Problem 4.12

Discrete time signal is given by:

$x[n] = 9.1 \cos{(0.4\pi n + 0.4\pi)}$, $f_s = 5000$ samples/s.

Three different continuous time signals that would have produced $x[n]$ with frequencies less than or equal to 8000 Hz.

1. $\hat{\omega} = 0.4\pi$. Then $\omega = \hat{\omega} \times f_s$ and $f = \frac{2\pi}{\omega} = 1000$ Hz.

Hence, $x(t) = 9.1 \cos(2\pi(1000)t + 0.4\pi)$.

2. Computing the Alias frequency: $\hat{\omega} + 2\pi = 2.4\pi$ radians. Then, $f = 6000$ Hz.

Hence, $x(t) = 9.1 \cos(2\pi(6000)t + 0.4\pi)$.

3. Computing the aliased frequency given by, $2\pi - \hat{\omega} = 1.6\pi$ radians. Then, $f = 4000$ Hz and $\phi = -0.4\pi$.

Hence, $x(t) = 9.1 \cos(2\pi(4000)t - 0.4\pi)$.