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