$\mathcal{E}(\omega)$

3. Let ~~E~~ be the cost function for 'w' weights

We know that if w^* is the final solution then

$$\mathcal{E}(w^*) \leq \mathcal{E}(w)$$

$$\mathcal{E}(w) = \sum_{n=1}^{k} (d(n) - y(n))^2 + \beta \sum_{i=1}^{k} w_i^2$$

with a learning rate η, we get the steepest descent update rule to be

$$\hat{\omega}(n+1) = \hat{w}(n) - \eta \hat{g}(n)$$

where $g(n) = \nabla \mathcal{E}(\omega)$

$$= \nabla[\mathcal{E}(\omega)]$$

$$= -e(n)x(n) + 2\beta w(n)$$ [From LMS and $\frac{d}{d\omega}\omega^2 = 2\omega$]

$\Rightarrow$ ~~$w_k(n+1) = \eta(-x_k(n) + 2\beta w_k(n)) + w(n)$~~

$$\Rightarrow w_k(n+1) = w_k(n) - \eta(x_k e(n) - 2\beta w_k)$$

Ans.