Fall 2017 EE 313 Linear Systems and Signals Prof. Evans

Homework #3

Sampling and Reconstruction

Assigned on Friday, September 22, 2017
Due on Friday, September 29, 2017, by 12:30 pm via Canvas submission

Late homework will not be accepted.

Reading: McClellan, Schafer and Yoder, *Signal Processing First*, 2003, Sec 4.1 to 4.5.
Companion Web site with demos and other supplemental information: http://dspfirst.gatech.edu/
Web site contains solutions to selected homework problems from *DSP First*.

Location of TA office hours and Ms. Ghosh's e-mail address are given on Canvas at
https://cluster34-files.instructure.com/courses/1017~1202937/files/1017~42941474/course%20files/signals/homework/homework1.pdf
and you must already be logged into Canvas at canvas.utexas.edu for the above link to work

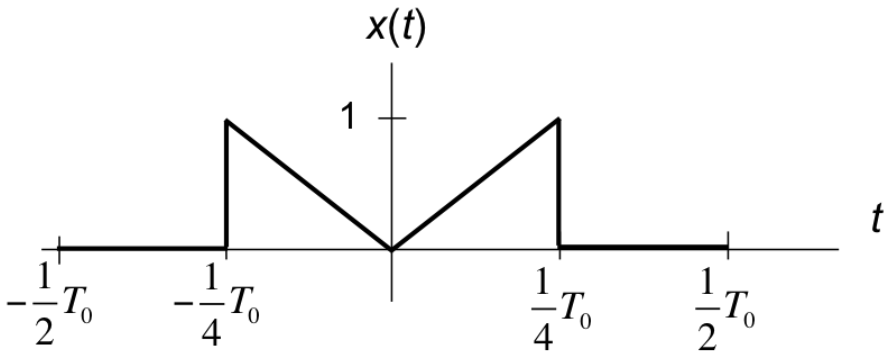
Office hours for Ms. Ghosh and Prof. Evans follow, as well as Prof. Evans' coffee hours on Friday.

Time Slot	***Monday***	***Tuesday***	***Wednesday***	***Thursday***	***Friday***
9:00 am			**Ghosh**		
9:30 am			**Ghosh**		
10:00 am			**Ghosh**		
10:30 am					
11:00 am		**Ghosh**		**Ghosh**	
11:30 am		**Ghosh**		**Ghosh**	
12:00 pm		**Ghosh**		**Ghosh**	Evans (EER cafe)
12:30 pm		Evans (EER 1.516)		Evans (EER 1.516)	Evans (EER cafe)
1:00 pm		Evans (EER 1.516)	Evans (EER 6.882)	Evans (EER 1.516)	Evans (EER cafe)
1:30 pm		Evans (EER 1.516)	Evans (EER 6.882)	Evans (EER 1.516)	Evans (EER cafe)
2:00 pm			Evans (EER 6.882)	Evans (EER 6.882)	
2:30 pm				Evans (EER 6.882)	
3:00 pm				Evans (EER 6.882)	

EE 313 tutoring is available on Mondays through Thursdays from 7:00pm to 10:00pm in ETC 4.150:
http://www.ece.utexas.edu/undergraduate/tutoring

1. Fourier Series. 25 points.

Compute the Fourier series of the following continuous-time signal that has a fundamental period T_0.



2. Sampling. 25 points.

Signal Processing First, problem P-4.1, page 96

3. Reconstruction. 25 points.

Signal Processing First, problem P-4.6, page 97

4. Audio Effects. 20 points.

Signal Processing First, problem P-4.17, page 100.

For part (b), use the spectrogram command in MATLAB to generate the time-frequency plot.

Please complete the following additional part:

(d) Write MATLAB code to generate a chirp signal $x[n] = \cos(\pi\ (0.7\text{x}10^{-4})\ n^2)$ for $n = 0, 1, \ldots, 24000$ and play $x[n]$ as an audio signal with sampling rate $f_s = 8000$. Describe what you hear. Explain why you are hearing it. Plot the spectrogram of $x[n]$ to aid your explanation.

As stated on the course descriptor, "Discussion of homework questions is encouraged. Please be sure to submit your own independent homework solution."

NOTE: In your solutions, please put all work for problem 1 together, then all work for problem 2 together, etc. Please see additional homework guidelines on the homework page.