

HW小考2

1. In the system of Figure 1

$$X_c(j\Omega) = 0, \quad |\Omega| \geq \frac{\pi}{T}$$

and

$$H(e^{j\omega}) = \begin{cases} e^{-j\omega}, & |\omega| < \frac{\pi}{L} \\ 0, & \frac{\pi}{L} < |\omega| \leq \pi \end{cases}$$

How is $y[n]$ related to the input signal $x_c(t)$?

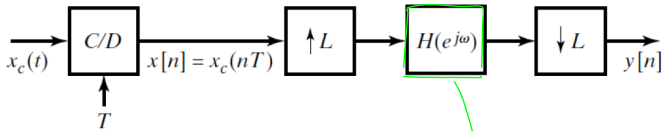
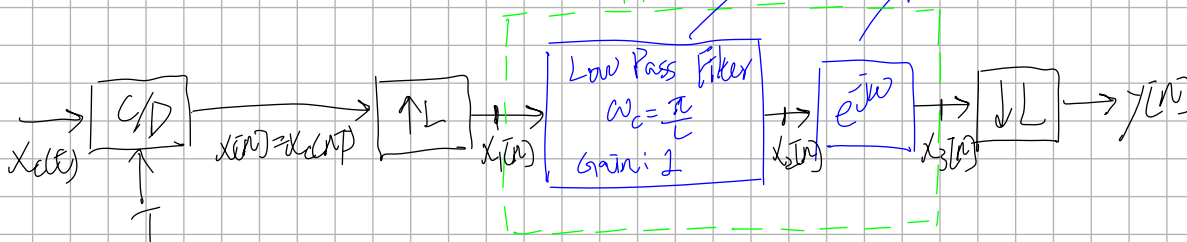
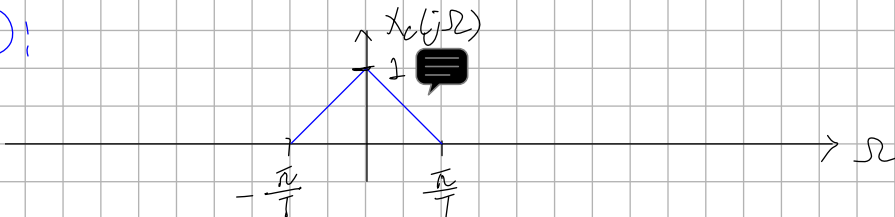


Figure 1

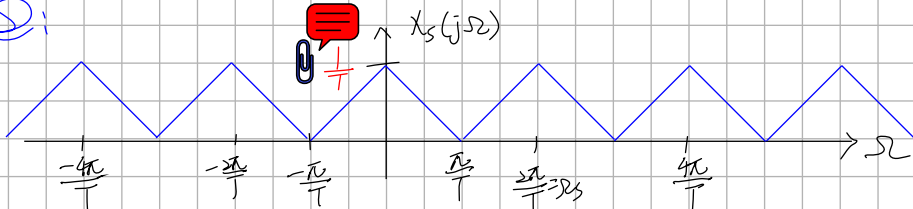


$$x_1[n] = \begin{cases} x[n \frac{L}{L}], & n=0, \pm L, \pm 2L, \dots \\ 0, & \text{otherwise} \end{cases} = x[n \frac{L}{L}], \quad n=0, \pm L, \pm 2L, \dots$$

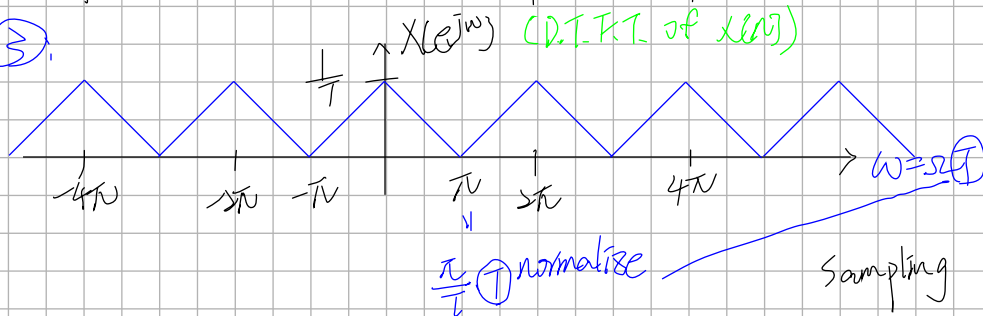
①:



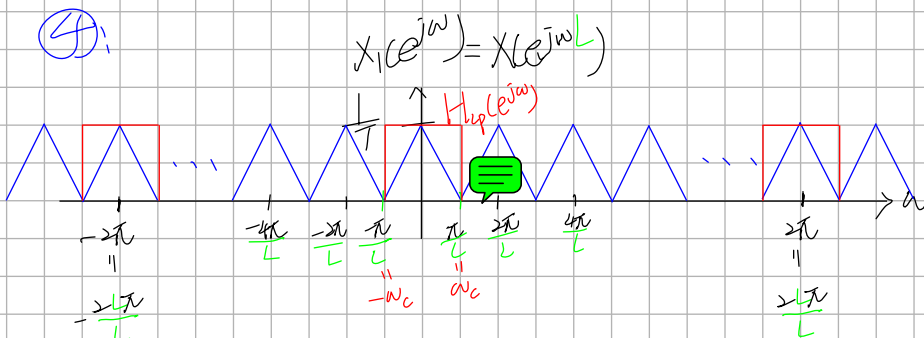
②:



③:



④:



Sampling Rate Expander:

$$X_1(e^{j\omega}) = \sum_{n=-\infty}^{\infty} x[n] \cdot e^{-j\omega n}$$

$$= \sum_{n=0, \pm L, \pm 2L, \dots} x[n] e^{-j\omega n}$$

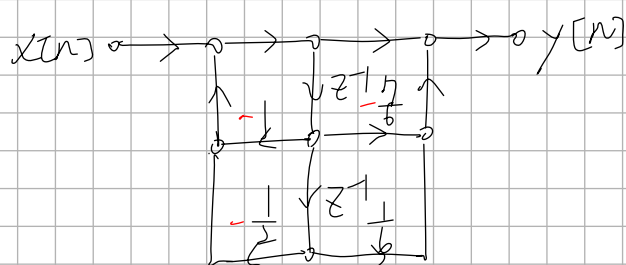
$$= \sum_{m=-\infty}^{\infty} x[m] e^{-j\omega m}$$

$$= X(e^{j\omega L})$$

3. Draw the signal flow graph for the transposed direct form II implementation of the LTI system with system function.

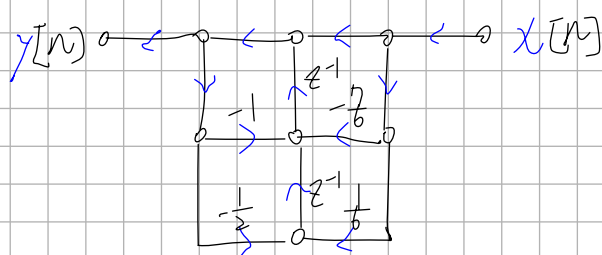
$$H(z) = \frac{1 - \frac{7}{6}z^{-1} + \frac{1}{6}z^{-2}}{1 + z^{-1} + \frac{1}{2}z^{-2}}$$

First, draw the signal flow graph in Direct Form II:

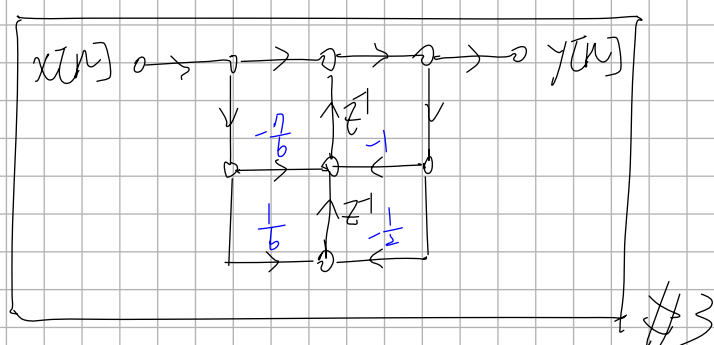


To obtain the Transposed version:

1. Reverse all arrows, $x[n]$, and $y[n]$:



2. Perform horizontal reflection: (Tip: draw from left-to-right and then top-to-down)



check:

6.15. Draw the signal flow graph for the transposed direct form II implementation of the LTI system with system function

$$H(z) = \frac{1 - \frac{7}{6}z^{-1} + \frac{1}{6}z^{-2}}{1 + z^{-1} + \frac{1}{2}z^{-2}}$$

6.15.

OK

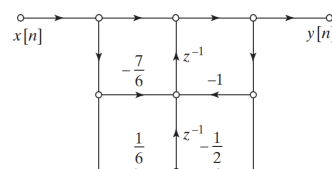


Figure P6.15