

**Department of CEAC, IIT Jammu Subject Name: Statistical Foundation for
ML, Quiz 3, MM:30, Date: 01/12/24**

Q1: [10 Marks]

1. The weight update expression of steepest descent algorithm is given by $w(n+1) = w(n) + \mu[p - R w(n)]$. This algorithm is used to estimate the coefficient of a second order moving average filter where the cross-correlation vector $p = \begin{bmatrix} 0.8 \\ 0.3 \end{bmatrix}$,

autocorrelation matrix of the observed sequence is $R = \begin{bmatrix} 1 & 0.5 \\ 0.5 & 1 \end{bmatrix}$, the learning rate $\mu = 1.0$

. With these set of observed values, determine the following:

- (i) Optimal weight as per Wiener-Hopf expression

Q2 : [10 Marks]

Prove that for a real auto correlation matrix R all the eigenvalues must be real and the eigenvectors corresponding to distinct eigenvalues of R are mutually orthogonal.

Q3 : [10 Marks]

- a) If X and Y are independent random variables, then prove that $H(XY) = H(X) + H(Y)$.
- b) Consider the following joint distribution: Find $H(X)$, $H(Y)$ and $H(XY)$

x	y	p(x,y)
1	1	1/2
0	a	1/16
0	b	1/16
0	c	1/16
0	d	1/16
1	a	1/16
1	b	1/16
1	c	1/16
1	d	1/16