

LLSMA2002 : Quantitative Research Methods in Management

Logic and Algorithms

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1 Objectives

The main objective of the course is to strengthen the logic reasoning skills for Ph.D. students, in order to help them develop rigorous arguments in order to write articles for scientific journals. The secondary objective is also to help them develop algorithms in order to solve problems that would come up in their thesis.

The main chapters of the course will be:

- Logic, automata and context free languages. Automata are very simple objects that can be used to start developing simple but very rigorous proofs.
- Turing machines. Turing machines build on automata to make it possible to build more elaborate proofs.
- Computability and Complexity theory. Based on the logic framework of the previous chapters, we will now analyze questions such as: does a problem have an answer? (surprisingly it is possible to prove that some questions cannot be answered) how can we prove that a problem is difficult to solve?
- Analysis of algorithms. In this last section we apply the concepts seen before to analyze some generic algorithms.

2 Teaching method

The course will be organized in flipped classroom mode, the students are expected to read the material before class, a forum will be set up in order to interact electronically during the reading. During the class sessions we will solve problems interactively.

The evaluation will be entirely based on the class participation.

3 Tentative Schedule

The schedule below can be adapted as a function of the interests of the participants to the course.

Date	Topic	Reference
Sept 26, 9:30 – 12:30	Introduction	ITC Chap 0+
Oct 3, 9:30 – 12:30	Regular Languages	ITC Chap 1
Oct 10, 14 – 17	Context Free Languages	ITC Chap 2
Oct 16, 9:30 – 12:30	Turing Machines + Decidability	ITC Chap 3
Oct 17, 9:30 – 12:30	Decidability	ITC Chap 4
Oct 31, 9:30 – 12:30	Reducibility	ITC Chap 5
Oct 31, 14 – 16	Complexity theory	ITC Chap 7

Room : Coubertin05

4 Bibliography

ITC *Introduction to the Theory of Computation, 3rd Ed.*, Michael Sipser, Cengage Learning, 2012.

AD *Algorithm Design*, Jon Kleinberg, Eva Tardos, Addison-Wesley, 2006.