

(1) Let  $\{f_k(t)\}_{k=1}^N$  be an orthonormal family of signals on  $[0, T_0]$ . Let  $x(t) = \sum_{k=1}^N x_k f_k(t)$  and  $y(t) = \sum_{k=1}^N y_k f_k(t)$ . Show that

$$\langle x(t), y(t) \rangle = \sum_{k=1}^N x_k y_k^*.$$

(2) Let  $X$  be a uniform random variable on the interval  $[0, 1]$ . Let  $Y$  be a random variable independent of  $X$  and uniformly distributed on  $[100, 102]$ . Find the p.d.f of the random variable  $Z = X + Y$ .