Probabilistic Models

What is a model?
- Description of reality
- Helps us simplify things. To capture important/highlight of something.
- So that... analysis, design.
- Ideally come up with a simplest possible model that explains reality.

Ex
F = ma

Ex: Toss a coin: H or T.
use models → design + analysis.

What about probabilistic models?

System have to operate or face up uncertainty, outcomes can not be predicted ahead of time.

Ex 1. Thermal noise in cool system
2. imperfect knowledge.
3. too complex to model deterministically.

Prob Performance Criteria

Design: make rational decisions that do well on average or most of the time.

Ex Dig. Com.

Info bits 0, 1, 0...

Encoder

Transmitted signal

Waveform

Noisy channel

Corrupted signal

Decoder

Bit
Binary Symmetric Channel (BSC)

Performance criteria: $\varepsilon$ must be $10^{-3}$

How to increase reliability:
- Redundancy
- But this wastes bandwidth
- Trade off data rate with error probability
Buffer 1.5 mb/s.

- If the buffer size is too large, packets get dropped.
- If the incoming rate is too high, packets get dropped.
- Statistical multiplexing goes on.
- Criteria: minimize prob of packet loss.
- How many users should I admit so that I achieve certain prob of packet loss?
Quantizing amplitude of speech waveform.

PDF

Min  0  Max

Criteria: minimize quantization error.

4bit + A/D

2^4 = 16