

The Binary Symmetric Channel

A Bernoulli Trial

Prof Hans Georg Schaathun

Høgskolen i Ålesund

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A Simple Communications Channel

Noise

Terminology



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The Binary Symmetric Channel

- A channel is a probabilistic function.
- The sender provides input, and the receiver gets output.
- The output may or may not be equal to the input.

- For example, the Binary Symmetric Channel (BSC)

$$\text{Probability } p : \begin{cases} 1 \mapsto 0 \\ 0 \mapsto 1 \end{cases} \quad (1)$$

$$\text{Probability } 1 - p : \begin{cases} 1 \mapsto 1 \\ 0 \mapsto 0 \end{cases} \quad (2)$$

- The Channel Output is a Stochastic Variable

Bernoulli Trial

Definition (Bernoulli Trial)

A Bernoulli trial is an experiment where

- there are **two** possible outcomes **Success (S)** or **Failure (F)**.
- the probability $P(S)$ of success is the same for every experiment.
- each experiment is independent of any previous experiment.

Clearly if we write $p = P(S)$, we have $P(F) = 1 - p$.

Summary

A Communications Channel is a probabilistic function.

- E.g. The Binary Symmetric Channel (BSC).

Transmitting one bit over a BSC is a Bernoulli trial.

- The result is either

Success Correct transmission.

Failure Transmission error, where b is sent and $b \oplus 1$ is received.