과목명	멀티미디어신호처리
담당교수	박규식 교수님
학과	소프트웨어학과
학번	32153180
이름	이상민
제출일자	2019.11.26

Chapter 3

3.1 Determine whether the signal is periodic or not. If the signal is periodic, determine the fundamental period.

(a) $x[n]=\cos(\frac{\pi n}{8})$

->

$$x[n]=\cos\left(\frac{\pi n}{8}\right)=\cos\left(\frac{\pi(n+N_1)}{8}\right)$$

$$=\cos\left(\frac{\pi n}{8}+\frac{\pi N_1}{8}\right)$$

$$\frac{\pi N_1}{8}=2\pi k. \qquad \therefore N_1=16.$$

the signal is periodic with $N_1=16$

(c) $x[n]=\sin(\frac{2\pi n}{3})+\cos(\frac{\pi n}{3})$

->

$$x[n]=\sin\left(\frac{2\pi n}{3}\right)+\cos\left(\frac{\pi n}{3}\right)$$

$$=\sin\left(\frac{2\pi(n+N_1)}{3}\right)+\cos\left(\frac{\pi(n+N_2)}{3}\right).$$

$$=\sin\left(\frac{2\pi n}{3}+\frac{2\pi N_1}{3}\right)+\cos\left(\frac{\pi n}{3}+\frac{\pi N_2}{3}\right).$$

$$\frac{2\pi N_1}{3}=2\pi k. \qquad \therefore N_1=3.$$

$$\frac{\pi N_2}{3}=2\pi k. \qquad \therefore N_2=6.$$

$$N=LCM(3,6)=6.$$

the signal is periodic with $N=6$.

3.2 Determine whether it is energy signal or power signal. Calculate the corresponding energy or average power.

(a) $x[n]=(-0.5)^n u[n]$

->

$x[n]=(-0.5)^n u[n]$ Energy signal.

$$E=\sum_{n=-\infty}^{\infty}\left|(-0.5)^n u[n]\right|^2=\sum_{n=0}^{\infty}(-0.5)^{2n}$$

$$=\sum_{n=0}^{\infty}(0.25)^n=\frac{1}{1-0.25}=\frac{4}{3}$$

(c) $x[n] = u[n-1] - u[n-7]$

->

$x[n] = u[n-1] - u[n-7]$ Energy signal

$$E = \sum_{n=-\infty}^{\infty} |u[n-1] - u[n-7]|^2$$

$$= \sum_{n=1}^{6} (1)^2 = 6.$$

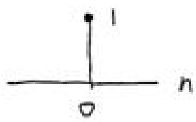
3.3 Draw the following signals.

(a) $x[n] = \delta[-n]$

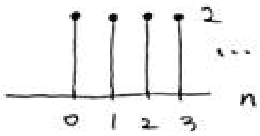
(c) $x[n] = 2u[n-1]$

->

$x[n] = \delta[-n]$



$x[n] = 2u[n-1]$

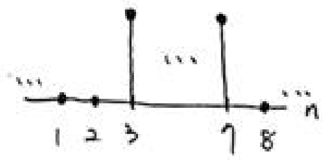


3.4 Express the following pulse signals in terms of unit step function either in summing form or in product form.

(a) $x[n] = \begin{cases} 1 & \text{for } 3 \le n \le 7 \\ 0 & otherwise \end{cases}$

->

$x[n] = \begin{cases} 1 & \text{for } 3 \le n \le 7 \\ 0 & \text{otherwise} \end{cases}$



$x[n] = u[n-3] - u[n-8]$

$= u[n-3]\,u[-n+7]$

3.5 For given a discrete sequence $x[n]=\{-1,\mathbf{2},0,3\}$*, sketch the following discrete signals.*

(a) $x[n]$

(b) $x_1[n]=x[n-2]$

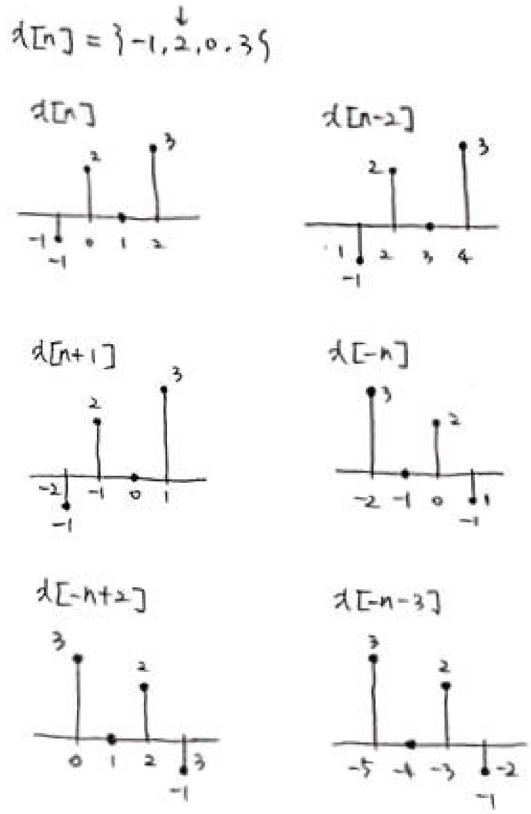
(c) $x_2[n]=x[n+1]$

(d) $x_3[n]=x[-n]$

(e) $x_4[n]=x[-n+2]$

(f) $x_5[n]=x[-n-3]$

->



3.6 For given a discrete sequence $x[n]=\{-1,\mathbf{2},0,3\}$*, sketch the following discrete signals.*

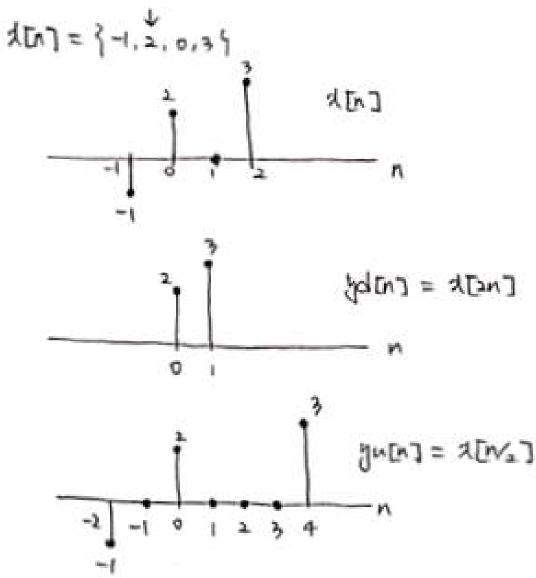
(a) $x[n]$ down-sampled by 2 signal

$yd[n]=x[2n]$

(b) $x[n]$ up-sampled by 2signal

$yu[n]=x[\frac{n}{2}]$

->



3.7 An analog sinusoid signal $x(t) = \cos(2\pi(2000)t)$ *is sampled to get the discrete signal by Nyquist-Shannon sampling theory.*

(a) What is the bandwidth of the analog signal?

-> $f_{\max} = Bandwidth = 2000$

(b) What is the Nyquist sampling rate?

-> Nyquist sampling rate $f_s = 2 * Bandwidth = 4000$

3.8 An analog sinusoid signal $x(t) = \cos(2\pi(2000)t) + \cos(2\pi(3000)t)$ *is sampled to get the discrete signal by Nyquist-Shannon sampling theory.*

(a) What is the bandwidth of the analog signal?

-> $f_{\max} = Bandwidth = 3000$

(b) What is the Nyquist sampling rate?

-> Nyquist sampling rate $f_s = 2 * Bandwidth = 6000$

3.9 In general, an analog speech is quantized to 8bits/sample. How much is the quantizer SNR in dB for this condition?

-> $SNR(dB) = 6.02N + 1.76dB$

$$= 6.02 * 8 + 1.76 = 49.92dB$$