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```
%partner Max Chen
%Introduction: The purpose of the lab was to understand the basics
%of making discrete functions in matlab, and how they can be
%manipulated
%(shifting, interpolation, decimation).
%Equipment: MATLAB, PC
```

Q1

Q2

```
%plot unit sample fucntion from -10 to 10 when n0=4
clear all;
close all;
n1=-10;
n2=10;
n0=4;

subplot(2,2,1);
[x1,n]=unit/sample(n0,n1,n2);
stem(n,x1)
xlabel('n')
ylabel('x')
title('Unit Sample')

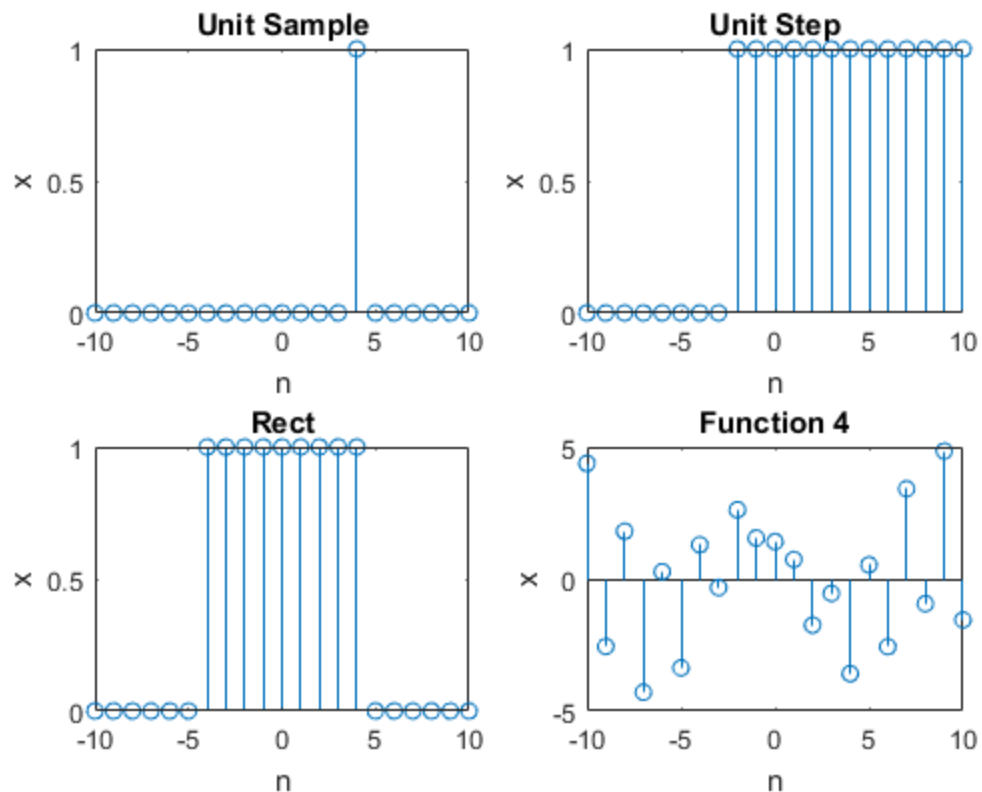
%plot unit step
n0=-2;
subplot(2,2,2);
x2=unitstep(n0,n1,n2);
stem(n,x2)
xlabel('n')
ylabel('x')
title('Unit Step')
```

```

%plot rect(n/10)
start=floor((10-1)/2)*-1;
last=start*-1+1;
x3=unitstep(start,n1,n2);
x4=unitstep(last,n1,n2);
x5=x3-x4;
subplot(2,2,3);
stem(n,x5)
xlabel('n')
ylabel('x')
title('Rect')

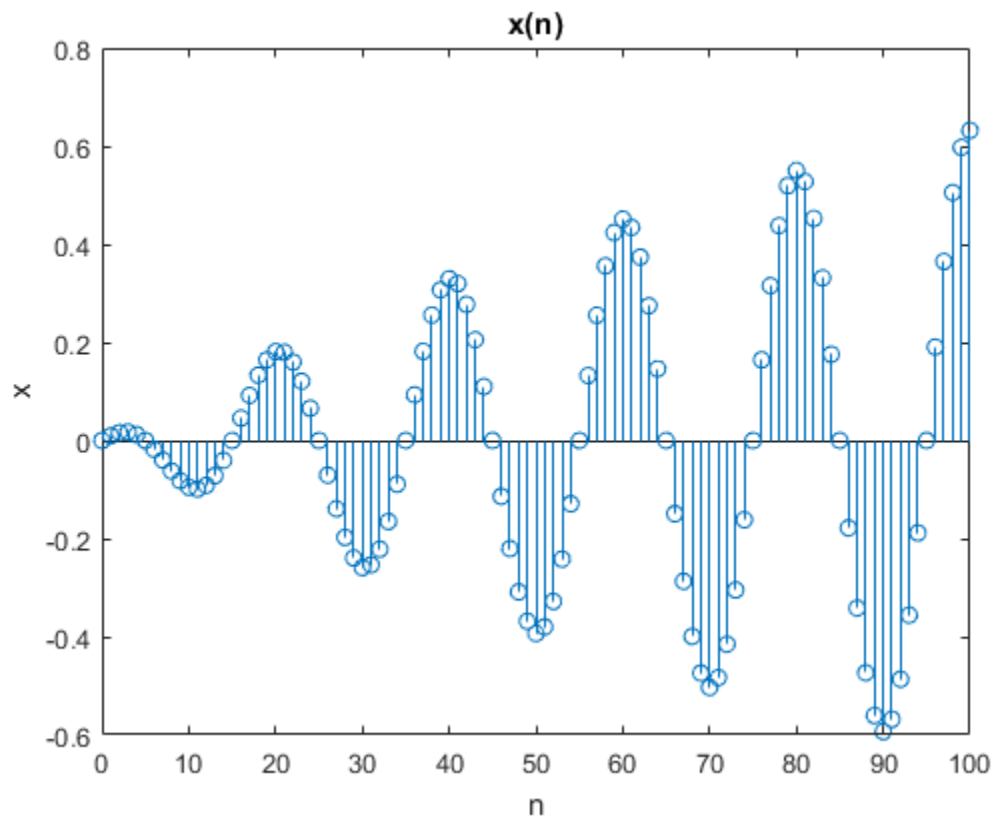
%plot cos
x6=2*cos(0.2*pi.*n+pi/4)+3*sin(3.*n);
subplot(2,2,4);
stem(n,x6)
xlabel('n')
ylabel('x')
title('Function 4')
%The function is not peridoic. Graphicaly it can be determined since
the
%pattern does not repeat.Algebraically it can be determined that the
sin
%portion of the fuction is not periodic since w/2=3/2pi which is not
a
%rational number therfore the whole function is not periodic.

```



Q3

```
%3.1
%Plot x(n)
clear all;
close all;
n=0:100;
x=(1-exp(-0.01.*n)).*cos(pi.*n/10);
stem(n,x);
xlabel('n')
ylabel('x')
title('x(n)')
```



3.2

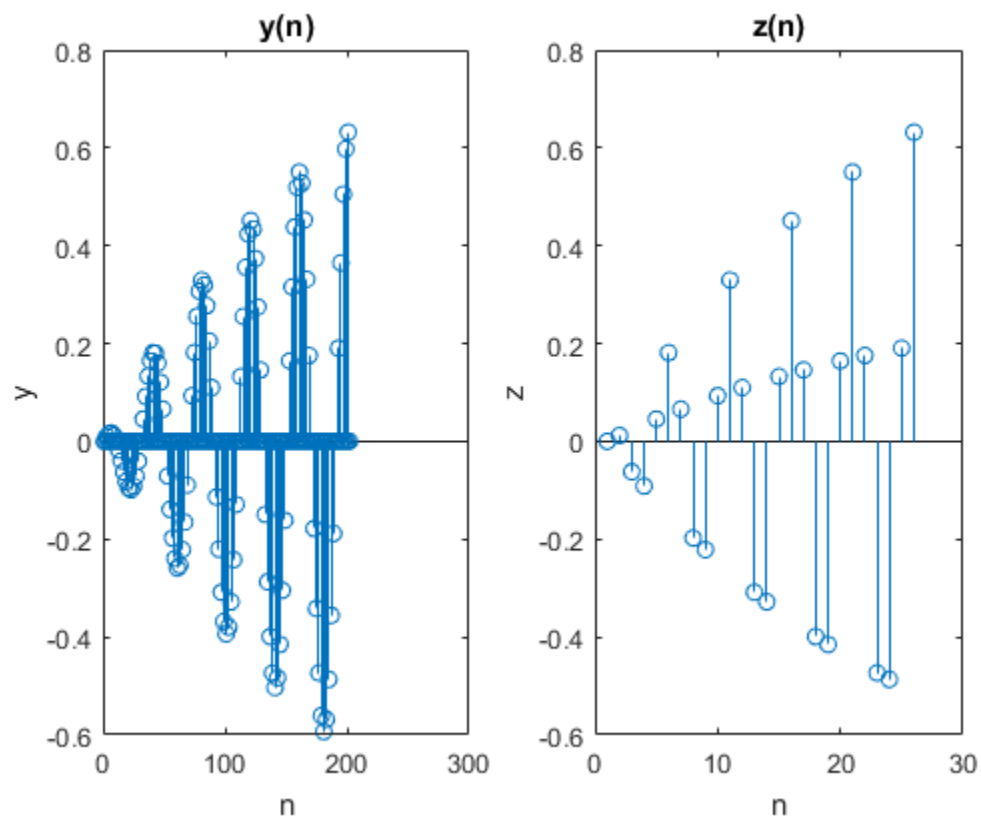
```
%Plot y(n)=x(n/2)
clear all;
n=0:100;
x=(1-exp(-0.01.*n)).*cos(pi.*n/10);
y=upsample(x,2);
subplot(1,2,1);
k= length(y);
stem((1:k),y);
xlabel('n')
ylabel('y')
```

```

title('y(n)')

%Plot z(n)=x(4n)
clear all;
n=0:100;
x=(1-exp(-0.01.*n)).*cos(pi.*n/10);
z=downsample(x,4);
subplot(1,2,2);
k=length(z);
stem((1:k),z);
xlabel('n')
ylabel('z')
title('z(n)')

```



3.3

```

%Plot y(n)=x(n/4)
clear all;
n=0:100;
x=(1-exp(-0.01.*n)).*cos(pi.*n/10);
y=upsample(x,4);
k=length(y);
subplot(1,2,1);
stem((1:k),y);
xlabel('n')
ylabel('y')

```

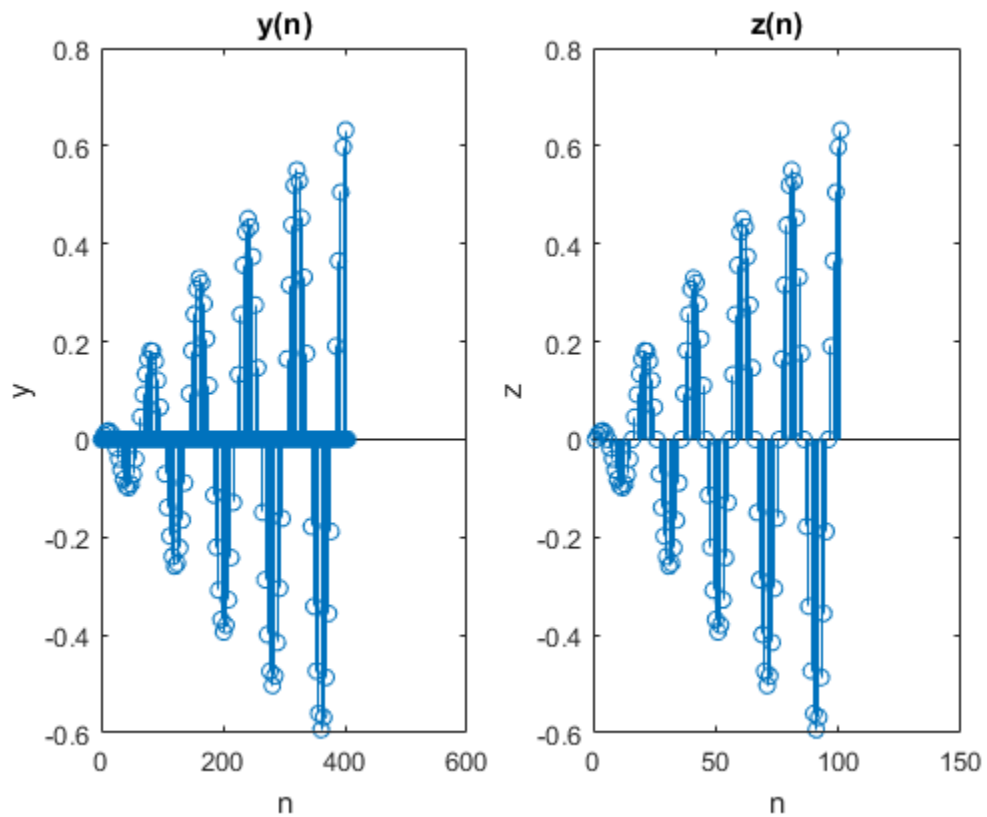
```

title('y(n)')

%Plot z(n)=y(4n)
z=downsample(y,4);
k=length(z);
subplot(1,2,2);
stem((1:k),z);
xlabel('n')
ylabel('z')
title('z(n)')

%x(n)=z(n). This is because x(n) is first upsampled(y(n)), and than
down sampled (z(n)).
%This returns the original function x(n).

```



3.4

```

%plot y(n)=x(4n)
clear all;
n=0:100;
x=(1-exp(-0.01.*n)).*cos(pi.*n/10);
y=downsample(x,4);
k=length(y);
subplot(1,2,1);
stem((1:k),y);
xlabel('n')

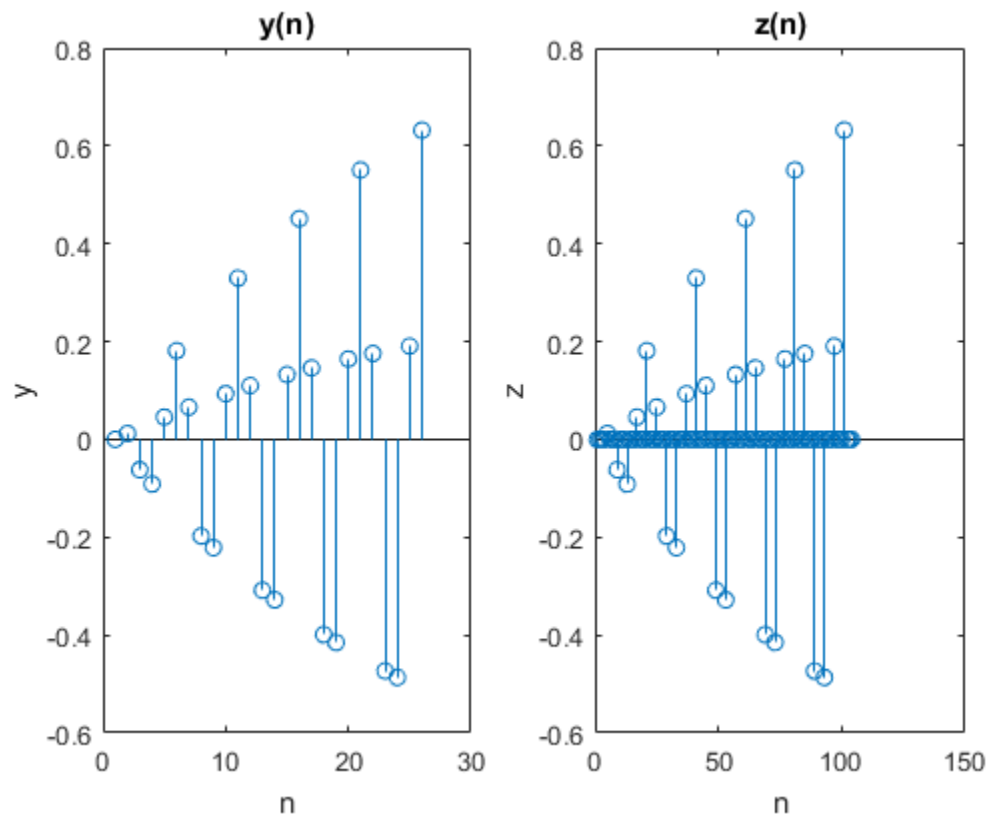
```

```

ylabel('y')
title('y(n)')

%plot z(n)=y(n/4)
z=upsample(y,4);
subplot(1,2,2);
k=length(z);
stem((1:k),z);
xlabel('n')
ylabel('z')
title('z(n)')
%x(n)!=z(n). This is because the signal is first downsampled (y(n)),
    and
%than upsampled (z(n)). Information is lost when it is downsampled and
    when
%it is upsampled again, information is missing.

```



4

```

clear all;
n1=-10;
n2=10;
n0=-2;
[xa,n]=unitstep(n0,n1,n2);
n0=2;
[xb,n]=unitstep(n0 ,n1,n2);

```

```
x1=n.*(xa-xb);

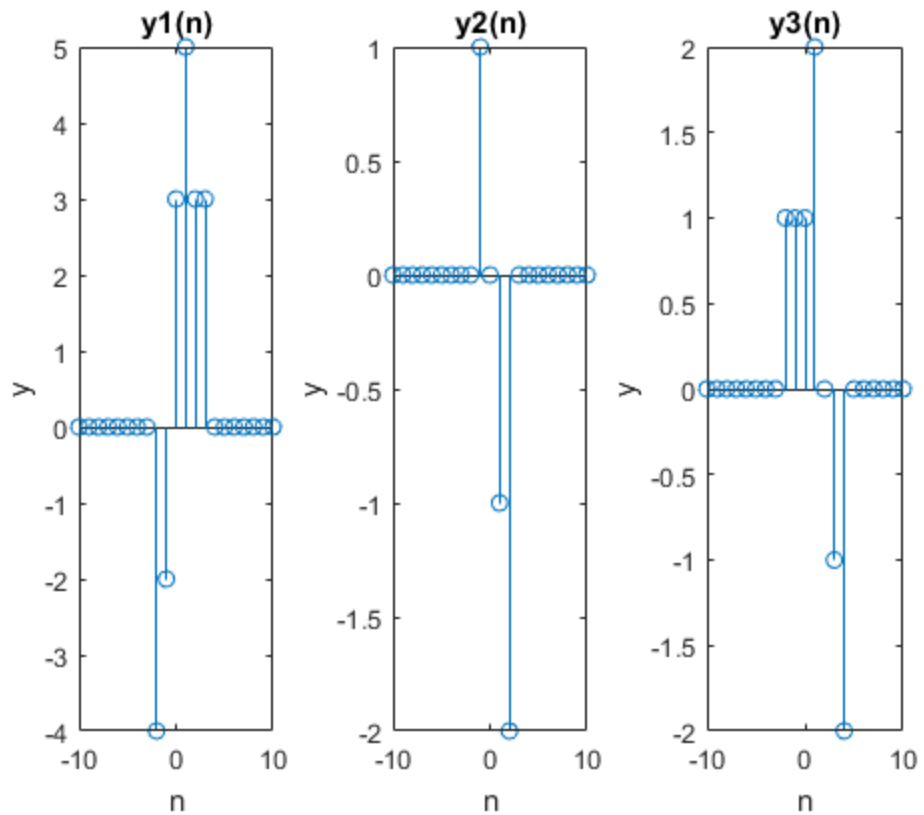
n0=0;
[xc,n]=unitstep(n0,n1,n2);
n0=4;
[xd,n]=unitstep(n0,n1,n2);
x2= xc-xd;

y1= 2*x1+3*x2;
y2= fliplr(x1);

y3_a= zeros(size(n));
xlinv=fliplr(x1);
y3_a(3:end)= xlinv(1:end-2);

y3_b= zeros(size(n));
y3_b(1:end-2)= x2(3:end);

y3=y3_a+y3_b;
%plot y1
subplot(1,3,1);
stem(n,y1);
xlabel('n')
ylabel('y')
title('y1(n)')
%plot y2
subplot(1,3,2);
stem(n,y2);
xlabel('n')
ylabel('y')
title('y2(n)')
%plot y3
subplot(1,3,3);
stem(n,y3);
xlabel('n')
ylabel('y')
title('y3(n)')
```



Conclusion

%The lab went as planned. The lab displays the fundamentals of DT
%functions.

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