ECE 113 HW 1

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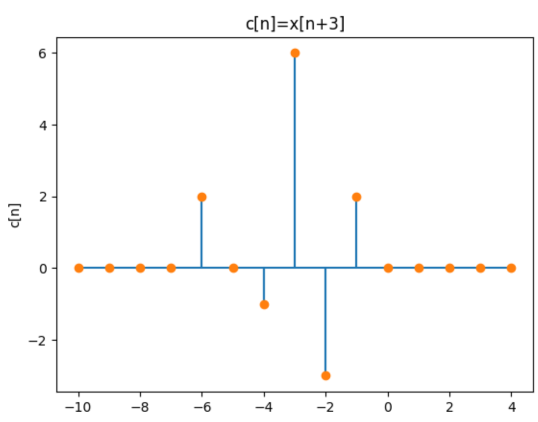
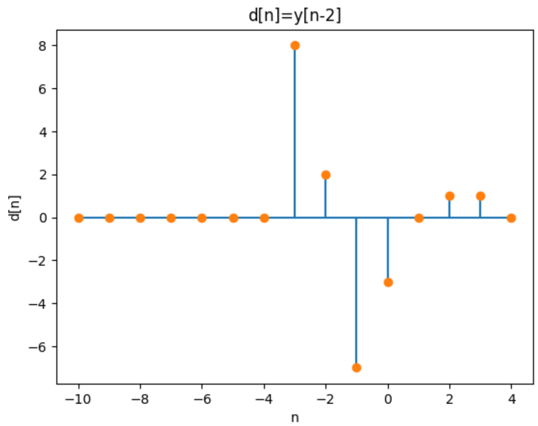
Problem 1

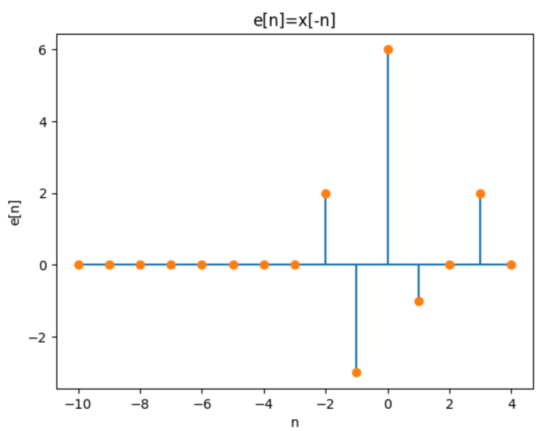
(a)



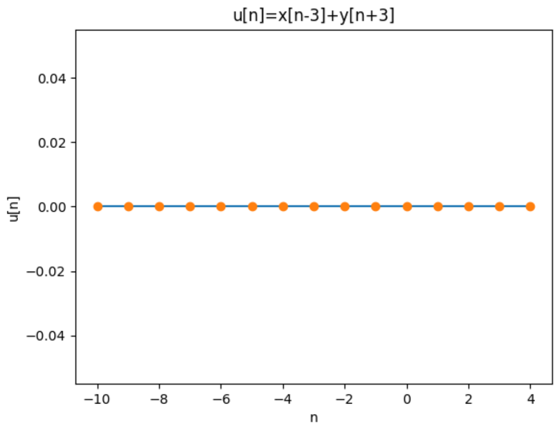
(b)



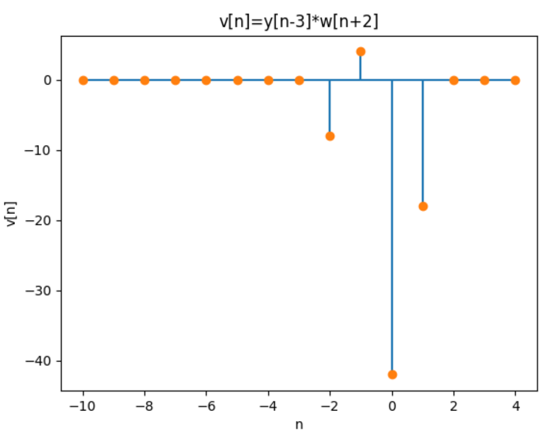
(c)



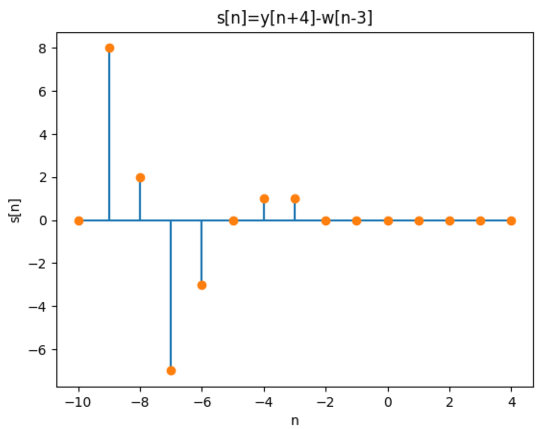
(d)


u[n]=x[n-3]+y[n+3]
u[n]
0.04
0.02
0.00
−0.02
−0.04
−10
−8
−6
−4
−2
0
2
4
n

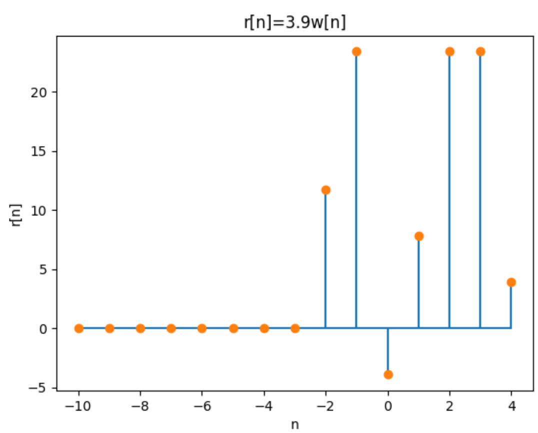
(e)


v[n]=y[n-3]*w[n+2]
v[n]
0
−10
−20
−30
−40
−10
−8
−6
−4
−2
0
2
4
n

(f)


s[n]=y[n+4]-w[n-3]
s[n]
n
8
6
4
2
0
−2
−4
−6
−10
−8
−6
−4
−2
0
2
4

(g)


r[n]=3.9w[n]
r[n]
n
20
15
10
5
0
−5
−10
−8
−6
−4
−2
0
2
4

Problem 2

(a)

$$\boxed{20}$$

(b)

$$\boxed{25}$$

(c)

$$\boxed{40}$$

(d)

$$\boxed{80}$$

(e)

$$\boxed{20}$$

(f)

$$\boxed{8}$$

Problem 3

(a)

Since $e^{j\theta} = \cos(\theta) + j\sin(\theta)$, we have that the fundamental period of $\hat{x}_a[n]$ is $\boxed{8}$

(b)

We have that $F_0 = 0.3$, therefore we have that the period of the sequence is $\frac{k}{0.3}$. The minimum k such that this evaluates to a positive integer is $k = 3$. Therefore, the fundamental period of the sequence is $\boxed{10}$.

(c)

The period of $e^{j\pi n/8}$ is 16 and the period of $e^{j\pi n/5}$ is 10. Therefore, the period of the sequence is the least common multiple of these two, which is $\boxed{80}$.

(d)

The period of $\sin(0.15\pi n)$ is 40 and the period of $\cos(0.12\pi n + 0.1\pi)$ is 50. Therefore, the period of the sequence is the least common multiple of these two, which is $\boxed{200}$.

(e)

The period of $\sin(0.15\pi n + 0.75\pi)$ is 10 and the period of $\cos(0.8\pi n + 0.2\pi)$ is 5, and the period of $\cos(1.3\pi n)$ is 20. Therefore, the period of the sequence is the least common multiple of these three, which is $\boxed{20}$.

Problem 4

(i)

In order for the sequence to be periodic, we must have that

$$x(1-2(n+N_2)) = x(1-2n)$$

for some period N_2, since the signal is periodic for period of N we have that

$$x(1-2n) = x(1-2n-N) = x(1-2n-2N)$$

Therefore we have that $x(1-2(n))$ is periodic with period of $N_2 = N$.

(ii)

If N is an integer then the signal is periodic, since $(-1)^{n+N} = (-1)^n$ if N is even, and $(-1)^{n+2N} = (-1)^n$ if N is odd. But if N is not an integer, then the signal is not periodic.