ECE113, Winter 2023 **Homework #2**
Digital Signal Processing Prof. A. Kadambi
University of California, Los Angeles; Department of ECE TA: S. Zhou, A. Vilesov

Due Friday, 3 Feb 2023, by 11:59pm to Gradescope.
50 points total.

1. (10 points) Determine the even and odd parts of the following real sequences:
   (a) $x_1[n] = u[n-3]$
   (b) $x_2[n] = \alpha^n u[n-1]$
   (c) $x_3[n] = n\alpha^n u[n+1]$
   (d) $x_4[n] = \alpha^{|n|}$

2. (10 points) Answer True or False. In each case, either prove your answer or give a counter-example.
   (a) A power sequence is necessarily an energy sequence.
   (b) Every energy sequence has zero average power.
   (c) If $x[n]$ is an energy sequence then $x[n] \to 0$ as $n \to \infty$.
   (d) There does not exist a sequence with infinite average power.

3. (10 points) System I is defined by $y[n] = \log(|x[n-1]|)$ and system II is defined by $y[n] = \exp(x[2n])$. Which of the following statements is correct?
   (a) Both systems are BIBO stable.
   (b) Both systems are unstable.
   (c) System I is unstable and system II is BIBO stable.
   (d) Both systems are time invariant.

   Please provide your answer and reasoning.

4. (10 points) Determine whether each of the following systems is linear or not, time-invariant or not, causal or not, BIBO stable or not, relaxed or not:
   (a) $y[n] = \ln(|x[n]| + 1)$
   (b) $y[n] = y[n-1] + x[n]$, $y[-1] = 0$
   (c) $y[n] = y[n-1] + x[n]$, $y[-1] = 1$
   (d) $y[n] = 2 + x[n]$

5. (10 points) Determine the conditions on the parameters of the following systems for stability:
   (a) $h[n] = a^n u[-n]$.
   (b) $h[n] = a^n(u[n] - u[n-100])$.
   (c) $h[n] = r^n \sin[nw_0]u[n]$
   (d) $h[n] = a^{|n|}$
   (e) $h[n] = K(-1)^n u[n]$