

<IT@CookBook, 처음 만나는 통신이론> 연습문제 정답

2장

2.1 (a) $100 [\text{W}]$ (b) $100 [\text{W}]$

2.2 $\exp(-j2000\pi t)$ 의 주파수 = $-1000 [\text{Hz}]$
 $\exp(j2000\pi t)$ 의 주파수 = $1000 [\text{Hz}]$

2.3 (a) $|X(50)| = \sqrt{2}$, $\angle X(50) = \frac{\pi}{4}$ (b) $X(-50) = 1 - j$

2.4 $c_2 = 0$

2.5 (a) $\frac{1}{3 + j2\pi f}$ (b) $\frac{1}{10^3} \text{rect}\left(\frac{f}{10^3}\right)$ (c) $1 + \exp(-j2\pi f)$

(d) $\frac{1}{2} \{ \delta(f - 100) + \delta(f + 100) \} \exp(-j2\pi f)$

2.6 0

2.7 1

2.8 $t_0 = \frac{1}{8 \times 10^3} [\text{s}]$

3장

3.1 (a) 선형 시스템 (b) 시불변 시스템

3.2 (a) $\exp(-j2\pi f)$ (b) $\text{rect}(t-1)$

3.3 왜곡이 발생하지 않는다.

3.4 $\hat{x}(t) = \text{sinc}(t)\sin(2000\pi t)$, $x_+(t) = \text{sinc}(t)\exp(j2000\pi t)$

3.5 (a) 1 (b) $-j\text{sinc}(t)$ (c) $-j\cos(20\pi t)$

3.6 $2\sin(2000\pi t)$

3.7 $1 - \exp(-j2\pi f T)$

4장

4.1 1 [W]

4.2 5 [mW]

4.3 110 [kHz], 900 [kHz]

4.4 455 [kHz]

4.5 (a) $\frac{4}{5}$ (b) $\frac{8}{33}$

4.6 10

4.7 $10 \operatorname{sinc}(t) \sin(2000\pi t)$

4.8 (a) 0.3 (b) 1.5 [kHz]

4.9 AM : 1 [kHz], DSB-SC : 1 [kHz], SSB : 0.5 [kHz]

4.10 $A = 10^3$, $f_m = 10$ [kHz]

4.11 전압 제어 발진기(VCO)

4.12 5 [kHz]

4.13 200 [kHz]

5장

5.1 $\frac{27}{29}$

5.2 (a) $F_X(x) = \begin{cases} 0 & x < 1 \\ 0.3 & 1 \leq x < 2 \\ 0.6 & 2 \leq x < 3 \\ 1 & x \geq 3 \end{cases}$

(b) $f_X(x) = 0.3\delta(x-1) + 0.6\delta(x-2) + 0.4\delta(x-3)$

(c) $f_Y(y) = 0.3\delta(y-3) + 0.7\delta(y-1)$

5.3 (a) $A = 1, F_X(x) = \begin{cases} 0 & x < 0 \\ 1 - \exp(-x) & x \geq 0 \end{cases}$

(b) 1

(c) 5

(d) 1

(e) $f_Y(y) = \begin{cases} \frac{\exp(-\sqrt{y})}{2\sqrt{y}} & y > 0 \\ 0 & y \leq 0 \end{cases}$

5.4 3

5.5 2

5.6 (a) -0.8 (b) -0.8

5.7 (a) 0 (b) $R_s(t_1, t_2) = \frac{1}{6} \cos(2\pi 10^3(t_1 - t_2))$ (c) $\frac{1}{96} \cos(2\pi 10^3 \tau)$

5.8 평균 = 0, 전력 = $\frac{1}{2(1 + 4\pi^2 10^6)} [\text{W}]$

6장

6.1 (a) 200 [W] (b) $S_{X_I}(f) = \begin{cases} 2 & |f| \leq 50 \\ 0 & |f| > 50 \end{cases}$

6.2 $5 \times 10^{-7} \text{ [W]}$

6.3 5

6.4 (a) 200 [kHz] (b) 0.4 [W] (c) 100 [kHz] (d) $\frac{5}{4}$

6.5 (a) 1 [kW] (b) $\frac{4}{3}\pi^2 10^6 \text{ [W]}$

6.6 20 [kW]

6.7 2배

7장

7.1 (a) $\sum_{n=-\infty}^{\infty} 4 \times 10^3 \left\{ \delta(f - 4 \times 10^3 n) + \frac{1}{2} \delta(f - 10^3 - 4 \times 10^3 n) + \frac{1}{2} \delta(f + 10^3 - 4 \times 10^3 n) \right\}$

(b) 2 [kHz]

7.2 -100, -50, 50, 100 [Hz]

7.3 (a) $SQNR = 96$ (b) 6000개

7.4 2

7.5 (a) 양자화기 출력 : 0.5, 양자화 오차 : -0.2

(b) $\frac{1}{12}$ [W]

7.6 100

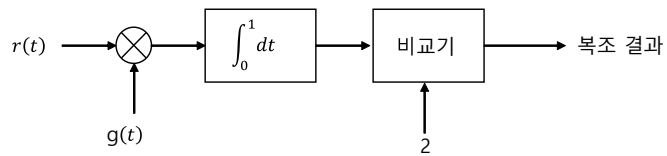
7.7 10

8장

8.1 3

8.2 (a) $\phi_1(t) = g(t)$

(b)



(c) $f_{r_1}(r_1) = \frac{1}{\sqrt{2\pi}} \exp\left(-\frac{(r_1 - \sqrt{2})^2}{2}\right)$

8.3 (a) 1 (b) 1

8.4 임펄스 응답 $h(t) = s(3-t)$, $SNR = 2$

8.5 0.5

8.6 200 [symbol/sec]

8.7 $w_0 = 0$, $w_1 = 10$

9장

9.1 $Q\left(\sqrt{2}\sin\left(\frac{\theta}{2}\right)\right)$

9.2 동기식 BFSK인 경우 : 500 [Hz], 비동기식 BFSK인 경우 : 1 [kHz]

9.3 (a) 5 [J] (b) $D_1 : r_1 < -2$, $D_2 : -2 \leq r_1 \leq 0$, $D_3 : 0 < r_1 \leq 2$, $D_4 : r_1 > 2$
 (c) $\frac{3}{2}Q(1)$

9.4 $Q\left(\frac{\cos\theta}{\sqrt{2}}\right)$

9.5 2×10^{-3}

9.6 위상의 종류 = 12가지, 진폭의 종류 = 3가지

9.7 $M = 16$

10장

10.1 2

10.2 8비트

10.3 0.8

10.4 2비트

10.5 (a) $G = \begin{bmatrix} 0 & 1 & 1 & 0 & 0 \\ 1 & 1 & 0 & 1 & 0 \\ 1 & 0 & 0 & 0 & 1 \end{bmatrix}$, $H = \begin{bmatrix} 1 & 0 & 0 & 1 & 1 \\ 0 & 1 & 1 & 1 & 0 \end{bmatrix}$

(b)

정보어	부호어
000	00000
001	10001
010	11010
011	01011
100	01100
101	11101
110	10110
111	00111

(c) 2

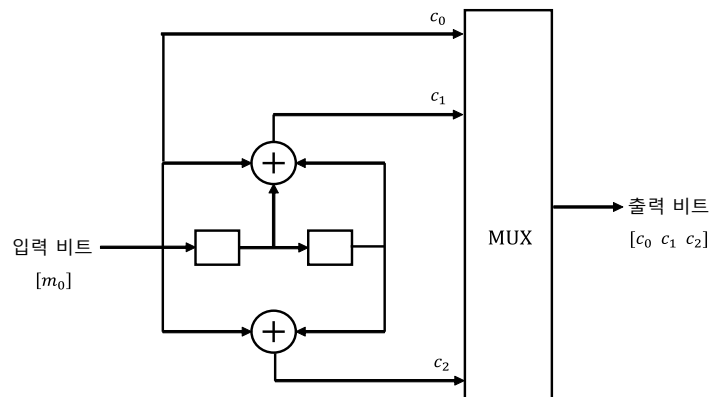
(d) [0 1 1 0 0]

10.6 (a) [1 1 1 1 1 1 1]

(b) [1 0 1 1 0 0 0]

10.7 6 이하의 자연수 중에서 1, 3을 제외한 값

10.8 (a)



(b) 3

(c) [1 1 1 0 1 0 1 0 0]

(d) 6

(e) 4

10.9 2×10^6 [bps]