Adama Science Technology University Final exam: PCE 6205,Stochastic model, estimation and control .Professor Seungnam kim Jan.1/14/2019. Student Name ID

1. Minimum Variance Estimator

Suppose a random variable is the sum of two random independent variables , as

where

Answer the following questions.

* 1. Find the mean and the valiance of
* Solution :
  1. Find the conditional expectation given and , i.e.,

and

* Solution :

Hence

* 1. Calculate the variance of the conditional expectation given , i.e.,

(remember this is not dependent of the specific value of )

* Solution:

Hence

* 1. Since , we may compare the variance of

and Show that the variance of is smaller than that of

* Solution :

Since , , Hence

1. The following signal is a vector in the square-integrable on the interval :

* Solution:

1. Consider the system

where

* 1. Find the least square estimator given
* Solution :
  1. Calculate singular values of A
* Solution:

Eigenvalues of , Hence the eigenvalues of are [1.1849, 11.8151]. gives the singular values of A is

* 1. Find the singular values of (remember the previous lecture)
* Solution:

Since , and eigenvalues of a square matrix M are same as those of , hence the singular values of =

1. A pair of random variables, and , has a joint density function

Find

* Solution:

First

Check the is a PDF.

Now

Hence

1. Total expectation

* Solution 1.2)