

HW #6 Solutions

① (a) $x(n) = \underbrace{\cos(10n + \pi)}_{\text{not periodic}} + \underbrace{\sin(\pi n/2)}_{\text{periodic}}$
 Since $\text{freq} \neq \frac{2\pi m}{N}$ $\text{freq} = \frac{2\pi \times 1}{4} = \frac{2\pi m}{N}$

$\Rightarrow$ Sum is NOT periodic

(b) $x(n) = \cos(\underbrace{3n + 0.3\pi})$
 $\text{freq} \neq \frac{2\pi m}{N} \Rightarrow$ not periodic

② (c) $y_3(n) = x(n/2 - 1)$
 just substitute values for n and get $y_3(n)$

$$y(0) = x(-1) = 1$$

$$y(1) = x(1/2 - 1) = x(-1) = 1$$

$$y(2) = x(1 - 1) = x(0) = 0$$

$$y(3) = x(1.5 - 1) = x(1/2) = x(0) = 0$$

$$y(4) = x(2 - 1) = x(1) = 1$$

$\vdots$

and so on

③ (c) $y(n) = x(n+1) u(n)$

- Linear since we have only linear terms of x

- Time invariance:

$$\text{output for } x(n-n_0) = x(n-n_0+1) u(n)$$

$$y(n-n_0) = x(n-n_0+1) u(n-n_0) \neq$$

$\Rightarrow$ Time Varying

- Since $y(n)$ does not depend on previous output values $y(n-1), y(n-2), \dots$, Then NOT recursive

-Causality : Since $y(n)$ depends on $x(n+1)$,
Then, NOT Causal.

④/a) $y(n) = x(n) - 0.5 y(n-1)$, $x(n) = u(n-1)$
 $y(-1) = 1$

$n=0$: $y(0) = x(0) - 0.5 y(-1) = 0 - 0.5 \times 1 = -0.5$

$n=1$: $y(1) = x(1) - 0.5 y(0) = 1 - 0.5 \times (-0.5) = 1.25$

$n=2$: $y(2) = x(2) - 0.5 y(1) = 1 - 0.5 (1.25) = 0.375$

$\vdots$
and so on