Lecture #10

10/12/2016

Last Class

- Orthogonal Codes
- CDMA Near Far Problem
- Convolutional Code Encoding

Today

- Convolutional Code Decoding

Next Class

- 3G Technologies

Announcements

- Homework #5 Due
- Homework #6 Posted
- Exam #1 (10/24/2016)

Convolutional Code Decoding

Due to transmission errors, a 1 to 1 mapping between transmitted sequences and observed sequences not always possible

The receiver must determine the "best possible" sequence of message bits (i.e. transmitter states)

Decoders that infer the most likely sequence are known as *Maximum Likelihood Decoders*

The approach of working with uncertainty is known as *soft-decision decoding*.

Deciding whether each bit is a 0 or 1 is called *hard decision decoding*

The Viterbi algorithm is widely used to decode convolutional codes

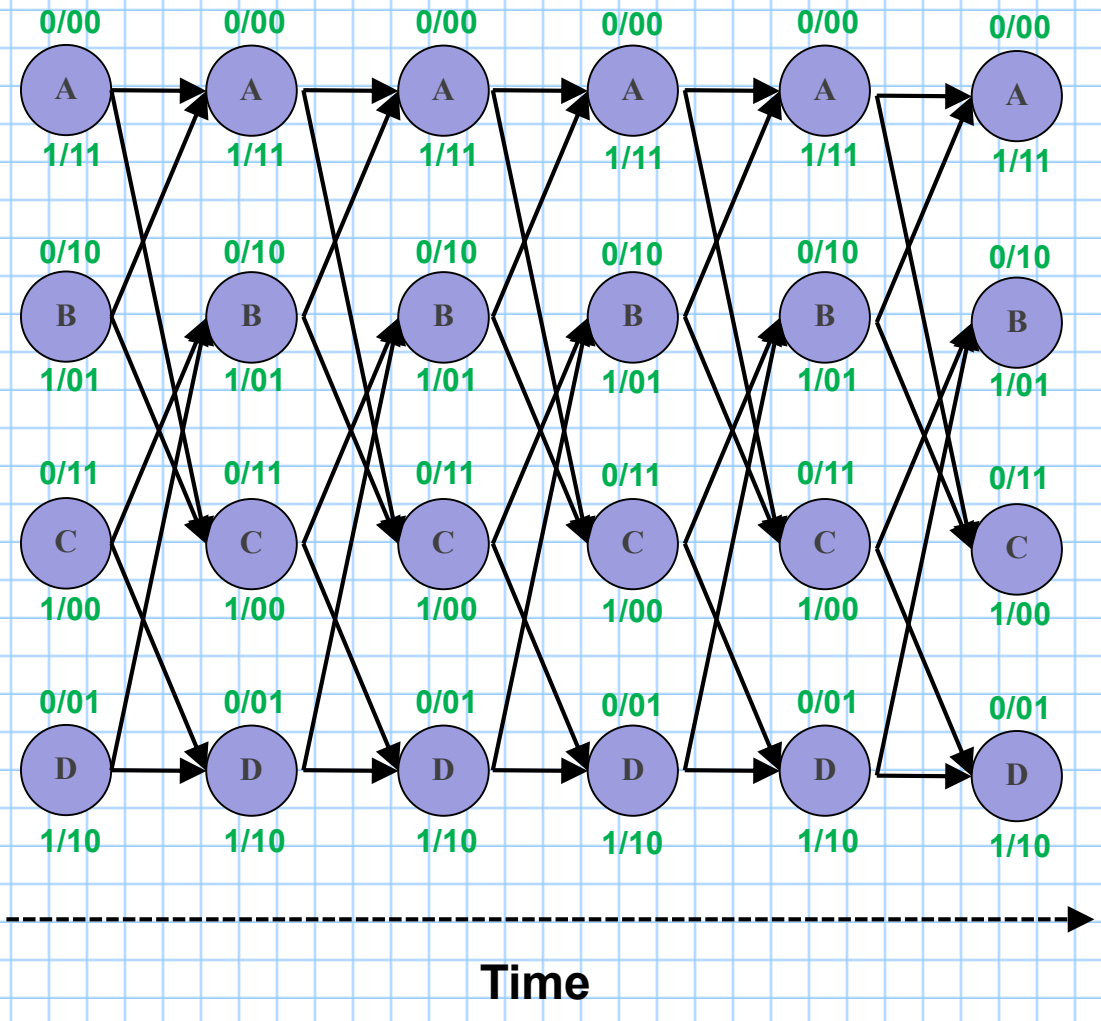
- **Walk the received sequence**
- **For each state, keep track of possible input sequence that would have produced observed sequence**
- **Input sequence requiring fewest errors is most likely**

Convolutional Code Encoding (Trellis View)

Another way the encoder can be represented is as a *trellis*

A trellis shows how a state machine evolves over time

Ex: Trellis representation of r = 2, k =3 convolutional encoder from previous examples



Convolutional Code Decoding (Trellis View)

We can now think about what the decoder needs to do in terms a trellis

Viterbi convolutional decoders find the maximum likelihood path through the Trellis

The Hamming distance between received and expected values can be used as a metric to evaluate paths

EX: After transmission through a noisy channel, the received encoded sequence is 11 10 11 00 01 10 (Bit Errors Highlighted)