

## COMMUNICATION THEORY, Homework Assignment 4, Fall 2023

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Consider the case where an analog signal  $x(t)$  plus additive noise  $n(t)$  are passing through an ideal low-pass filter of bandwidth  $W$ . The signal  $x(t)$  has a spectral density function  $G_x(f)$  defined as:

$$G_x(f) = \begin{cases} K[1 - \cos(2\pi f/W)] & \text{for } |f| \leq W \\ 0 & \text{for } |f| > W \end{cases}$$

with  $W = 20$  kHz and  $K = 8 \cdot 10^{-12}$  W/Hz. The noise is white i.e. has a constant spectral density function  $G_n(f) = \eta/2 = 4 \cdot 10^{-21}$  W/Hz.

Calculate the signal power, the noise power, and the SNR (signal-to-noise ratio) after the filter.