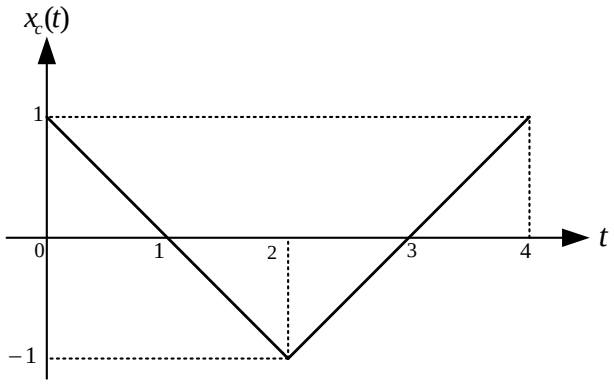
ECE310 Midterm-1 Friday, April 17, 2015

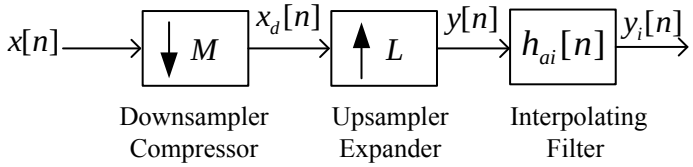
There are 5 questions in this midterm exam.

1) The continuous time signal $x_c(t)$ is given as in the following Fig. (20pts)

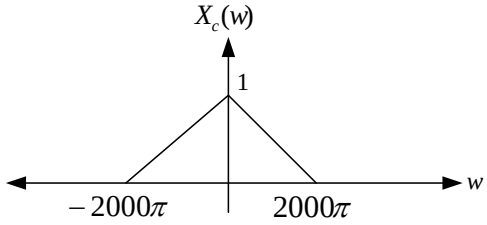


$x[n]$ is the digital signal obtained from $x_c(t)$ via sampling operation.
Find $x[n]$ for $T_s = 1$, $T_s = \frac{1}{4}$, $T_s = \frac{1}{8}$ and draw the graphs of $x[n]$ for each T_s value.

2) $x[n] = \cos\left(\frac{\pi}{4}n\right)$ $0 \le n \le 10$, find the signals $x_d[n], y[n]$ and $y_i[n]$ given in the following Fig. $M = L = 2$ and $h_{ai}[n]$ is the approximated interpolating filter (20pts)



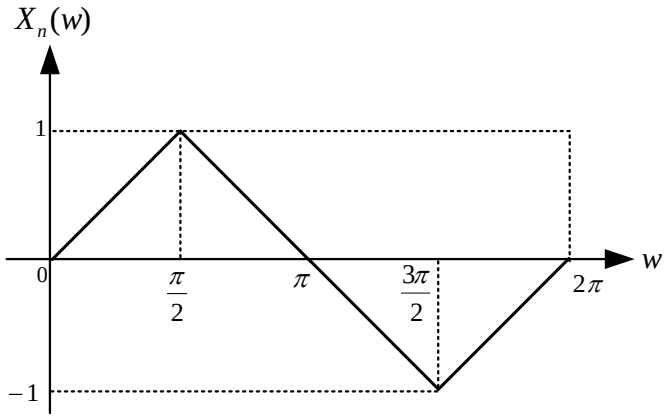
3) The Fourier transform of the continuous time signal $x_c(t)$ is given as (20pts)



Draw the Fourier transform of $x[n] = x_c(t)|_{t=nT_s}$ where $T_s = \frac{1}{3000}$

4) $x[n] = [1 \quad 2 \quad 0 \quad -3 \quad -1]$ and $\tilde{x}[n] = \sum_{k=-\infty}^{\infty} x[n-5k]$ draw one period of the following signals (15pts)
a) $\tilde{x}[-n]$ b) $\tilde{x}[2-n]$ c) $\tilde{x}[n-2]$ d) $\tilde{x}[2n-1]$

5) One period of the Fourier transform of the aperiodic signal $x[n]$ is given in the following Fig. (25pts)



a) Find 8-point DFT of $x[n]$, i.e., $X[k] =$?

b) Using $X[k]$ calculated in part-a find $x[n]$ via inverse DFT formula. Plot $|x[n]|$