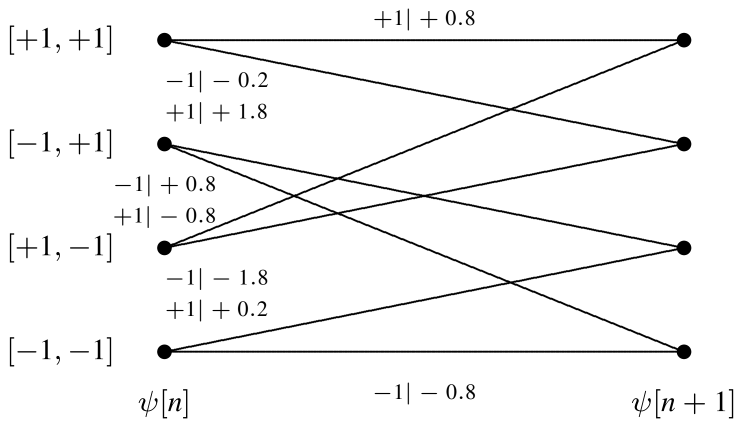
Receivers under ISI - Exercise 2

- Transmission of a 2-PAM ($A[n] \in \{\pm 1\}$) through channel

$$p[n] = \frac{1}{2}\,\delta[n] - \frac{1}{2}\,\delta[n-1] + 0.8\,\delta[n-2]$$

- Noiseless output: $o[n] = \frac{1}{2}\,A[n] - \frac{1}{2}\,A[n-1] + 0.8\,A[n-2]$
- Trellis diagram

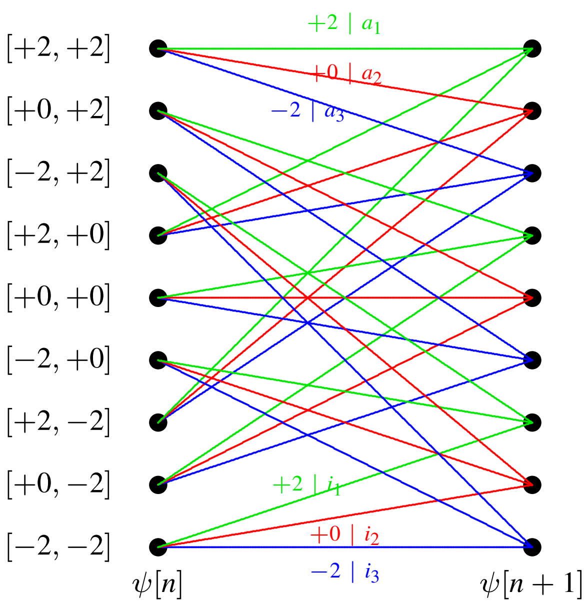
$A[n]$	$A[n-1]$	$A[n-2]$	$o[n]$
$+1$	$+1$	$+1$	$+0.8$
-1	$+1$	$+1$	-0.2
$+1$	-1	$+1$	$+1.8$
-1	-1	$+1$	$+0.8$
$+1$	$+1$	-1	-0.8
-1	$+1$	-1	-1.8
$+1$	-1	-1	$+0.2$
-1	-1	-1	-0.8



Receivers under ISI - Exercise 2

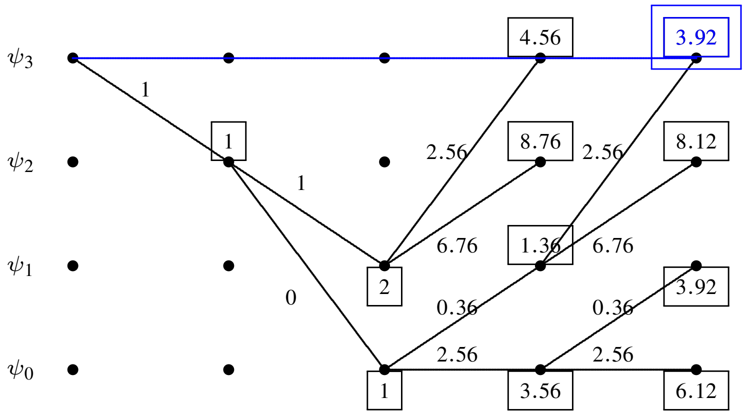
Trellis diagram for constellation of errors $\xi[n] = A_i[n] - A_j[n]$
For a 2-PAM $\xi[n] \in \{+2, 0, -2\}$ Now $o[n] = \frac{1}{2}\,\xi[n] - \frac{1}{2}\,\xi[n-1] + 0.8\,\xi[n-2]$

$\xi[n]$	$\xi[n-1]$	$\xi[n-2]$	$o[n]$
$+2$	$+2$	$+2$	$a_1 \equiv +1.6$
$+0$	$+2$	$+2$	$a_2 \equiv +0.6$
-2	$+2$	$+2$	$a_3 \equiv -0.4$
$+2$	$+0$	$+2$	$b_1 \equiv +2.6$
$+0$	$+0$	$+2$	$b_2 \equiv +1.6$
-2	$+0$	$+2$	$b_3 \equiv +0.6$
$+2$	-2	$+2$	$c_1 \equiv +3.6$
$+0$	-2	$+2$	$c_2 \equiv +2.6$
-2	-2	$+2$	$c_3 \equiv +1.6$
$+2$	$+2$	$+0$	$d_1 \equiv +0$
$+0$	$+2$	$+0$	$d_2 \equiv -1$
-2	$+2$	$+0$	$d_3 \equiv -2$
$+2$	$+0$	$+0$	$e_1 \equiv +1$
$+0$	$+0$	$+0$	$e_2 \equiv +0$
-2	$+0$	$+0$	$e_3 \equiv -1$
$+2$	-2	$+0$	$f_1 \equiv +2$
$+0$	-2	$+0$	$f_2 \equiv +1$
-2	-2	$+0$	$f_3 \equiv +0$
$+2$	$+2$	-2	$g_1 \equiv -1.6$
$+0$	$+2$	-2	$g_2 \equiv -2.6$
-2	$+2$	-2	$g_3 \equiv -3.6$
$+2$	$+0$	-2	$h_1 \equiv -0.6$
$+0$	$+0$	-2	$h_2 \equiv -1.6$
-2	$+0$	-2	$h_3 \equiv -2.6$
$+2$	-2	-2	$i_1 \equiv +0.4$
$+0$	-2	-2	$i_2 \equiv -0.6$
-2	-2	-2	$i_3 \equiv -1.6$



Receivers under ISI - Exercise 2 - Calculating D_{min}

Minimum distance with respect to the sequence $A[n] = +1, \forall n$

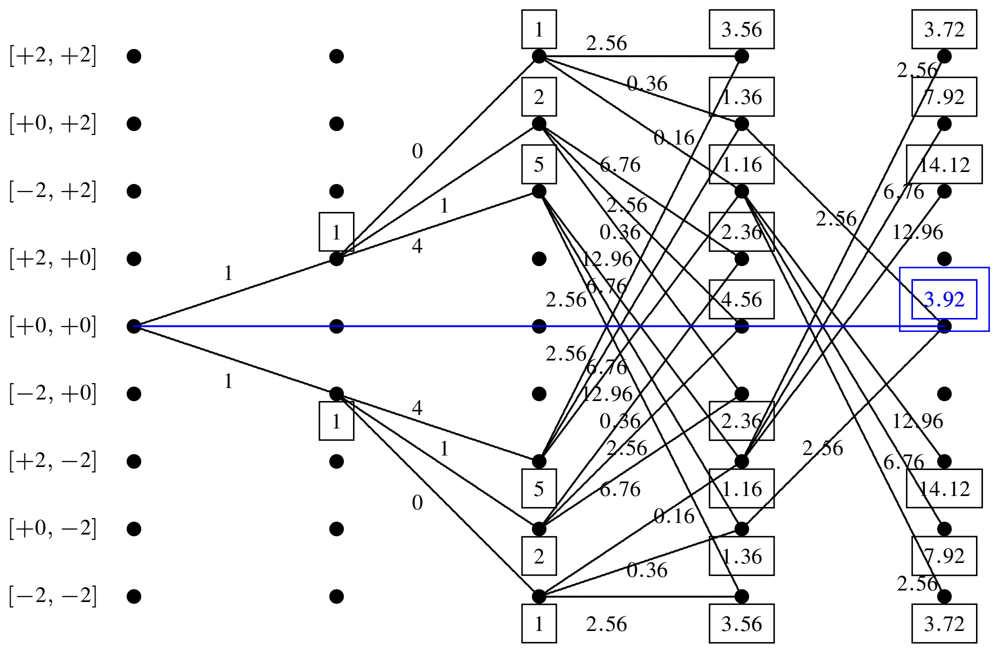


$D_{min} = \sqrt{3.92}$

$D_{min} = 1.9799$

Receivers under ISI - Exercise 2 - Calculating D_{min}

Minimum distance calculated through the constellation of errors: reference $\xi[n] = 0, \forall n$



$D_{min} = \sqrt{3.92}$

$D_{min} = 1.9799$

REMARK: Only two branches move back to state $[+0, +0]$,and both have metric 2.56

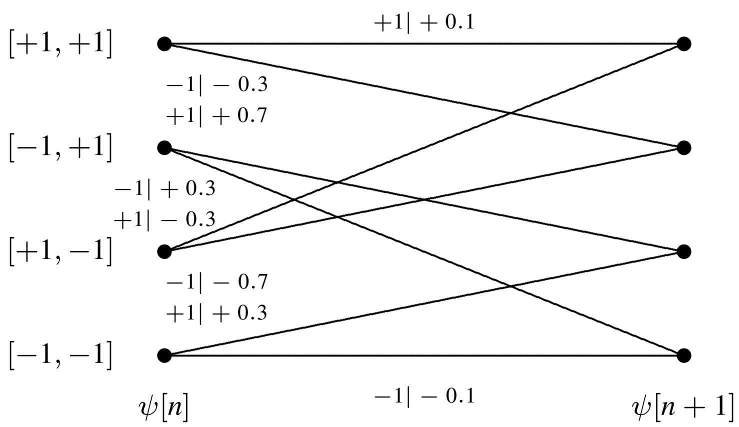
Receivers under ISI - Exercise 9

- Transmission of a 2-PAM ($A[n] \in \{\pm 1\}$) through channel

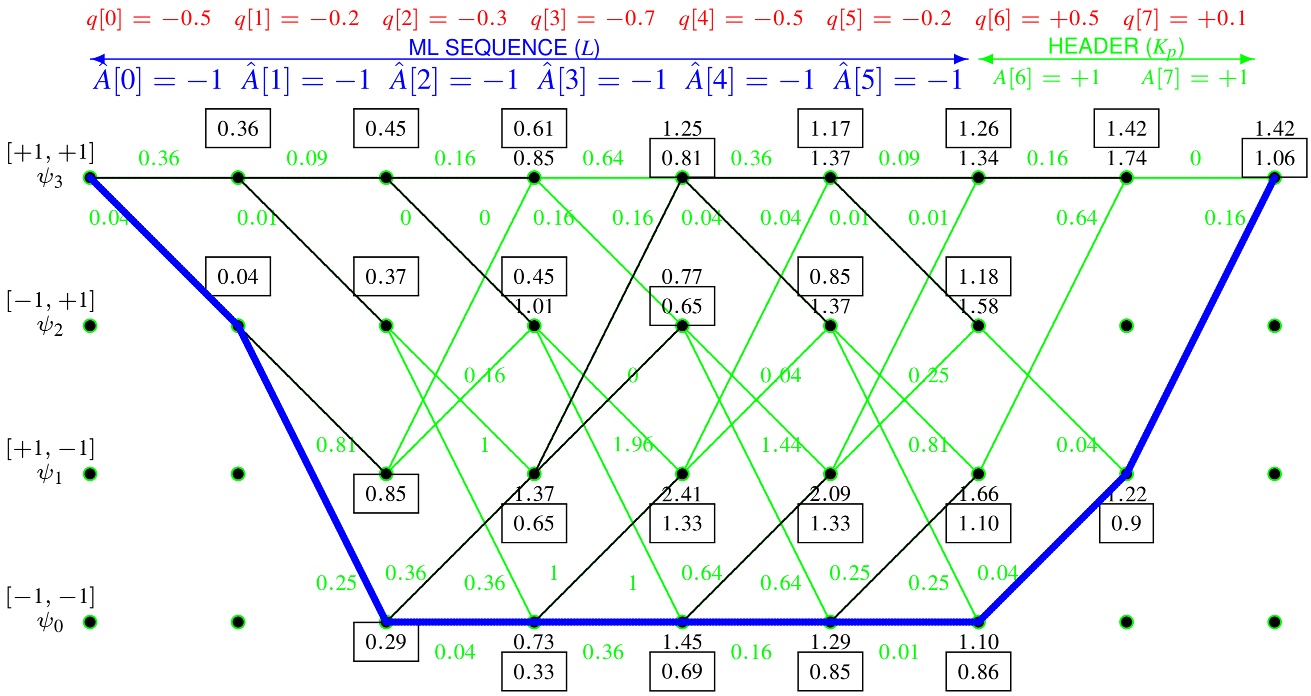
$$p[n] = 0.2\,\delta[n] - 0.3\,\delta[n-1] + 0.2\,\delta[n-2]$$

- Noiseless output: $o[n] = 0.2\,A[n] - 0.3\,A[n-1] + 0.2\,A[n-2]$
- Trellis diagram

$A[n]$	$A[n-1]$	$A[n-2]$	$o[n]$
$+1$	$+1$	$+1$	$+0.1$
-1	$+1$	$+1$	-0.3
$+1$	-1	$+1$	$+0.7$
-1	-1	$+1$	$+0.3$
$+1$	$+1$	-1	-0.3
-1	$+1$	-1	-0.7
$+1$	-1	-1	$+0.3$
-1	-1	-1	-0.1



Receivers under ISI - Exercise 9



- Green: branches to be considered for decoding (and corresponding metric)
- Black: survival paths for every state
- Blue: path for the maximum likelihood sequence