

ESE 471 Spring 2021: Homework 3

1. Rice 2.43 (see Rice Book pp 107-109 in Canvas files)
2. Rice 2.45 (see Rice Book pp 107-109 in Canvas files)
3. (From Proakis and Salehi problem 2.40): A lowpass signal $x(t)$ with bandwidth of 50 Hz is sampled at the Nyquist rate and the resulting sampled values are

$$x(nT) = \begin{cases} -1, & -4 \leq n \leq -1 \\ 1, & 1 \leq n \leq 4 \\ 0, & o.w. \end{cases}$$

Find $x(0.005)$ by using the Nyquist sampling theorem.

4. Rice A.6 (copied here). The square-root raised-cosine pulse shape given in Rice in Equation (A.30) has two values of t which produce an indeterminate form. This problem explores the evaluation of $p(t)$ at these values.
 - (a) Show that $p(t)$ at $t = 0$ is an indeterminate of the form $0/0$. Using l'Hôpital's rule, show that

$$\lim_{t \rightarrow 0} p(t) = \frac{1}{\sqrt{T_s}} \left[1 - \alpha + \frac{4\alpha}{\pi} \right]$$

- (b) Show that $p(t)$ at $t = \pm \frac{T_s}{4\alpha}$ is an indeterminate of the form $0/0$. Using l'Hôpital's rule, show that

$$\lim_{t \rightarrow \frac{T_s}{4\alpha}} p(t) = \frac{\alpha}{\sqrt{2T_s}} \left[\left(1 + \frac{2}{\pi} \right) \sin \left(\frac{\pi}{4\alpha} \right) + \left(1 - \frac{2}{\pi} \right) \cos \left(\frac{\pi}{4\alpha} \right) \right].$$