ECE250: Signals and Systems
Practice Sheet 4- Answers

Q1.(a) $x[n] - x[n-1] = a_k[1 - e^{-jk(2\pi/N)}]$

Q1.(b) $a_k = a*_k$

Q2 $x_1(1-t) + x_1(t-1) \leftrightarrow a_k + a_{-k}(e^{-jwk})$

$x[n] - x[n-1] = a_k[1 - e^{-jk(2\pi/N)}]$

Q3. $x_1(t) = \frac{1}{\sqrt{2}}je^{j\frac{\pi}{2}t} + \frac{1}{\sqrt{2}}je^{-j\frac{\pi}{2}t}, \quad x_2(t) = \frac{-1}{\sqrt{2}}je^{j\frac{\pi}{2}t} - \frac{1}{\sqrt{2}}je^{-j\frac{\pi}{2}t}$

Q4. Assuming T is the fundamental time period of $x(t)$:

(a) $a_k(e^{jk\frac{2\pi}{T}t_0} + e^{-jk\frac{2\pi}{T}t_0})$

(b) $-k^2(\frac{2\pi}{T})^2 a_k(e^{jk\frac{2\pi}{T}t_0} + e^{-jk\frac{2\pi}{T}t_0})$

Q5.

$$y[n] = \frac{1}{2}e^{j(2\pi)n} + \frac{1}{2}e^{j(2\pi)2n} + \frac{3}{8}e^{j(2\pi)3n} \tag{1}$$

Q6.

$$y[n] = \sum_{k=0}^{3} a_k H(e^{j(2\pi/4)k})e^{jk(2\pi/4)n} \tag{2}$$

Q7. (a) $a_0 = 1, a_1 = a_{-1} = 1/2$

(b) $b_1 = b^*_{-1} = e^{-j\pi/4}/2$

(c) $c_2 = c^*_{-2} = 1/4j$

(d) $c_2 = c_{-2} = 1/4j$