ECE 581 Homework 11
Due Tuesday 5 AM November 12, 2015 (14 Total Hmwk points) Show work.
Electronic Submission – Please submit via "Assignment" under Sakai

Problem 11-1 (10 points Total) A linear shift-invariant discrete-time system is given by $y[n] = x[n] + x[n - 2]$, where $x[n]$ is the input and $y[n]$ is the output and n is an integer. The input discrete-time random process, $X[n]$, is a random discrete-time sequence of statistically independent and identically distributed random variables whose amplitudes have a Gaussian distribution with mean zero and a variance of 2.

(a) (2 points) (i) What is the mean of the *input* random process, $X[n]$?

(ii) Sketch and completely label this mean sequence.

(b) (2 points) (i) What is the autocorrelation sequence of the *input* random process, $X[n]$?

(ii) Sketch and completely label this autocorrelation sequence.

(c) (2 points) (i) What is the mean sequence of the *output* random process, $Y[n]$?

(ii) Sketch and completely label this mean sequence.

(d) (2 points) (i) What is the autocorrelation sequence of the *output* random process, $Y[n]$?

(ii) Sketch and completely label this autocorrelation sequence.

(e) (2 points) Are random variables taken from the output random sequence $Y[n]$ that have a separation of one correlated or uncorrelated? If correlated, what is the numerical value of the correlation? If uncorrelated, explain why.

Problem 11-2 (4 points Total) The input random process $X[k]$ to a discrete-time linear shift-invariant system has mean 0 and autocorrelation function $R_X[l] = 2\delta[l]$. The output of the system is $Y[k]$, and the unit sample response of the system is given by $h[k] = \delta[k] - 2\delta[k - 1]$.

(a) (2 points) (i) What is the autocorrelation function of the output, $R_Y[k]$?

(ii) Sketch and completely label this autocorrelation function.

(b) (2 points) (i) What is the variance of the system output?

(ii) (points) Sketch and label the variance of the system output.

Reference: Problems 11-2 is from Therrien and Tummala (2012) chapter 9, problem 9-27 (on closed reserve in Bostock)