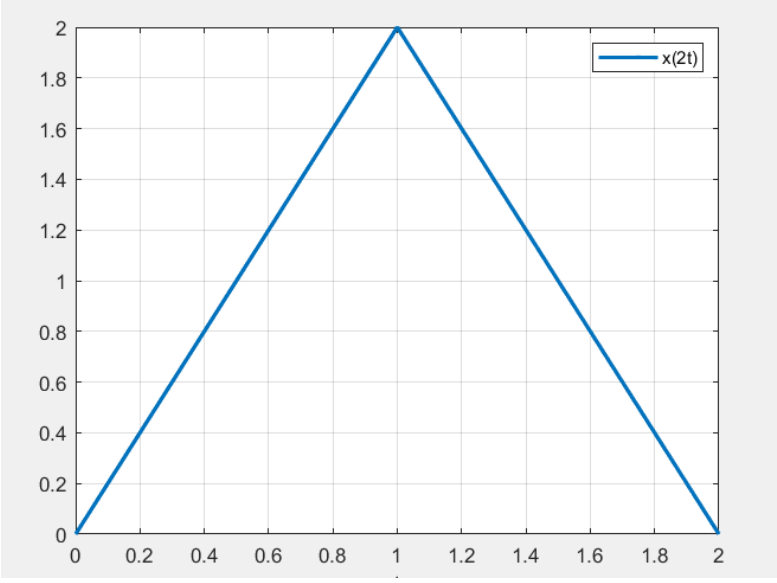
b)

```
>> subplot(5,1,2);
>> plot(-t,X,'LineWidth',2)
```



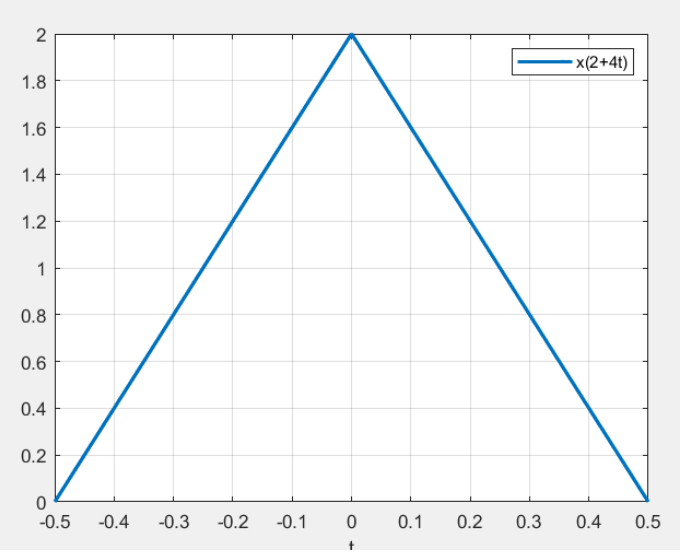
c)

```
subplot(5,1,3);
plot((1/2).*t,X,'LineWidth',2)
grid on
xlabel('t');
legend('x(2t)');
```



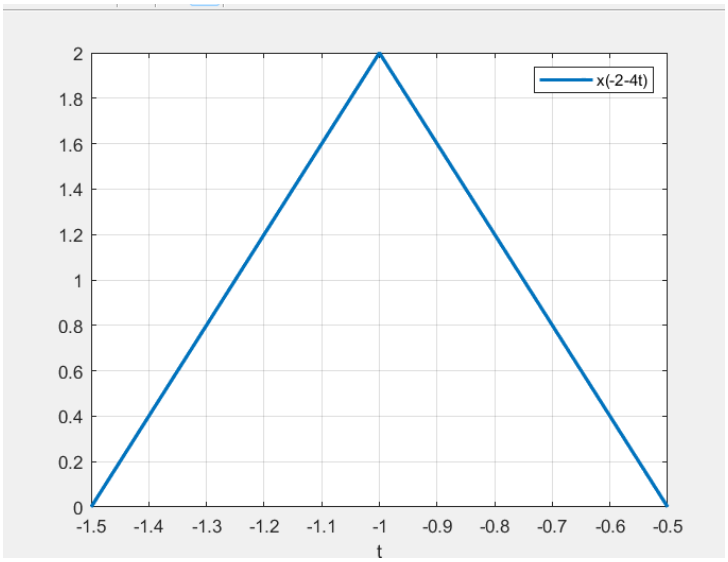
d)

```
plot((1/4).*(2-t),X,'LineWidth',2);
grid on
xlabel('t');
legend('x(2+4t)');
```



e)

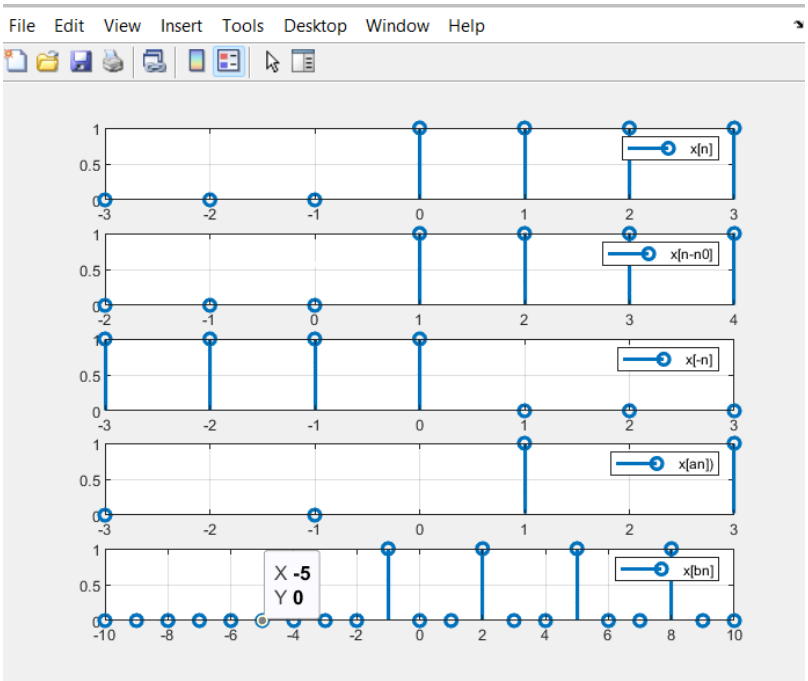
```
plot(-(1/4).*(2+t),X,'LineWidth',2);
grid on
xlabel('t');
legend('x(-2-4t)');
```



Task 4:

```
function [ ] = sequence(x,n,n0,a,b)
subplot(5,1,1);
stem(n,x,'LineWidth',2);
grid on
legend ('x[n]');

subplot(5,1,2);
stem(n+n0, x,'LineWidth', 2);
grid on
legend('x[n-n0]')

subplot(5,1,3);
stem(-n , x,'LineWidth', 2);
grid on
legend('x[-n]')

x1=downsample(x,a);
n1=n(1:a:end);
subplot(5,1,4);
stem(n1,x1,'LineWidth',2);
grid on
legend('x[an])');

x2=upsample(x,b);
i=(length(x2)-1)/2;
n2=-i:i;
subplot(5,1,5);
stem(n2,x2,'LineWidth',2);
grid on
legend('x[bn]');
```

```
>> n = -3:3;
x = (n>=0);
>> sequence(x,n,1,2,3)
```



Critical Analysis/Conclusion:

In this lab, I learnt how to transform different signals in MATLAB sing scripts and commands. I learnt how to scale, shift, and reverse the signals respectively. Moreover, I also learnt the basic operations that are to be performed on independent variables. This lab was helpful in enhancing my coding skills and aptitude to imagine signals operations by using simulation techniques.