LUND UNIVERSITY
Electrical and Information Technology

Information Theory, 2012

EIT080, 7.5 credits

The course introduces the conscpets of Information and Information Theory, and gives the basic priciples 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 sructures 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 trasmitted 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 ears, in some sence 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 problem solving class each week. The lectures are given by Stefan Höst and the classes by Adnan Prlja. See web page for details.

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/eit080`.

Literature Thomas M. Cover and Joy A. Thomas, *Elements of Information Theory (2nd ed)*, and complementary material.

Exam During the course there will be four hand in problem (Information measure, Huffman coding, LZ and Gaussian channel).

The exam is a home exam.

Plan of the lectures and classes

Lecture		Part	Chapter
L1	12/3,10-12	Information measure	2.1-2.2
L2	14/3,10-12	Basic properties of entropy	2.3-2.10
C1	15/3,10-12		P1-12
L3	19/3,10-12	Entropy rate of Markov sources	4.1-4.5
L4	21/3,10-12	AEP and Source coding theorem	3.1-3.3
C2	22/3,10-12		P13-19
L5	26/3,10-12	Source coding and Kraft inequality	5.1-5.5
L6	28/3,10-12	Huffman codes	5.6-5.8
C3	29/3,10-12		P20-26,28,29
Eastern		Eastern Eastern Eastern	Eastern
L7	16/4,10-12	Universal source coding	13.4-13.5
L8	18/4,10-12	Ziv-Lempel	(13.1-13.2)(*)
C4	19/4,10-12		P30,31,33,34,36
L9	23/4,10-12	Channel coding theorem	7.5-7.13
C5	26/4,10-12		P37-40
L10	27/4,10-12	Channel Capacity	7.1-7.4
L11	3/5,8-10	Channel Coding	(*)
C6	4/5,10-12		P41-45+more
L12	7/5,10-12	Differential entropy	8.1-8.6
L13	9/5,10-12	Gaussian channel	9.1-9.5
C7	11/5,10-12		P47-53
L14	14/5,13-15		
C8	15/5,13-15		

(*) Will be distributed

A file with the selected problems and soultions can be found ion the course home page. The problem schedule after eastern is likly to change.

All lectures and classes are scheduled in E:2311, except 9/5 which is in E:3139.