

PROBLEM 1

Random processes $x[n]$ and $y[n]$ are defined by

$$x[n] = v_1[n] + 3v_2[n-1]$$

and $y[n] = v_2[n+1] + 3v_1[n+1]$

where $v_1[n]$ and $v_2[n]$ are independent white noise processes with variance equal to 0.5.

a) What are the autocorrelation functions of x and y ?

Are these processes wide-sense stationary?

b) What is the crosscorrelation function $R_{xy}[n, n_0]$?

Are these processes jointly stationary (in the wide sense)?

PROBLEM 2

Find the Power Spectral Density Functions corresponding to the following correlation functions and verify that they are real and non-negative

a)
$$R_x(l) = \begin{cases} 3-|l|, & -3 \leq l \leq 3 \\ 0, & \text{otherwise} \end{cases}$$

b)
$$R_x(l) = \{ 2(-0.6)^{|l|} + \delta(l) \}$$

PROBLEM 3

Prove the property $R_x(0) \geq R_x(l)$, $l \neq 0$

(Hint: Use the positive semidefinite property with $a(n) = \begin{cases} b, & n=0 \\ b^*, & n=l \\ 0, & \text{otherwise} \end{cases}$)