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% Exercise 2.1.7. Characteristics of Signals.

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clc; clear; close all;

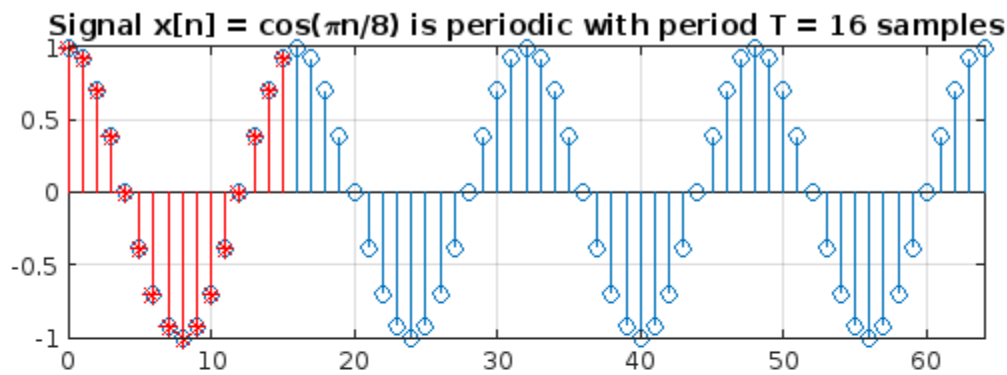
a. $x[n] = \cos(w_0*n)$.

```
n = 0:64;
% i)
w0 = pi/8;
% Period is calculated as:
P = 2*pi/w0;
x = cos(w0*n);

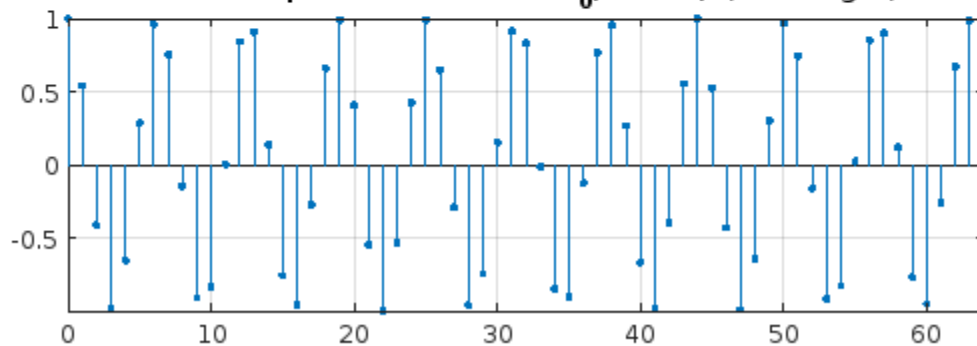
figure('Name','Exercise 2.1.7. Characteristics of Signals');
subplot(2,1,1);
stem(n,x);
hold on;
grid on;
axis tight;
title(['Signal  $x[n] = \cos(\pi n/8)$  is periodic with period  $T = ', num2str(P), '$ 
samples']);
stem(n(1:P),x(1:P),'r*');

% ii)
w01 = 1;
x1 = cos(w01*n);

subplot(2,1,2);
stem(n,x1,'.');
hold on;
grid on;
axis tight;
title('Signal  $x_1[n] = \cos(n)$  is not periodic because  $\omega_0/2\pi = k/T$ ,  $k$ 
integer, should be rational');
```



Signal $x_1[n] = \cos(n)$ is not periodic because $\omega_0/2\pi = k/T$, k integer, should be rational



b. $x[n] = \exp(j\omega_0 n) * u[n]$.

```
n2 = 0:39;
w02 = pi/10;
x2 = exp(1i*w02*n2);
```

```
figure('Name','Exercise 2.1.7. Characteristics of Signals');
subplot(2,2,1);
stem(n2,real(x2));
grid on
axis tight;
title('\Ree\{x_2[n]\}');
```

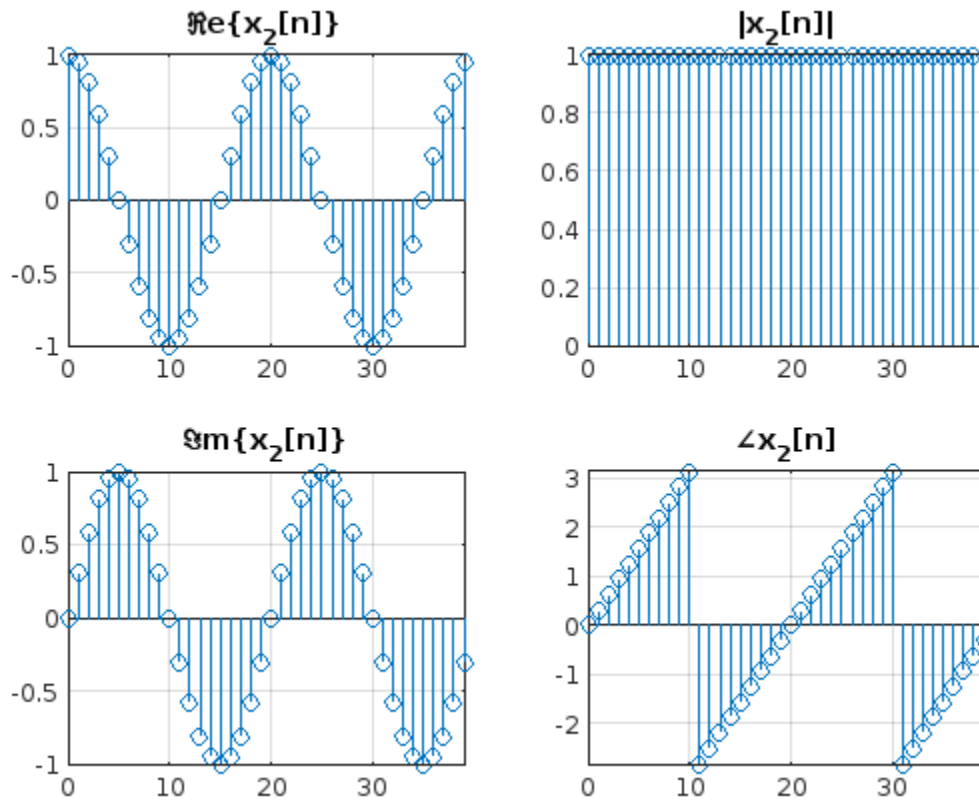
```
subplot(2,2,3);
stem(n2,imag(x2));
grid on
axis tight;
title('\Imm\{x_2[n]\}');
```

```
subplot(2,2,2);
stem(n2,abs(x2));
grid on
axis tight;
title('|x_2[n]|');
```

```

subplot(2,2,4);
stem(n2,angle(x2));
grid on
axis tight;
title('\angle x_2[n]');

```



C.

```

y0 = abs(10*x2);
y1 = angle(conj(x2));
y2 = real(1i*x2);
y3 = imag(conj(1i*x2));

figure('Name','Exercise 2.1.7. Characteristics of Signals');
subplot(2,2,1);
stem(n2,y0);
grid on
axis tight;
title('y_0[n] = |10x_2[n]| ');

subplot(2,2,3);
stem(n2,y2);
grid on
axis tight;

```

```

title('y_2[n] = \Ree\{jx_2[n]\}');

subplot(2,2,2);
stem(n2,y1);
grid on
axis tight;
title('y_1[n]=\angle x_2^{\ast}[n] ');

subplot(2,2,4);
stem(n2,y3);
grid on
axis tight;
title('y_3[n]=\Imm\{(jx_2[n])^{\ast}\}');

figure('Name','Exercise 2.1.7. Characteristics of Signals');
subplot(2,2,1);
stem(n2,real(y0));
grid on
axis tight;
title('\Ree\{y_0[n]\}');

subplot(2,2,3);
stem(n2,imag(y0));
grid on
axis tight;
title('\Imm\{y_0[n]\}');

subplot(2,2,2);
stem(n2,abs(y0));
grid on
axis tight;
title('|y_0[n]|');

subplot(2,2,4);
stem(n2,angle(y0));
grid on
axis tight;
title('\angle y_0[n]');

figure('Name','Exercise 2.1.7. Characteristics of Signals');
subplot(2,2,1);
stem(n2,real(y1));
grid on
axis tight;
title('\Ree\{y_1[n]\}');

subplot(2,2,3);
stem(n2,imag(y1));
grid on
axis tight;
title('\Imm\{y_1[n]\}');

subplot(2,2,2);
stem(n2,abs(y1));

```

```

grid on
axis tight;
title('|y_1[n]|');

subplot(2,2,4);
stem(n2,angle(y1));
grid on
axis tight;
title('\angley_1[n]');

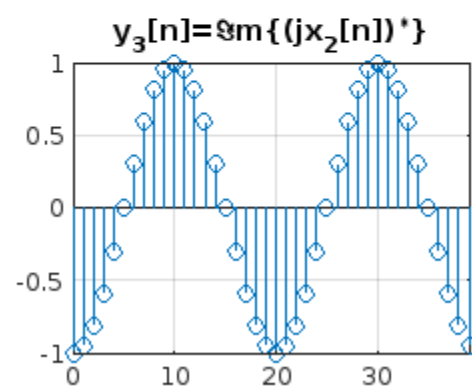
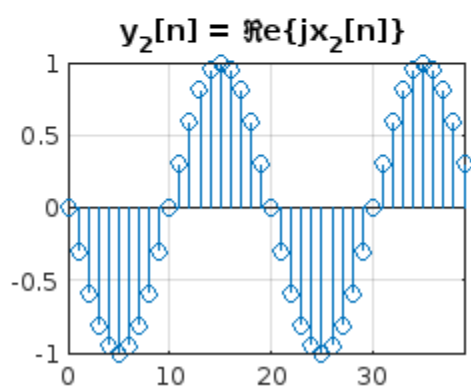
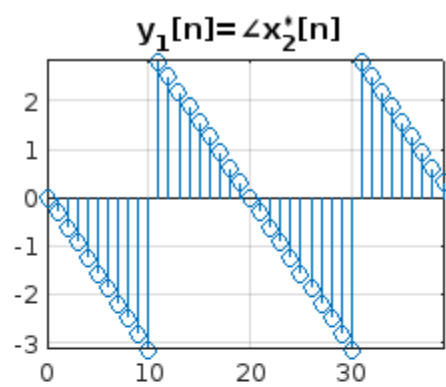
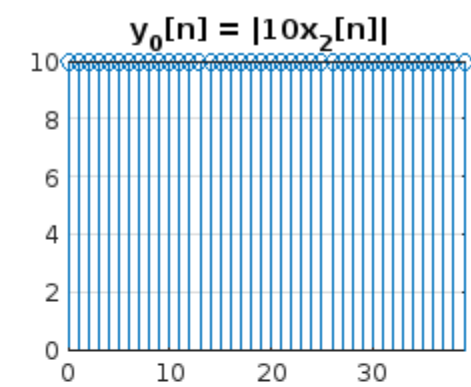
figure('Name','Exercise 2.1.7. Characteristics of Signals');
subplot(2,2,1);
stem(n2,real(y2));
hold on;
stem(n2,real(y3),'r. ');
grid on
axis tight;
title('\Ree\{y_2[n]\} (blue) and \Ree\{y_3[n]\} (red) ');

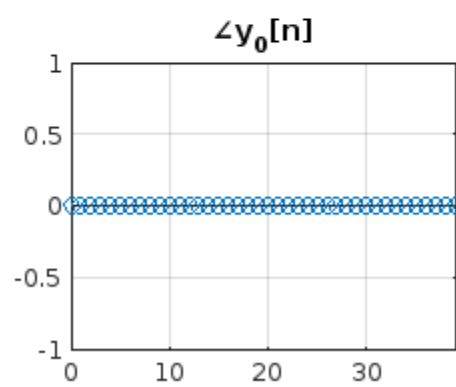
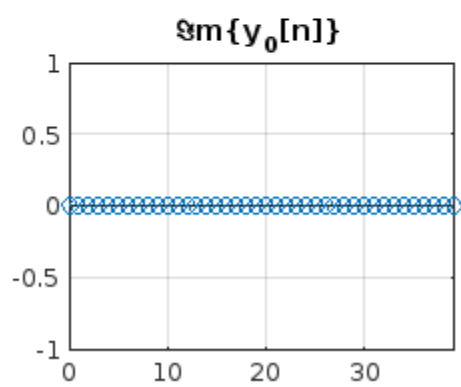
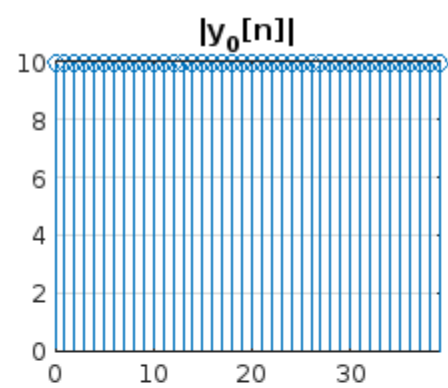
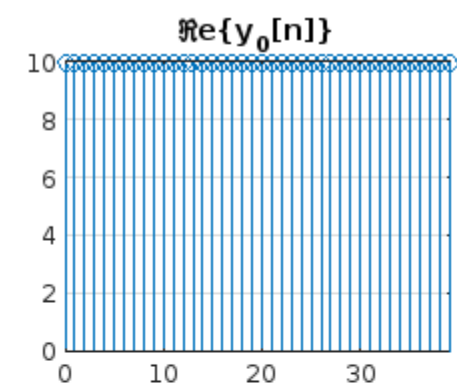
subplot(2,2,3);
stem(n2,imag(y2));
hold on;
stem(n2,imag(y3),'r. ');
grid on
axis tight;
title('\Imm\{y_2[n]\} (blue) and \Imm\{y_3[n]\} (red) ');

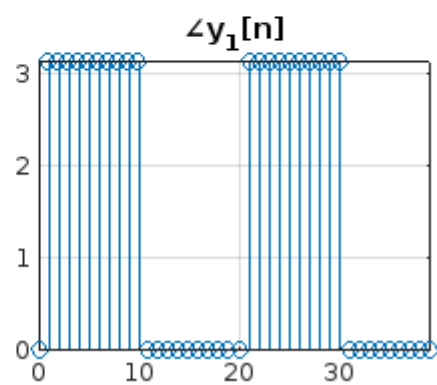
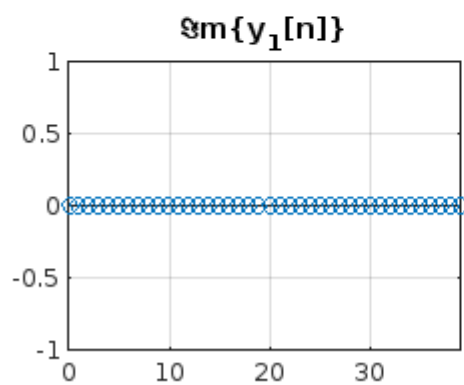
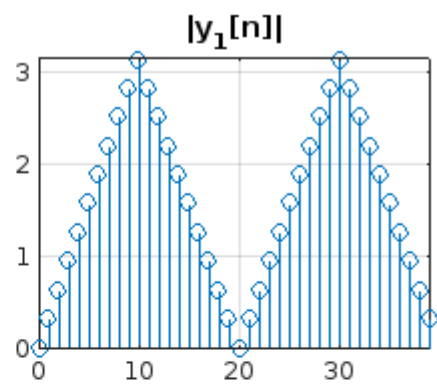
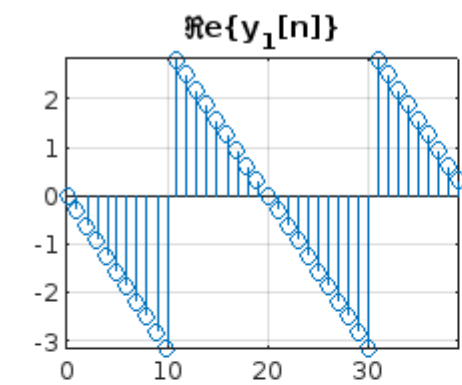
subplot(2,2,2);
stem(n2,abs(y2));
hold on;
stem(n2,abs(y3),'r. ');
grid on
axis tight;
title('|y_2[n]| (blue) and |y_3[n]| (red) ');

subplot(2,2,4);
stem(n2,angle(y2));
hold on;
stem(n2,angle(y3),'r. ');
grid on
axis tight;
title('\angley_2[n] (blue) and \angley_3[n] (red) ');

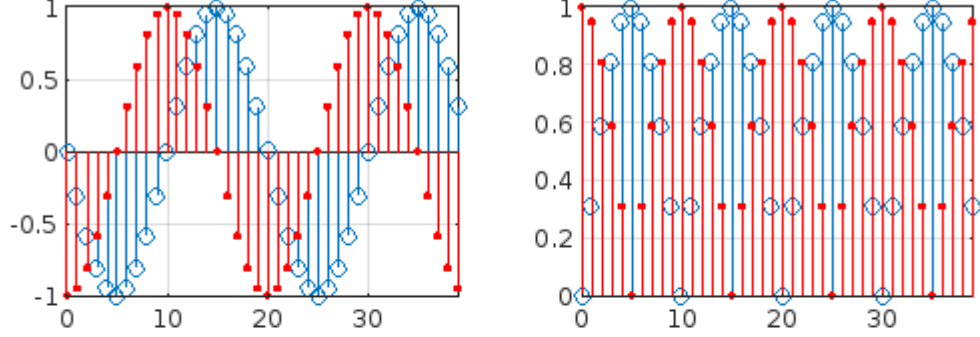
```



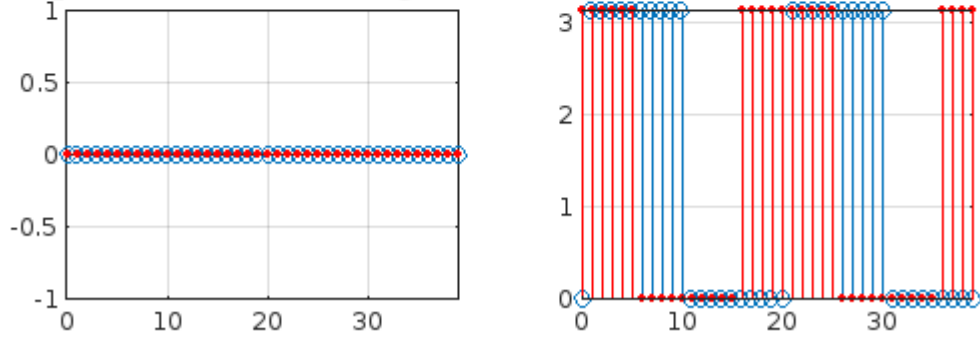




$\Re\{y_2[n]\}$ (blue) and $\Re\{y_3[n]\}$ (red) $|y_2[n]|$ (blue) and $|y_3[n]|$ (red)



$\Im\{y_2[n]\}$ (blue) and $\Im\{y_3[n]\}$ (red) $\angle y_2[n]$ (blue) and $\angle y_3[n]$ (red)



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