Lec-30 01/03/18

DIFFERENTIAL PULSE CODE MODULATION

DPCM-I

$$x[n]$$

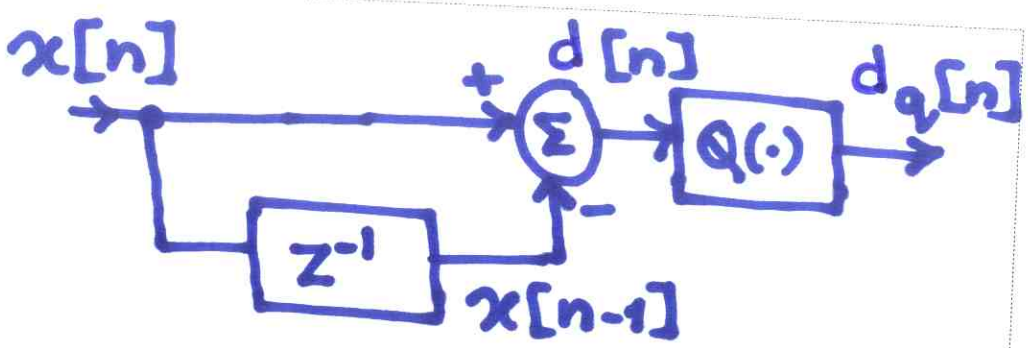
$$d[n] = x[n] - x[n-1]$$

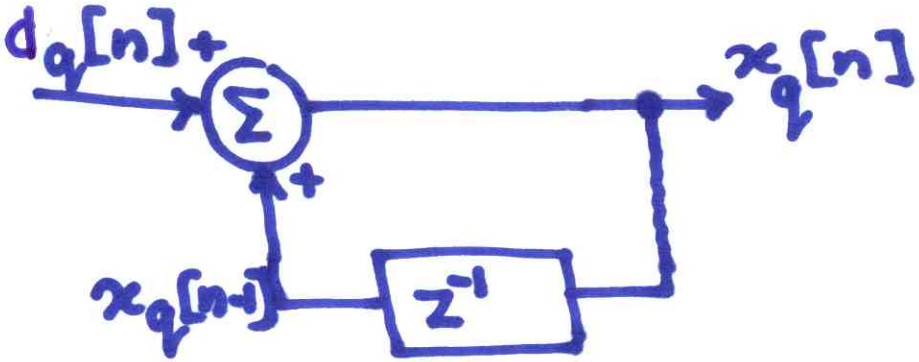
source o/p $x[n]$ →	6.2	9.7	13.2	5.9	8.0	7.4	4.2	1.8
$d[n] = x[n] - x[n-1]$	6.2	3.5	3.5	-7.3	2.1	-0.6	-3.2	-2.4
reconstruction	6.2	9.7	13.2	5.9	8.0	7.4	4.2	1.8
7-level $Q(\cdot)$	-6	-4	-2	0	2	4	6	
$d_q[n]$	6	4	4	-6	2	0	-4	-2
$x_q[n]$	6	10	14	8	10	10	6	2
error	0.2	-0.3	-0.8	-2.1	-2	-2.6	-1.8	-2.2

$$d[n] = x[n] - x[n-1]$$

$$d[n] \rightarrow \boxed{Q(\cdot)} \rightarrow d_q[n]$$

$$d_q[n] = d[n] + q[n]$$





$$d[1] = x[1] - x[0]$$

$$d_q[1] = d[1] + q[1]$$

$$x_q[1] = x[0] + d_q[1] = x[0] + d[1] + q[1] = x[1] + q[1]$$

$$d[2] = x[2] - x[1]$$

$$d_q[2] = d[2] + q[2]$$

$$x_q[2] = x_q[1] + d_q[2] = x[1] + q[1] + d[2] + q[2]$$

$$= x[2] + q[1] + q[2]$$

$$d[n] = x[n] - x[n-1]$$

$$d_q[n] = d[n] + q[n]$$

$$x_q[n] = x[n] + \underbrace{\sum_{k=1}^{n} q[k]}$$

$$d[n] = x[n] - x_q[n-1]$$

$$d[1] = x[1] - x[0]$$

$$d_q[1] = d[1] + q[1]$$

$$x_q[1] = x[0] + d_q[1]$$

$$= x[0] + d[1] + q[1]$$

$$= x[1] + q[1]$$

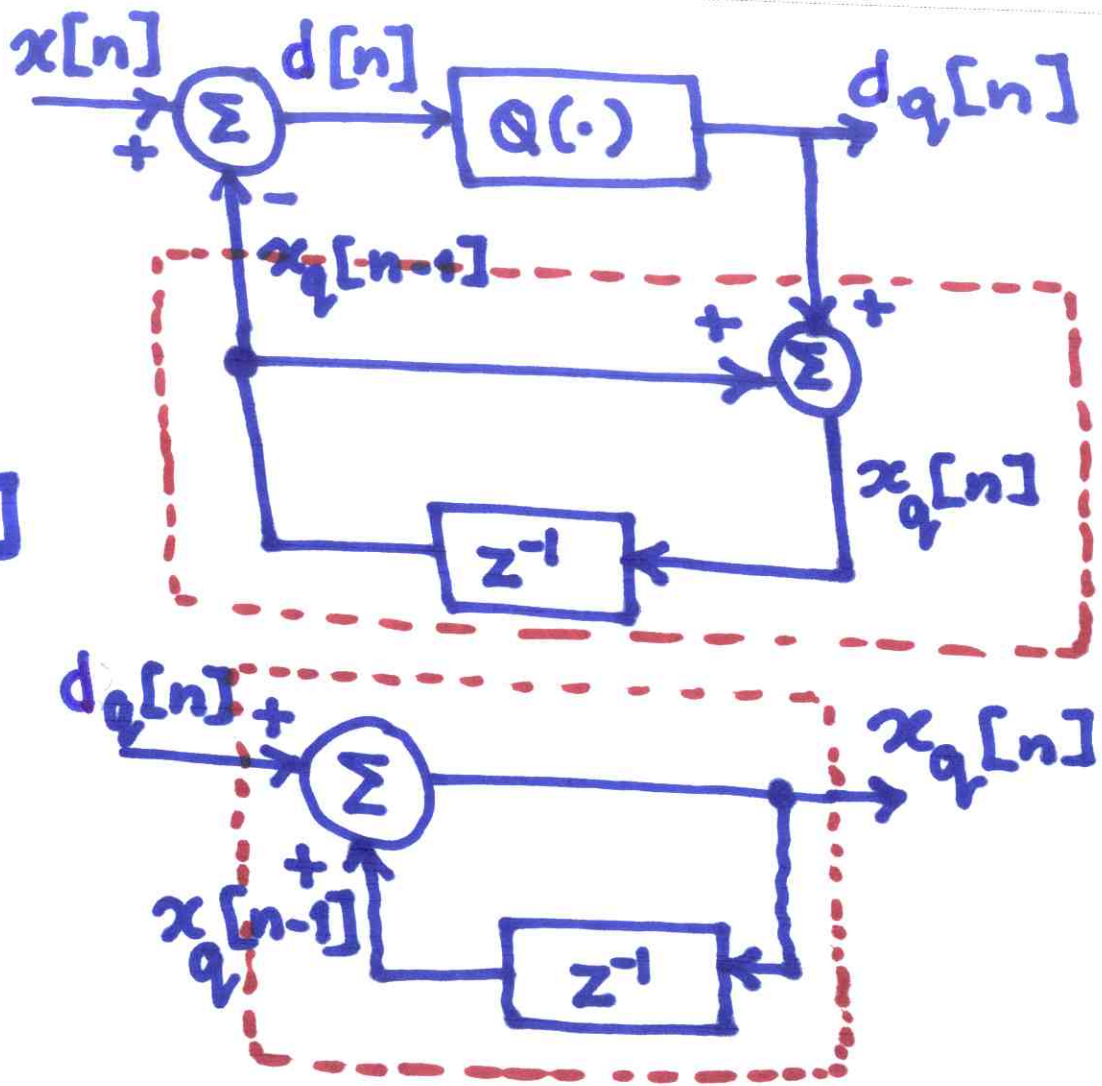
$$d[2] = x[2] - x_q[1]$$

$$d_q[2] = d[2] + q[2]$$

$$x_q[2] = x_q[1] + d_q[2]$$

$$= x_q[1] + d[2] + q[2]$$

$$= x[2] + q[2]$$



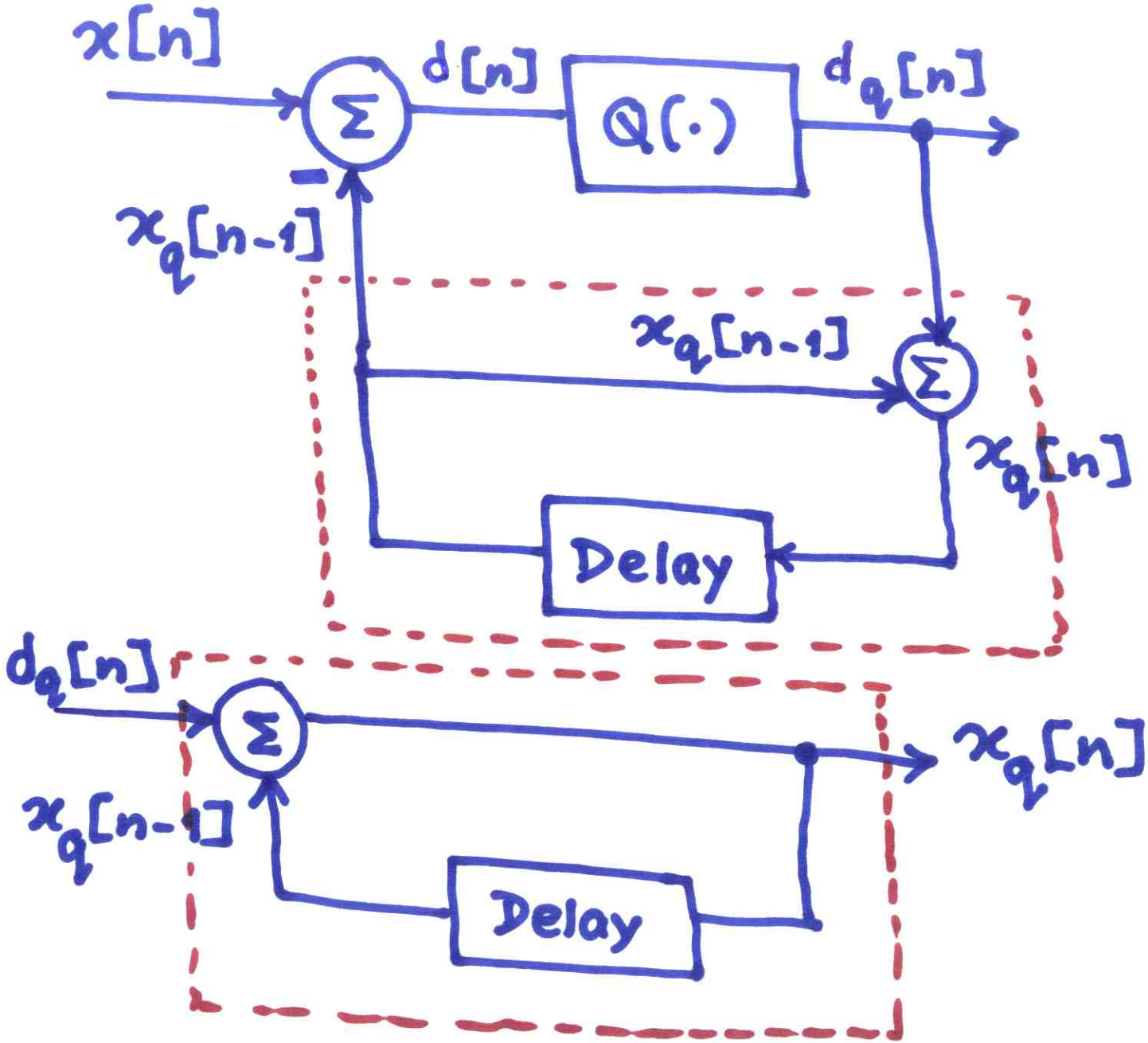
$$d[n] = x[n] - x_q[n-1]$$

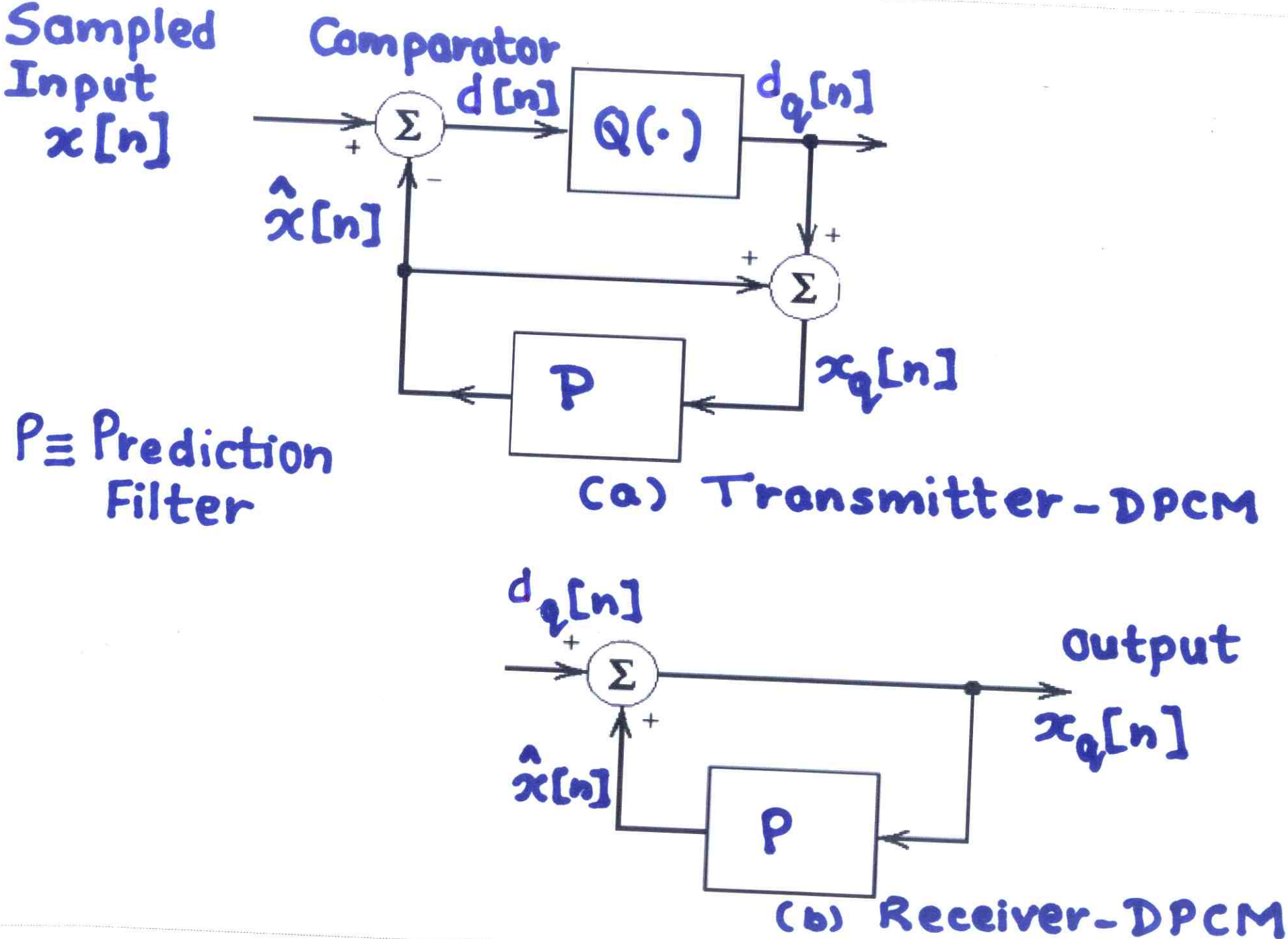
$$d_q[n] = d[n] + q[n]$$

$$x_q[n] = x_q[n-1] + d_q[n]$$

$$= x_q[n-1] + d[n] + q[n]$$

$$= x[n] + q[n]$$


x[n]
d[n]
Q(.)
$d_q[n]$
$x_q[n-1]$
$x_q[n-1]$
$x_q[n]$
Delay
$d_q[n]$
$x_q[n]$
$x_q[n-1]$
Delay


Sampled Input x[n]
Comparator
d[n]
Q(·)
$d_q[n]$
Σ
+
−
$\hat{x}[n]$
+
+
Σ
P
$x_q[n]$
P ≡ Prediction Filter
(a) Transmitter - DPCM
$d_q[n]$
+
Σ
+
Output
$x_q[n]$
$\hat{x}[n]$
P
(b) Receiver - DPCM

$$P: f\left(x_q[n-1], x_q[n-2], \ldots x_q[0]\right)$$

$$= \hat{x}[n]$$

Differential Pulse Code Modulation

DPCM