EE 207-01 – Winter 2010
Quiz 7

SER	ID	NAME **KEY**

Let the signal $x(t)$ be given as below

$$x(t) = 10 + 2\cos(12\pi t) + 4\cos(20\pi t)$$

If $x(t)$ was ideally (delta) sampled at 30 samples/second .

(a) What is the Nyquist Rate ?

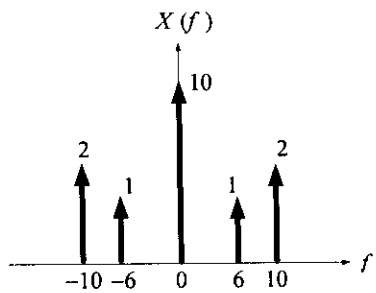
(b) Is their aliasing, explain ?

(c) Plot the spectrum of the sampled signal , showing all components for $|f| \leq 40$ Hz.

Solution

$$x(t) = 10 + 2\cos(2\pi(6)t) + 4\cos(2\pi(10)t)$$

$$X(f) = 10\delta(f) + [\delta(f+6) + \delta(f-6)] + 2[\delta(f+10) + \delta(f-10)]$$

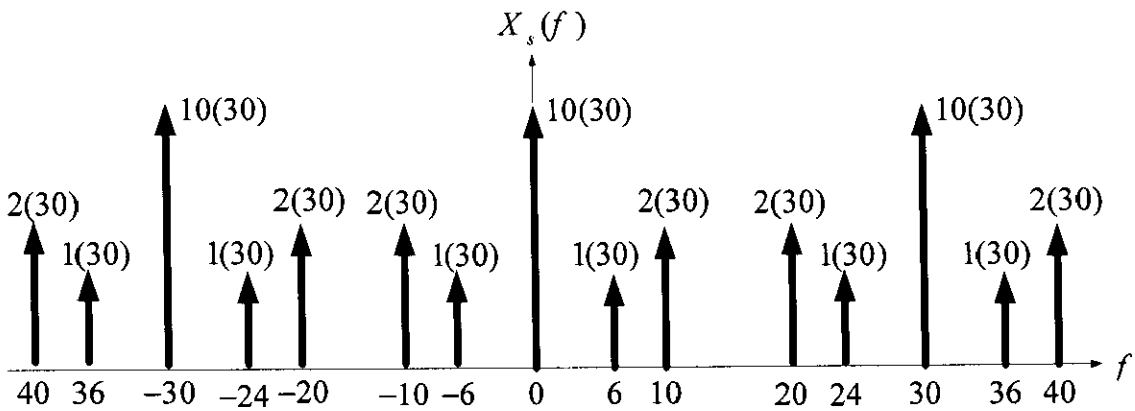


(*a*) Nyquist Rate = 2(maximum Ftrequrncy)= 2(10) = 20

(*b*) Since $f_s = 30 >$ Nyquist Rate (20) $\Rightarrow$ **No aliasing**

(c) For Ideal Sampling

$$X_s(f) = f_s \sum_{n=-\infty}^{\infty} X(f - nf_s)$$



EE 207-02 – Winter 2010
Quiz 7

SER	ID	NAME **KEY**

Let $X(z)$ be given as

$$X(z)=\frac{1}{(1-z^{-1})(1+0.5z^{-1})}$$

Find $x(n)$?

Solution

$$X(z)=\frac{1}{(1-z^{-1})(1+0.5z^{-1})}=\frac{z^2}{z(1-z^{-1})z(1+0.5z^{-1})}=\frac{z^2}{(z-1)(z+0.5)}$$

$$\Rightarrow \frac{X(z)}{z}=\frac{z}{(z-1)(z+0.5)}=\frac{A_1}{(z-1)}+\frac{A_2}{(z+0.5)}$$

$$A_1=\left.\frac{z}{(z+0.5)}\right|_{z=1}=\frac{1}{(1+0.5)}=\frac{2}{3}$$

$$A_2=\left.\frac{z}{(z-1)}\right|_{z=-0.5}=\frac{-0.5}{(-0.5-1)}=\frac{1}{3}$$

$$\Rightarrow X(z)=\frac{2}{3}\frac{z}{(z-1)}+\frac{1}{3}\frac{z}{(z+0.5)}$$

$$\Rightarrow x(n)=\frac{2}{3}u(n)+\frac{1}{3}\left(-\frac{1}{2}\right)^n u(n)$$