2.59 For Code-Time-Division Multiple Access, the received signal is given by: $y(t)=\sum_{k=1}^{K}\sum_{i=-M}^{M}A_k b_k[i]s(t-iT-\tau_k)+\sigma n(t)$. Since each user offset is controlled so that $\tau_k-\tau_{k-1}=T/K$, $y(t)=\sum_{j=-KM}^{KM+K-1}A_{\left\lfloor \frac{j}{K}\right\rfloor+1}b[j]s(t-jT/K)+\sigma n(t)$

Since the waveform *s(t)* has a duration *T*, every bit overlaps with 2(K-1) bits where each pair of bits has a different amplitude. The cross-correlations between every 2 pair of signature waveforms is given by:

$$\rho_{kl}=\int_0^T s(t)s(t-(l-k)T/K)dt,\quad l>k$$

$$\rho_{kl}=\int_0^T s(t)s(t-T+(l-k)T/K)dt,\quad l<k$$

Therefore calling $R(\tau)=\int s(t)s(t-\tau)dt$ we have

$$\rho_{kl}=\begin{cases}R\left(\dfrac{l-k}{K}T\right), & \mathrm{l>k}\\ R\left(T-\dfrac{l-k}{K}T\right), & \mathrm{l<k}\end{cases}$$

We conclude that $$\mathbf{R}[0]=\begin{bmatrix}1 & R(T/K) & R(2T/K) & \cdots & R(\frac{K-1}{K}T)\\ R(T/K) & 1 & \cdots & \cdots & R(\frac{K-2}{K}T)\\ R(2T/K) & \vdots & \ddots & \cdots & \vdots\\ \vdots & \vdots & \vdots & \ddots & \vdots\\ R(\frac{K-1}{K}T) & R(\frac{K-2}{K}T) & \cdots & \cdots & 1\end{bmatrix}$$

$$\mathbf{R}[1]=\begin{bmatrix}0 & R(\frac{K-1}{K}T) & R(\frac{K-2}{K}T) & \cdots & R(T/K)\\ 0 & 0 & \cdots & \cdots & R(\frac{2}{K}T)\\ 0 & \vdots & \ddots & \cdots & \vdots\\ \vdots & \vdots & \vdots & \ddots & \vdots\\ 0 & 0 & \cdots & \cdots & 0\end{bmatrix}$$