**Computer Assignment - 01 - Spring 2019**
**Signals & Systems**

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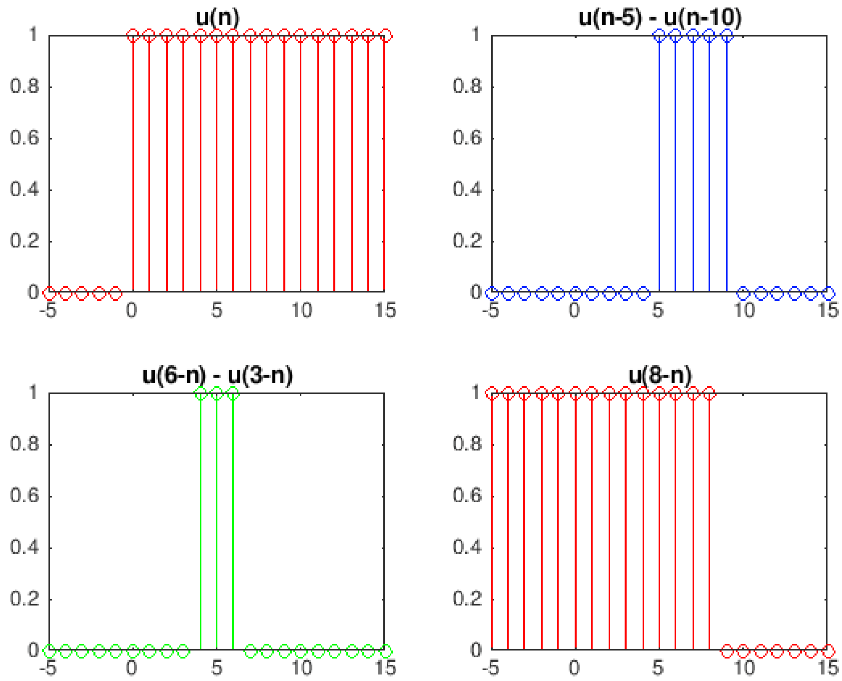
***1) Signal Transformations:***

**1. Given u[n] the unit step sequence,using the stem function plot the following**

**1) $u[n-5]-u[n-10]$**
**2) $u[6-n]-u[3-n]$**
**3) $u[8-n]$**

Sol)

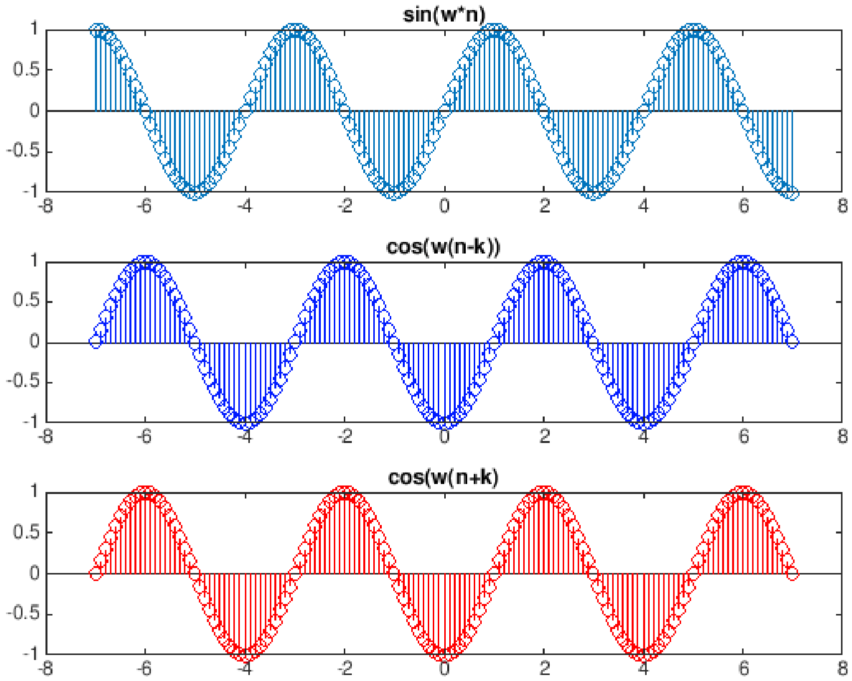
```
n=-5:1:15;
ut=myUnitStep(n);
subplot(221)
stem(n,ut,'r');
title('u(n)');
p=n-5;
q=n-10;
p1=myUnitStep(p);
q1=myUnitStep(q);
r1=p1-q1;
subplot(222);
stem(n,r1,'b');
title('u(n-5) - u(n-10)');
s=6-n;
t=3-n;
r2=myUnitStep(s)-myUnitStep(t);
subplot(223)
stem(n,r2,'g');
title('u(6-n) - u(3-n)');
u=8-n;
r3=myUnitStep(u);
subplot(224)
stem(n,r3,'r');
title('u(8-n)');

function u=myUnitStep(n)
u=zeros(size(n));
u(n>=0)=1;
return;
end
```




**2. Given the signal sin[ω0n], plot the following: Assume the unknown values**
**∗ cos[ω0(n − n0)]**
**∗ cos[ω0(n + n0]**

Sol)

```
clc
clear
close all
%%
%for w=pi/2;
n=-7:0.1:7;
xlim([-7,7]);
ylim([-1,1]);
k=2;
p=n-k;
q=n+k;
subplot(311);
stem(n,sin((pi/2)*n));
title('sin(w*n)');
subplot(312);
stem(n,cos((pi/2)*p),'b');
title('cos(w(n-k))');
subplot(313);
stem(n,cos((pi/2)*q),'r');
title('cos(w(n+k)');
```




**3. Given the signal x(t)**

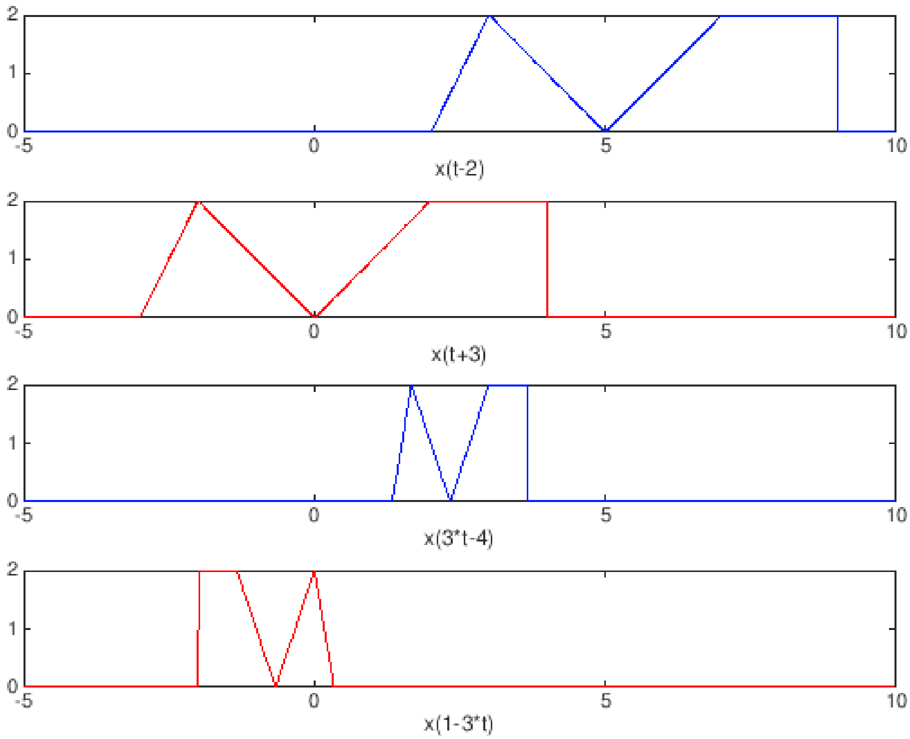
$$x(t) = \begin{cases} 0 & t < 0 \\ 2t & 0 \le t < 1 \\ 3 - t & 1 \le t < 3 \\ t - 3 & 3 \le t < 5 \\ 2 & 5 \le t < 7 \\ 0 & t \ge 7 \end{cases}$$

**– Plot the following**

**$*$ $x(t - 2)$**
**$*$ $x(t + 3)$**
**$*$ $x(3t - 4)$**
**$*$ $x(1 - 3t)$**

Sol)

```
clc
clear
close all
%%
t=-5:0.01:10;
subplot(411);
plot(t,fun(t-2),'b');
xlabel('x(t-2)');
subplot(412);
plot(t,fun(t+3),'r');
xlabel('x(t+3)');
subplot(413);
```



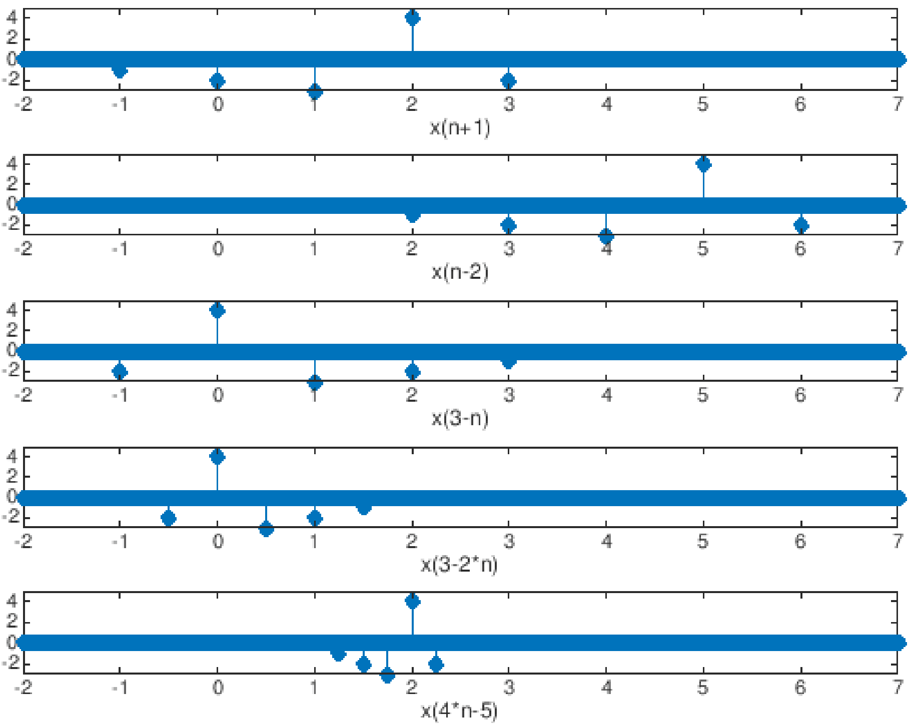
```
plot(t,fun(3*t-4),'b');
xlabel('x(3*t-4)');
subplot(414);
plot(t,fun(1-3*t),'r');
xlabel('x(1-3*t)');

function x=fun(t)
x = zeros(size(t));
x(t<0) = 0;
x(t>=0 & t<1)=2*t(t>=0 & t<1);
x(t>=1 & t<3)=3-t(t>=1 & t<3);
x(t>=3 & t<5)=-3+t(t>=3 & t<5);
x(t>=5 & t<7)=2;
x(t>=7)=0;
return;
end
```

**4. Given the discrete signal, $x[n] = [-1, -2, -3, 4, -2]$**
**plot the following transformations**

**$*$ $x[n+1]$**
**$*$ $x[n-2]$**
**$*$ $x[3-n]$**
**$*$ $x[3-2n]$**
**$*$ $x[4n+5]$**

Sol)

```
clc
clear
close all
%%
n=-2:0.01:7;
subplot(511);
stem(n,fun(n+1),'filled');
xlabel('x(n+1)');
subplot(512);
stem(n,fun(n-2),'filled');
xlabel('x(n-2)');
subplot(513);
stem(n,fun(3-n),'filled');
xlabel('x(3-n)');
subplot(514);
stem(n,fun(3-2*n),'filled');
xlabel('x(3-2*n)');
subplot(515);
stem(n,fun(4*n-5),'filled');
xlabel('x(4*n-5)');

function x=fun(n)
x=zeros(size(n));
x(n==0)=-1;
x(n==1)=-2;
```



```
x(n==2)=-3;
x(n==3)=4;
x(n==4)=-2;
end
```

***2) Signal Generation***

**1. Consider the signal**

$$x(t) = \begin{cases} e^{(2t)} & -1 < t < 0 \\ e^{(-2t)} & 0 < t < 1 \\ 0 & \text{otherwise} \end{cases}$$

**Answer/do the following**

- **Plot x(t)**
- **Define y(t) as a periodic signal equal to x(t) in the fundamental period T = 3.**

**Plot y(t). Assume the number of pulses to be plotted as 5.**

```
clc
clear
close all
%%
t=-12:0.01:12;
y=zeros(size(t));
for x=-10:1:10
y=y+fun(t+x*3);
end
subplot(211);
plot(t,fun(t));
xlabel('x(t)');
axis([-6,8,-1,1]);
subplot(212);
plot(t,y);
xlabel('y(t) with period 3');
axis([-8,8,-1,1]);

function x=fun(t)
x=zeros(size(t));
x(t>-1&t<0)=exp(2*t(t>-1&t<0));
x(t>0&t<1)=exp(-2*t(t>0&t<1));
return;
end
```