Problem 1 *Sampling a Sinc-Square*

(a) $T_s = 1$ s.

(b) There is no aliasing.

(c) There is aliasing.

Problem 2 *Sampling a Periodic Signal*

(a) $T_0 = 2\pi$
$N = 9$.

(b) There is no aliasing.

(c) There is aliasing. The reconstructed continuous-time signal is $\tilde{x}(t) = \frac{1}{2}\cos(2t) - 2\sin(t)$, $t \in \mathbb{R}$.

Problem 3 *Product of Two Bandlimited Signals*

$T_s = \frac{1}{2W_1 + 2W_2}$.

Problem 4 *Energy of Sampled Signal*

$E_s = \frac{1}{T_s} E_c$.

Problem 5 *Upsampling*

(a) $x_1(\cdot)$ needs to be upsampled by a factor of $N_1 = 5$ and $x_2(\cdot)$ needs to be upsampled by a factor of $N_2 = 3$.

(b) ...

Problem 6 *Echo echo echo*

(a) $h[n] = \delta[n] + \frac{1}{8}\delta[n-1]$.

(b) $h[n] = \delta[n] - \frac{(-1)^n}{8\pi(n-1/2)}$.

Problem 7 *Fourier Series Coefficients of Sampled Periodic Signal*

(a) $N = 21$.

(b) The Fourier series coefficients of $x[\cdot]$ are periodic with period 21 and $a_{k,\mathrm{DT}} = \left(\frac{1}{2}\right)^k$, $k = -10, \ldots, 10$.

Problem 8 *Digital System That Processes a Continuous-Time Signal*

$$\hat{h}(f) = \begin{cases} \frac{1}{1-\frac{1}{2}e^{-j2\pi f T_s}}, & |f| \leq \frac{1}{2T_s} \\ 0, & |f| > \frac{1}{2T_s}. \end{cases}$$

Problem 9 *Analog System That Processes a Discrete-Time Signal*

$$\hat{h}(f) = \frac{1}{3 + 4j2\pi f/T_s + (j2\pi f/T_s)^2}, \ |f| \leq \frac{1}{2}.$$