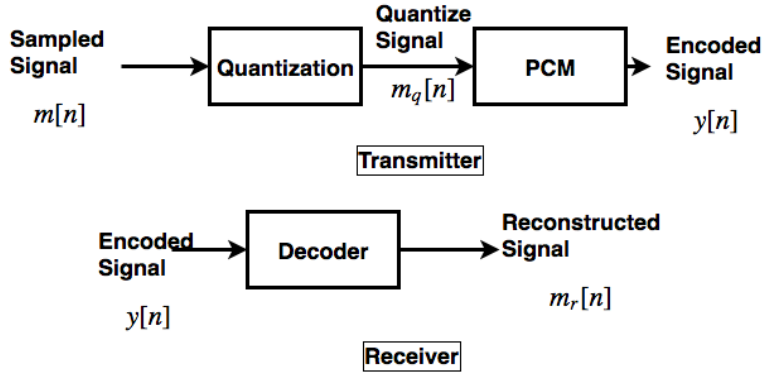
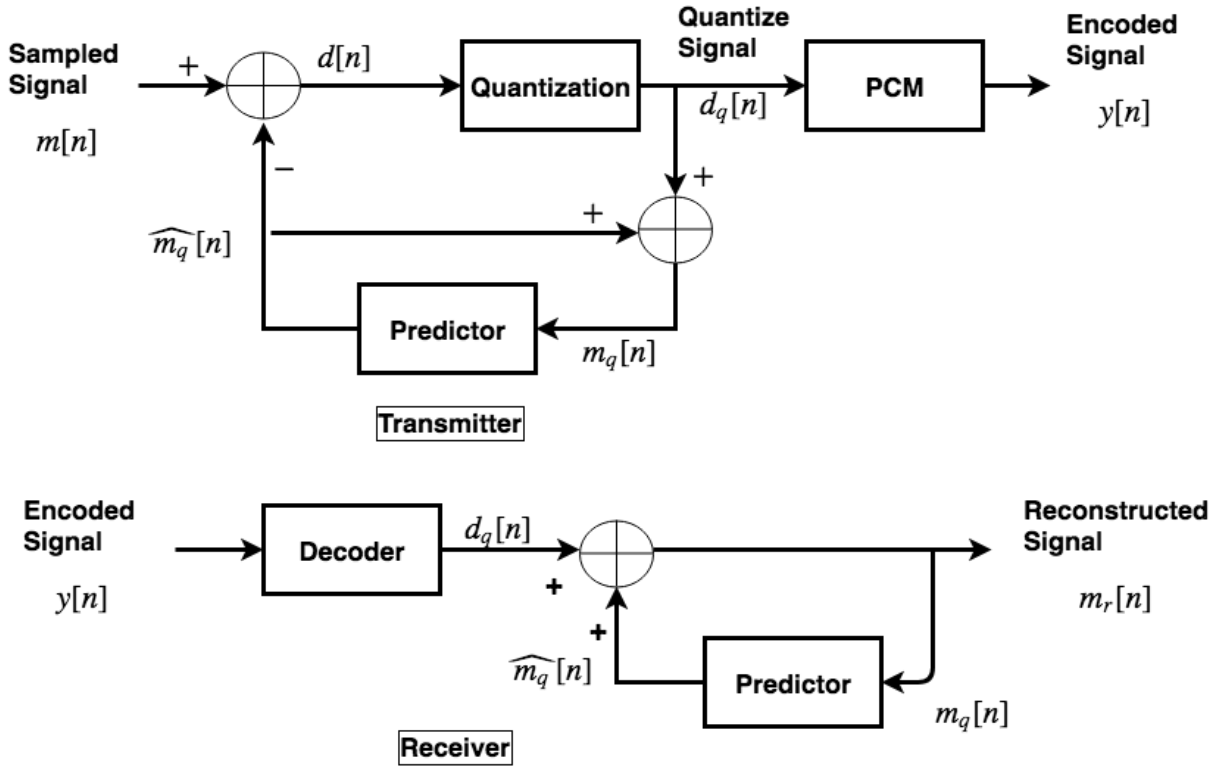
Lab. 6 PCM and DPCM

1. Consider an analog signal $\mathrm{m(t)} = \sin(2\pi 50\mathrm{t})$. Sample it at $f_s = 5000$ samples/sec. Implement 5 bit pulse code modulation (PCM) transmitter and receiver. Find RMSE between input sampled signal $m[n]$ and reconstructed signal $m_r[n]$. Repeat for speech signal and listen to reconstructed signal (**16000** samples/sec**).** Is 5 bit encoding good for speech? (Note that we are not considering noise addition which happens in practice).



2. Consider an analog signal$\mathrm{m(t)} = \sin(2\pi 50\mathrm{t})$. Sample it at $f_s = 5000$. Implement 5 bit Differential Pulse code modulation (DPCM) transmitter and receiver. Find RMSE between input sampled signal $m[n]$ and reconstructed signal $m_r[n]$. Repeat for speech signal and also listen to reconstructed signal. Use predicted value = previous sample value i.e.,

Predictor's equation: $\hat{m}[n] = m[n-1]$



3. Repeat Q.2 by considering predictor equation as

Predictor's equation: $\hat{m}[n] = a_1 m[n-1] + a_2 m[n-2] + a_3 m[n-3]$

How to find coefficients $a_1, a_2 \; and \; a_3$ using input samples. Use pseudo inverse (Least squares estimation of coefficients)

$$\begin{bmatrix} m[0] \\ m[1] \\ m[2] \\ m[3] \\ . \\ . \\ . \end{bmatrix} = \begin{bmatrix} 0 & 0 & 0 \\ m[0] & 0 & 0 \\ m[1] & m[0] & 0 \\ m[2] & m[1] & m[0] \\ . & . & . \\ . & . & . \\ . & . & . \end{bmatrix} \begin{bmatrix} a_1 \\ a_2 \\ a_3 \end{bmatrix}$$