

Réseaux, information et communications

Lecturers

Guy LEDUC (Coordinator) and Jean CARDINAL

Course mnemonic

INFO-F303

ECTS credits

5 credits

Language(s) of instruction

French

Course period

First term

Campus

Plaine

Course content

Information Theory:

1. Coding theory: block codes & instantaneous codes, Kraft's & McMillan's inequalities
2. Random source: quantity of information and entropy, optimal codes (Shannon-Fano code, Huffman codes)
3. Lossless Compression: extensions of a source, Shannon's Noiseless Coding Theorem, LZW method & adaptive codes (FGK, Vitter)
4. Noisy Channel: cross, conditional and mutual information ; associated entropies, essential properties, channel capacity
5. Binary Symmetric Channel: reliability, information rate, Shannon's Fundamental Noisy Channel Theorem
6. Error-Correcting Codes: Hamming distance & fundamental inequalities
7. Linear Codes: generator & parity check matrix, canonical form, syndrome decoding, Reed-Müller codes, perfect codes (Hamming codes, Golay codes), polynomial codes, cyclic codes (BCH codes), MDS codes (Reed-Solomon codes)

Network Theory:

1. Internet architecture: network edge/core/access, protocol layers, history.
2. Application layer: web and HTTP, DNS, socket programming.
3. Transport layer: (de)multiplexing, connectionless transport (UDP), reliable data transfer, connection-oriented transport (TCP), congestion control.
4. Network layer: virtual circuit and datagram networks, router architecture, Internet Protocol (IP), addressing and forwarding, routing algorithms (RIP, OSPF, BGP).
5. Link layer and Local Area Networks: Error detection, multiple access protocols (Aloha, CSMA/CD, Ethernet), addressing, hubs/switches, transparent bridges, spanning tree protocol.

Objectives (and/or specific learning outcomes)

At the end of the course students will understand well the principles of computer networks, their layered architectures (OSI and TCP/IP models), the fundamental mechanisms governing the protocols in various layers, and some examples of existing protocols.

Pre-requisites and co-requisites

Co-requisites courses

INFO-F201 | Systèmes d'exploitation | 5 crédits, MATH-F307 | Mathématiques discrètes | 5 crédits and MATH-F315 | Probabilités et statistiques | 5 crédits

Course having this one as co-requisite

INFO-F309 | Administration de systèmes | 5 crédits

Teaching method and learning activities

Course + problem solving lessons

References, bibliography and recommended reading

Information Theory:

Jiří Adámek, Foundations of Coding, John Wiley, 1991

Richard W. Hamming, Coding and Information Theory, Prentice-Hall, 1980

Other on-line reference through Virtual University Web site

Network Theory:

James F. Kurose and Keith W. Ross. Computer Networking - A Top-Down Approach (Sixth Edition), Addison-Wesley, 2012. A cheaper and identical edition is published by Pearson Education (ISBN 978-0-273-76896-8), 2013.

Slides: <http://www.montefiore.ulg.ac.be/~leduc/cours/reseaux.html>

Other information

Place(s) of teaching

Plaine

Contact(s)

Guy Leduc : <http://www.run.montefiore.ulg.ac.be/People/GuyLeduc/index.php>

Christophe Petit : <http://homepages.ulb.ac.be/~chripeti/index.html>

Evaluation method(s)

written examination and Practice work

Evaluation method(s) (additional information)

Information theory part : written exam with open books. Duration: 1h30.

Network part : written exam, closed books. duration: 2h30.

Determination of the mark (including the weighting of partial marks)

> TInformation theory : 25%

> Network theory : 55%

> Network labs : 20%

> In August, same weighting, except when network labs are worse than network exam, in which case the lab mark is discarded and the network exam mark is weighted at 75%.

Main language(s) of evaluation

French

Programmes

Programmes proposing this course at the faculty of Sciences

BA-INFO | Bachelor in Computer science | unit 3

