Assignment 3

1. Interpolation in frequency domain

- Create a sine signal with one period consisting of 10 samples (Fs = 10Hz).
- Enhance the sine signal sampling by using frequency domain interpolation using a variable factor L (e.g. L = 5) yielding in a sampling frequency of Fs*M.

2. Up-sampling in time domain

- Up-sampling is the method to artificially increase the sampling rate by inserting zeros between the sample values of the original discrete signal.
- Enhance the sine signal sampling of section 1 by using time domain up-sampling using a variable factor L (e.g. L=5).

3. Interpolation in time domain

- Explain why time domain interpolation requires low pass filtering of the up-sampled signal.
- Design a corresponding low pass filter
  - MATLAB commands: `fir1, filter`

4. Down-sampling in time domain

- Reduce the number of samples by a variable factor M (e.g. M=3)

Home Assignment: Resample demo

- Implement a demo script `demoresample.m` which shows the effects of up-sampling/interpolation and down-sampling/decimation.
  - Generate a Fourier series (as in assignment 2) with variable series length [1 21], fixed signal frequency (5Hz), fixed sample frequency (100Hz), fixed amplitude (1) and fixed signal length (1sec).
  - Provide two sliders for Up-sampling and down-sampling with factors [1 10].
  - Use two checkboxes to enable interpolation and decimation.
  - Use a 3x2 plot to show the following:
    - Time-domain plots (1st column); two-sided linear spectrum (2nd column).
    - Original Fourier series (1st row); up-sampled/interpolated signal (2nd row); down-sampled/decimated signal (3rd row);
- MATLAB files must have a header. Plots should be labeled and must have axis labeling.
- Required upload
  - `demoresample.m`