Theory of information coding computing and complexity

Lecturers
Nicolas CERF (Coordinator) and Jérémie ROLAND

Course mnemonic
INFO-H422

ECTS credits
5 credits

Language(s) of instruction
English

Course period
Second term

Campus
Solbosch

Course content

Information and coding theory

- Shannon entropies
- asymptotic equipartition (typical sequences)
- source coding (e.g., Huffman codes)
- channel capacity
- channel coding and error correcting codes (e.g., Hamming codes)

Computability theory

- computation models
- notions of algorithm and language
- decidable, semi-decidable and undecidable problems
- notion of reduction between problems

Complexity theory

- P and NP classes
- polynomial reduction
- NP-completeness and heuristics

Objectives (and/or specific learning outcomes)

Goal: to develop an understanding of information, coding, computing and complexity theories

At the end of the course, students will be able to:

- rigorously define all studied notions (including tools and related mathematical models)
- illustrate these notions through examples and/or formal proofs
- explain the use and application field of these notions
- solve fundamental problems in information theory such as computing a channel capacity or constructing source codes and error correcting codes

Pre-requisits and co-requisits

Course having this one as co-requisit

MEMO-H504 | Mémoire de fin d'études en Informatique | 20 crédits

Teaching method and learning activities

- Theory courses (all sections)
- Exercice sessions (information and coding theory only)

References, bibliography and recommended reading

- T.M. Cover and J.A. Thomas, Elements of information theory, (John Wiley and Sons, New York, 2006)
- M. Sipser, Introduction to the theory of computation, (Cengage Learning, 2013)

Course notes

Podcast and Université virtuelle

Other information

Place(s) of teaching

Solbosch

Contact(s)

- Nicolas CERF (Nicolas.Cerf@ulb.be)
- Jérémie ROLAND (Jeremie.Roland@ulb.be)

Evaluation method(s)

Oral examination

Evaluation method(s) (additional information)

Open book oral examination

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

100% final exam evaluation.

Both parts of the course will be graded on a scale from 0 to 20.

The global grade is the weighted average of these two grades (the part on "Information and coding theory" counts for 60%, while the part on "Computing and complexity theory" counts for 40%), rounded to the closest half integer.

If the credits of the course are not acquired after a given evaluation session, any partial grade (for one part of the course) that is higher or equal to 10/20 will be automatically transferred to the next session. In no circumstances will a grade strictly lower than 10/20 be transferred to another session.

Main language(s) of evaluation

English

Other language(s) of evaluation, if applicable

French

Programmes

Programmes proposing this course at the Brussels School of Engineering

MA-IREL | Master of science in Electrical Engineering | finalité electronics and information technologies/unit 2 and MA-IRIF | Master of science in Computer Science and Engineering | finalité Professional/unit 1