LUND UNIVERSITY
Electrical and Information Technology

Information Theory, 2014

EITN45, 7.5 credits

The course introduces the concepts of Information and Information Theory, and gives the basic principles of storing, compressing ans transmission of information. In all times communication has been one of the basic needs of humanity. In 1948 Claude Shannon published a landmark paper where he introduced information theory. One of the fundamental results was that all information can be represented in binary form, and today we have a variety of digital communication systems spanning from digital TV and mobile phones to Internet as a whole. We use them on a regular basis and many important structures rely on them, e.g. the telephony system, required to be one of the most reliable communication systems, is based on digital communications where the traffic is transmitted over fiber optic connections. We also use digital media, such as CD, DVD and flash memories, to store and distribute audio and video. The list can be made much longer with for example satellite communication and navigation equipment. Despite this we are still at the beginning of the evolution, and the world will see many more different kinds of communication systems and applications. It is remarkable that all of the above systems, that together has changed our way of living during the last 50 years, in some sense falls back to the theory from Shannon. In this course you will be given the fundamentals of Information Theory. It will explain and set up the theoretical limitations and possibilities of modern communication systems.

Schedule There are two lectures and one exercise each week. The lectures are given by Stefan Höst and the exercises by Eduardo Medeiros.

Registration All students must be registered in Ladok. A list will be circulated during the first lecture and available the first two weeks.

Web Course home page `www.eit.lth.se/course/eitn45`.

Literature Compendium *Information Theory Engineering*, sold at KFS for 250 kr.

Exam Hand in problems and home exam.

Preliminary plan of lectures

Lecture		Part	Chapter
L1	17/3,10-12	Information measure	(Ch 2), 3.1-2
L2	19/3,10-12	Properties of information	3.2-3
E1	20/3,10-12		
L3	24/3,10-12	Entropy rate of Markov sources	3.4
L4	26/3,10-12	Kraft inequality and source coding	4.1-2
E2	27/3,10-12		
L5	31/3,10-12	Huffman codes	4.3
L6	2/4,10-12	Lempel-Ziv algorithms	5.1-3
E3	3/4,10-12		
L7	7/4,10-12	AEP and its consequences	6.1-3
L8	9/4,10-12	Channel coding theorem	6.3-4
E4	10/4,10-12		
Eastern		Eastern Eastern Eastern	
L9	5/5,10-12	Channel capacity	6.5
L10	7/5,10-12	Channel coding	7.1 (7.2?)
E5	8/5,10-12		
L11	12/5,10-12	Differential entropy	8.1-2
L12	14/5,10-12	Gaussian channel	9.1-2
E6	15/5,10-12		
L13	19/5,10-12	Shannon's fundamental limit	9.3-4
L14	21/5,13-15	Reserve	
E7	22/5,10-12		

The schedule for the exercises as well as a file with the selected problems and solutions can be found on the course home page. The problem schedule will be updated on the home page.

All lectures and exercises are scheduled in E:2311.