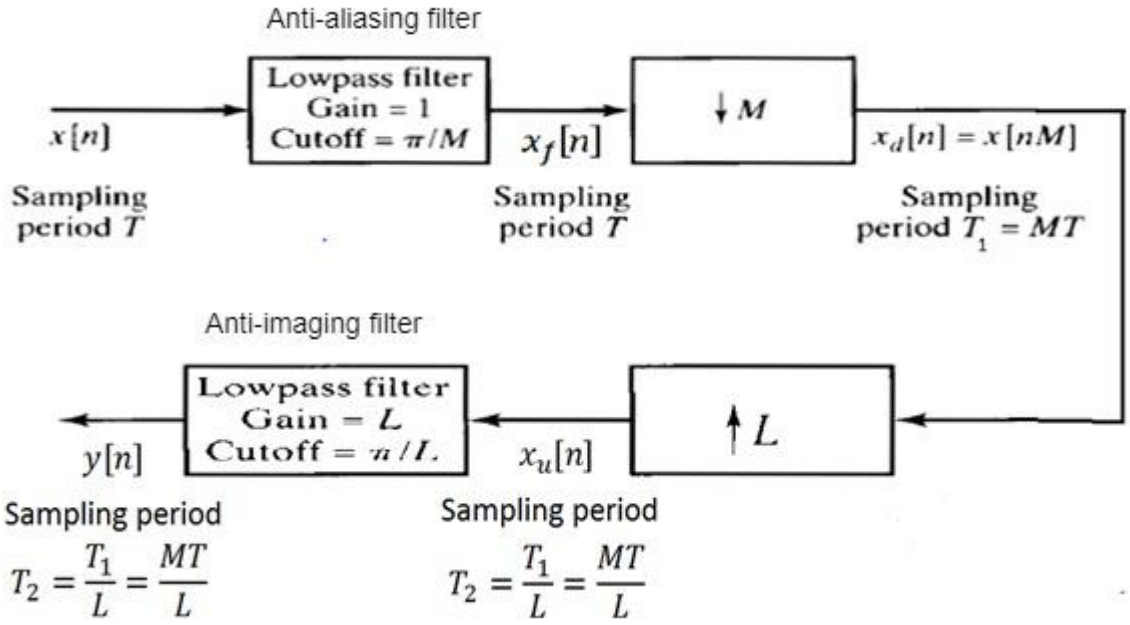
EE5801: CSP Lab/ EE5301: DSP Lab
Assignment 3

Problem:

Implementation of decimation and interpolation.

Technical details:



Input:

$$x[n] = \sin(2\pi f_0 n/f_s) + 0.5\sin(2\pi f_1 n/f_s) + 0.6\sin(2\pi f_2 n/f_s)$$

where, $f_0 = 100Hz$, $f_1 = 200Hz$, $f_2 = 300Hz$, $f_s = 2400\ Hz$

1. **Decimation and interpolation by factor 2 (M=L=2):**

   LPF(HBF) specifications

   - $Anti\ aliasing\ Gain = 1, Anti\ imaging\ Gain = L$
   - $Cutoff\ frequency\ (f_c) = 600\ Hz$
   - $Sampling\ frequency\ (f_s) = 2400\ Hz$
   - $Digital\ cutoff\ frequency\ (\omega_c) = \frac{\pi}{2}$
   - $Number\ of\ samples\ (N) = 39$

2. **Decimation and interpolation by factor 3 (M=L=3):**

LPF specifications

- $Anti\ aliasing\ Gain = 1, Anti\ imaging\ Gain = L$
- $Cutoff\ frequency\ (f_c) = 400\ Hz$
- $Sampling\ frequency\ (f_s) = 2400\ Hz$
- $Digital\ cutoff\ frequency\ (\omega_c) = \frac{\pi}{3}$
- $Number\ of\ samples\ (N) = 39$

Instructions:

- Take input x[n] and decimate it first and then interpolate to get y[n]. y[n] should come same as x[n] with average error in the order of 10^{-2}.
- Compute the error vector e[n] = y[n]-x[n] and average error.
- Write generalized code for decimation and interpolation by any factor.
- Please take care of practical implementation of decimation and interpolation as discussed in lecture 3.

Submission Details:

- Write C code to implement above system.
- **Coding format:** Write main.c and two separate files named common_funtions.c which contains separate functions corresponding to different blocks and header file named common_functions.h which contains function declarations.
- Write your understanding about decimation and interpolation in your own words in MS word or Latex.

- Upload the below files in a single zip file with your id, Example: EE21MTECH11010_**A3**.zip.
    1. main.c
    2. common_functions.c
    3. common_functions.h
    4. A text file containing your input x[n], output y[n] and error vector e[n] and average error for M=L=2 and M=L=3
    5. Pdf of your MS word or latex document.

Grading:

- Output - 50%
- coding format - 30%
- writting submission(pdf file) - 20%
- late submission - (-5)%