Midterm Exam

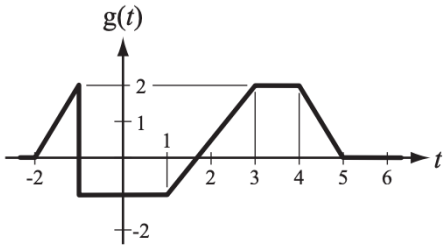
Signal and System, Fall 2022
School of BioMedical Convergence Engineering, PNU
Oct. 20. 17:00 - 20:00

I. REMARK

- This is a open book exam.
- There are a total of 100 points in the exam. Each problem specifies its point total.
- You must SHOW YOUR WORK to get full credit.

II. PROBLEM SET

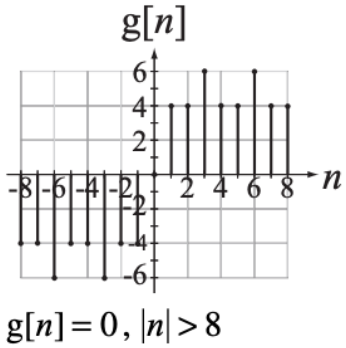
1) [20 points] The graphical definition of a function is given in the figure below.



$g(t) = 0, \quad t < -2$ or $t > 6$

   a) Graph $-g(\frac{-t+3}{2})$ and $-2g(-2t-1)$.
   b) Graph $g(t) * \delta(t) + g(t) * \delta(t-1)$.
   c) Graph the even and odd parts of the function $g(t)$.

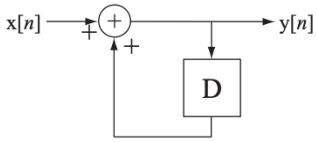
2) [30 points] The graphical definition of a function is given in the figure below.



$g[n] = 0, \; |n| > 8$

   a) Graph $g[-2n] * \delta[n-3] * \delta[n+2]$.
   b) Assume $x[n] = u[n+2] - u[n-3]$. Graph $x[n] * g[n]$.
   c) Graph the even and odd parts of the function $g[n]$.
   d) [MATLAB] Check whether your answer of b) is correct using MATLAB. You can use the "conv()" function
   e) [MATLAB] Check whether your answer of c) is correct using MATLAB.

3) [20 points] A system is given as



   a) Show that the system is linear and time-invariant (LTI).
   b) What is the impulse response sequence of the sytem? In other words, if $x[n] = \delta[n]$, what is $y[n]$?
   c) [MATLAB] Prove your answer b) using simple "for" loop in MATLAB. Plot the response sequence $y[n]$ in the range of $-5 \leq n \leq 20$.

4) [30 points] A signal is given as

$$x[n] = \begin{cases} 0, & n < -5 \\ (n/5) + 1, & -5 \leq n < 0 \\ \cos 2\pi n/20, & 0 \leq n < 10 \\ 0, & n \geq 10 \end{cases} \tag{1}$$

   a) [MATLAB] Make a custom MATLAB function where the input is vector n and the output is vector $x[n]$. The function name should be "MyFun". Plot $x[n]$ in the range of $-10 \leq n \leq 20$ using "MyFun".
   b) [MATLAB] Assume $h[n] = \delta[n] + 2\delta[n-1] + -\delta[n-2]$. Plot $h[n]$ in the range of $-2 \leq n \leq 5$.
   c) [MATLAB] Using "conv()" function, compute $y[n] = x[n] * h[n]$ and plot $y[n]$. Note that indexing is correct in your graph.