

Information theory
To be finished in 60 minutes

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Name

What is the advantage and disadvantage of applying block interleaving over a noisy channel?

advantage:

disadvantage:

How many errors can you correct/detect using a block code with a code distance of 7? If you implement a combined correction/detection strategy, what combinations are possible?

Find the Huffman code for the source below.

$c_i = ?$	a_i	p_i
	A	0.1
	B	0.05
	C	0.1
	D	0.2
	E	0.25
	F	0.3

In a city traffic jam we measure 0.5 bit of information from the tooting and shouting considered as a source (denoted by TS), while we measure 0.3 bit from the cloud patterns in the sky (C). What is the mutual entropy and mutual information of the two sources, and what are the conditional entropies of one over the other? (please give **four concrete numbers** as an answer)

When coding a source with LZ code, what is sent over the channel to the decoder?

What the correctable single-error vectors of the 5x binary repetition code?

What is the definition of information? How can we measure information? What is the measurement unit of information?

State the channel coding theorem.

Define the concept of bit error rate. Which codes can be characterized by their bit error rate?

What is the expected number of errors in a single code word of a (15, 11) Hamming code when it is transmitted over a binary symmetric channel with an error probability of 0.1?

We have two binary symmetric channels, one with an error probability of 0.5 and another with an error probability of 0.6. Which one is more suitable for information transmission and why?

Define the concept of *prefix* source codes.

Draw a block diagram showing the channel coding process.

Define the concept of *cyclic* block codes.

Why is it advisable to use systematic linear block codes in contrast to general linear block codes?

Define the concept of mutual information.

Specify the parity check matrix and the corresponding generator matrix of a (7,4) Hamming code.

Using the code above, find the code vector and the syndrome for the message vector $[1\ 0\ 0\ 1]$.