

# AI1103: Assignment 2

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and latex-tikz codes from

[https://github.com/ASHWITHA-11008/  
Assignment-2/blob/main/Assignment-2.tex](https://github.com/ASHWITHA-11008/Assignment-2/blob/main/Assignment-2.tex)

## 1 PROBLEM

$X(t)$  is a random process with a constant mean value of 2 and the autocorrelation function  $R_x(\tau) = 4(e^{-0.2|\tau|} + 1)$ . Let  $Y$  and  $Z$  be the random variables obtained by sampling  $X(t)$  at  $t = 2$  and  $t = 4$  respectively. Let  $W = Y - Z$ . The variance of  $W$  is

- (a) 13.36   (b) 9.36   (c) 2.64   (d) 8.00

## 2 SOLUTION

Given  $W = Y - Z$

Variance of  $W$

$$\begin{aligned}\sigma_W^2 &= E[Y - Z]^2 - (E[Y - Z])^2 \\ &= E[Y^2] + E[Z^2] - 2E[YZ]\end{aligned}$$

$$E[Y - Z] = 0$$

The mean is zero.

We know,

$$\begin{aligned}R_X(\tau) &= E[X(t)X(t + \tau)] \\ E[X^2(t)] &= R_X(0) \\ E[X^2(2)] &= E[X^2(4)] = R_X(0)\end{aligned}$$

So,

$$\begin{aligned}\sigma_W^2 &= R_X(0) + R_X(0) - 2R_X(2) \\ &= 4(e^{-0.2|0|} + 1) + 4(e^{-0.2|0|} + 1) - 2 \times 4(e^{-0.2|2|} + 1) \\ &= 8 + 8 - 2[4(0.67 + 1)] \\ &= 2.64\end{aligned}$$

So, option c is correct.