Seminar 2

DEDP

1. Compute the average value, the average squared value, and the variance for a stationary random process with the distribution of a sample:

   - $w_1(x) = \mathcal{U}[a, b]$ for some $a, b \in \mathbb{R}$
   - $w_1(x) = \frac{1}{2} - \frac{1}{8}x$. For this one, also plot the function and check that its integral really is 1

2. Compute the temporal average value, the temporal average squared value, the temporal variance, and the temporal autocorrelation function for the following realization of a finite-length random process:

$$v = [-1, 2, -1, 2, -1, 2, -1, 2, -1, 2]$$

3. Find the autocorrelation function of the output of an ideal low-pass filter with transfer function

$$H(j\omega) = \begin{cases} A \cdot e^{j\Phi(\omega)}, & |\omega| \leq \omega_c \\ 0, & |\omega| > \omega_c \end{cases}$$

   if the input to the filter is white noise with PSD equal to P.

4. Let $x[n]$ be a discrete-time random process with triangular autocorrelation function

$$R_{xx}[\tau] = \begin{cases} 1 - \frac{|\tau|}{5}, & \tau = -5, -4, ...4, 5 \\ 0, & elsewhere \end{cases}$$

   $x[n]$ is applied to the system defined by $y[n] = x[n] - x[n-5]$. Find and sketch the autocorrelation function of the output.

5. Let $N(t)$ be a bandlimited white noise process with PSD equal to

$$S_{NN}(\omega) = \begin{cases} S, & |\omega| \leq B \\ 0, & |\omega| > B \end{cases}$$

   - Find and sketch the autocorrelation function of the process
   - If we sample the process, whet is the sampling rate F_s such that the resulting samples are uncorrelated?