

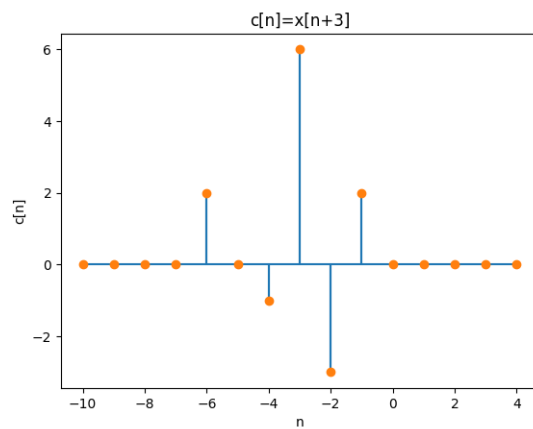
ECE 113 HW 1

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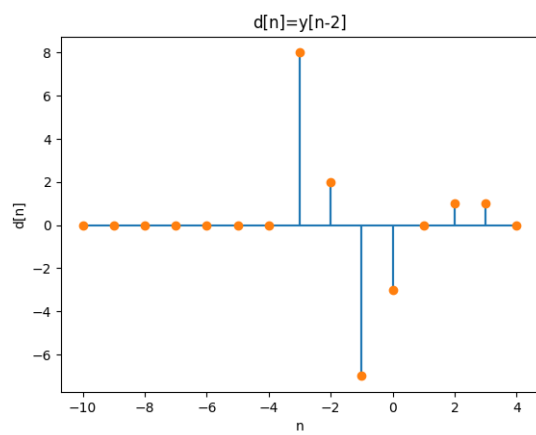
October 4, 2022

Problem 1

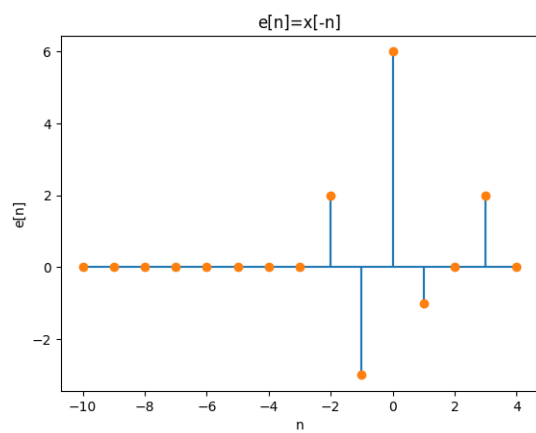
(a)



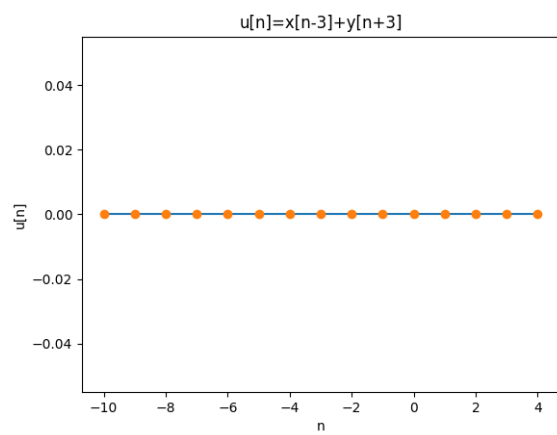
(b)



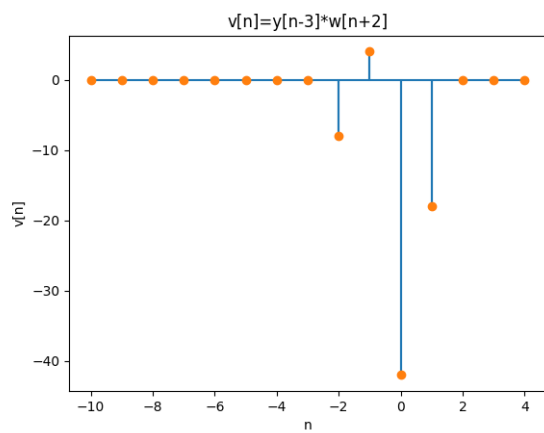
(c)



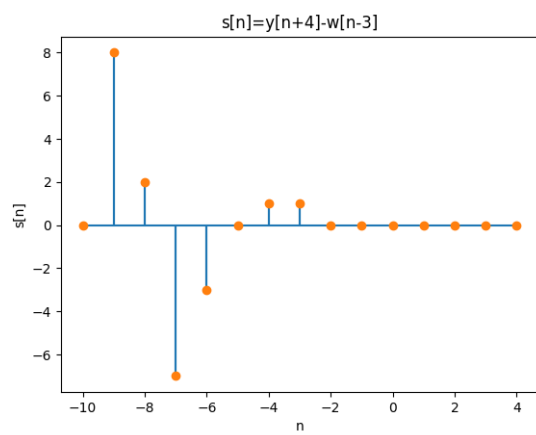
(d)



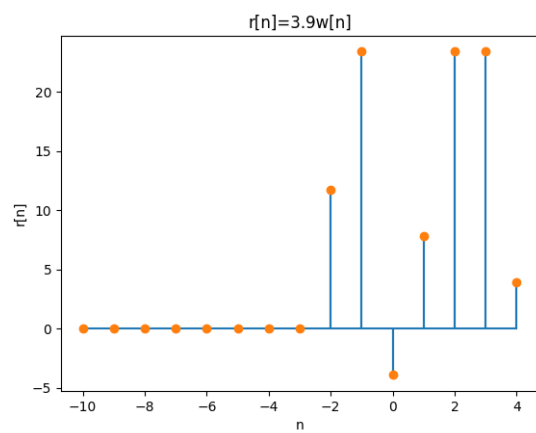
(e)



(f)



(g)



Problem 2

(a)

20

(b)

25

(c)

40

(d)

80

(e)

20

(f)

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 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 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 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 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)

No, it is not periodic, if N is guaranteed to be an integer, then the signal would be but since N is not guaranteed to be an integer, the signal is not periodic.