3.2 (a) $\int_{-2}^{2} \phi_1(t)\phi_2(t)\,dt = 0$

$\int_{-2}^{2} \phi_2(t)\phi_3(t)\,dt = 0$

$\int_{-2}^{2} \phi_3(t)\phi_1(t)\,dt = 0$

so they're orohogonal

(b) $\int_{-2}^{2} \phi_1(t)\phi_1(t)\,dt = 4A^2$

$\int_{-2}^{2} \phi_2(t)\phi_2(t)\,dt = 4A^2$

$\int_{-2}^{2} \phi_3(t)\phi_3(t)\,dt = 4A^2$

$4A^2 = 1 \Rightarrow A = \pm\frac{1}{2}$.

Due to $A>0$, so $A = \frac{1}{2}$.

(c) $x(t) = \phi_2(t) - \phi_3(t)$.

3.6 ~~assume that~~ $S(t)$ is defined in T period.

(a) $r_0 = \frac{\Delta^2}{2a}\ln\left(\frac{P(S_1)}{P(S_2)}\right) = \frac{0.1}{2} \times \ln\left(\frac{0.5}{0.5}\right) = 0$.

(b) $r_0 = \frac{\Delta^2}{2a}\ln\left(\frac{P(S_1)}{P(S_2)}\right) = \frac{0.1}{2T} \times \ln\left(\frac{0.3}{0.7}\right) = -\frac{0.04}{T}$

(c) $r_0 = \frac{\Delta^2}{2a}\ln\left(\frac{P(S_1)}{P(S_2)}\right) = \frac{0.1}{2T} \times \ln\left(\frac{0.8}{0.2}\right) = \frac{0.069}{T}$

(d) when $\begin{cases} P(S_1) = P(S_2), & r_0 = 0 \\ P(S_1) > P(S_2), & P(S_1) - P(S_2) \uparrow, \quad r_0 \uparrow. \\ P(S_1) < P(S_2), & P(S_1) - P(S_2) \uparrow, \quad r_0 \downarrow. \end{cases}$

The probability has an offset of r_0.

3.7

$$P_B = p(s_1)\int_{-0.2}^{0} \frac{1}{2}\,dz + p(s_2)\int_{0}^{0.2}\frac{1}{2}\,dz = 0.1$$

3.18.

we have:

$$\begin{bmatrix} 1 & -0.2 & 0.3 \\ 0.4 & 1 & -0.2 \\ -0.1 & 0.4 & 1 \end{bmatrix}\begin{bmatrix} C_{-1} \\ C_0 \\ C_1 \end{bmatrix} = \begin{bmatrix} 0 \\ 1 \\ 0 \end{bmatrix}$$

solution:

$$\begin{bmatrix} C_{-1} \\ C_0 \\ C_1 \end{bmatrix} = \begin{bmatrix} 0.259 \\ 0.835 \\ -0.308 \end{bmatrix}$$

and, $y_{-1} = 0$, $y_0 = 1$, $y_1 = 0$

we have. $\{z(k)\}$ for $k = 0, \pm 1, \dots, \pm 3$.

$\{z(k)\}$ = 0.1613, 0.1678, 0, 1, 0, $\underline{-0.1807}$, 0.1143

abs()

maximum sample amplitude: 0.1807

sum of intercode crosstalk amplitude: 0.6241