



UNIVERSIDADE LUSÍADA
LISBOA

Course Unit Program
Computation Theory

Academic Year 2024/2025

1. Organic Unit

Faculty of Business and Economic Sciences

2. Course

Computer Engineering

3. Cycle

1st

4. Course Unit

Computation Theory (L9030)

5. Scientific Area

6. Curricular Year

3rd

7. Type of Curricular Unit / Semester

1st Semester



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8. Class type and workload (work time)

Theoretical classes:

Practical classes:

Theoretical-Practical Classes 30,00

Tutorial Guidance: 20,00

9. ECTS Credits

6,00

10. Scientific Area Coordinator

11. Regent

Prof. Doutora MARIA INÊS VASCONCELLOS FURTADO

12. Assistants

13. Teaching Language

Portuguese

14. General Objectives

To Introduce the theoretical and practical foundations of the Theory of Computation, emphasizing the application of automata and grammars in the solution of computational problems. Students will be able to understand, model and simulate computational systems using automata and formal languages.

15. Specific Objectives

Explore the basic concepts of deterministic and non-deterministic finite automata, enabling students to build and simulate models in JFLAP.

Investigate automata models with output (Moore and Mealy), highlighting their applications and fundamental differences.

Introduce context-free languages (CLLs) and context-free grammars (CLGs), giving students the ability to build and simplify these models in JFLAP.

Train students in the practical application of Chomsky and Greibach normal forms for simpl

16. Skills to be acquired

Build and simulate deterministic and non-deterministic finite automata in JFLAP.

Differentiate and apply automata models with output (Moore and Mealy) to practical problems.

Develop and manipulate context-free languages by constructing and simplifying GLCs.

Apply Chomsky and Greibach normal forms to optimize the representation of GLCs.

Use JFLAP effectively to implement and simulate theoretical models in computing, including string validation and natural language processing.



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17. Teaching Methodology

Introduction to the theoretical material followed by the analysis and commentary of significant examples. Submission of work to be done autonomously by students to complement the lectures.

18. Course Unit Program



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- 1 Introduction to the Theory of Computation and the use of JFLAP
 - 1.1 Basic concepts of computer theory
 - Definition of automata and their importance in computer science.
 - Motivation and applications in computing.
 - 1.2 Introduction to JFLAP
 - Initial configuration of JFLAP.
 - User interface and basic navigation.
 - Initial example of creating a simple automaton.
2. Deterministic Finite Automata (AFDs)
 - 2.1 Definition and Structure of AFDs
 - States, alphabet, transition function and initial/acceptance state.
 - 2.2 Examples and Simulations in JFLAP
 - Step-by-step construction of an AFD in JFLAP.
 - Practical examples.
3. Non-deterministic Finite Automata (NFAs)
 - 3.1 Introduction to AFNs
 - Definition and comparison with AFDs.
 - 3.2 Simulations in JFLAP
 - Building and simulating AFNs in JFLAP.
 - Examples of problems that can be modeled by AFNs.
4. Automata with output: Moore and Mealy models
 - 4.1 Moore automata
 - Definition, structure and practical example in JFLAP.
 - 4.2 Mealy automata
 - Definition, structure and practical example in JFLAP.
 - 4.3 Comparing Models
 - Differences in output between Moore and Mealy.
5. Context Free Languages (CLLs)
 - 5.1 Introduction to CLLs
 - Definition and importance in computer theory.
 - 5.2 Context-Free Grammars (CLGs)
 - Definition and relation to CLLs.
 - Building GLCs in JFLAP.
6. Simplification of GLCs
 - 6.1 Chomsky Normal Form
 - Definition and transformation examples.
 - 6.2 Greibach Normal Form
 - Definition and examples of transformation.
 - 6.3 Applications and examples in JFLAP
 - Practical implementation of normal forms in JFLAP.
7. Stack Automata
 - 7.1 Definition and Structure of APs
 - States, alphabet, transition function, stack and initial/acceptance state.



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- 7.2 Examples and Simulations in JFLAP
 - Practical examples.
- 7.3 Examples of Applications in Computing
 - Use of automata for string validation, natural language processing, among others.

19. Assessment Methods

Assiduity and level of student participation. Completion of worksheets and two assessment tests

20. Didactic Resources

The classes will be given, whenever possible, using visual presentations.
Computers in practical classes with JFLAP.
Theoretical-practical lectures and exercises.

21. Sustainability Objectives

22. Keywords

Theory of computation
Automata
Languages



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23. Main Bibliography

Author(s): Michael Sipser
Title: Introduction to the Theory of Computation
Edition: 2 Year: 2005
Local:
Publisher: Course Technology

Author(s): Wayne Goddard
Title: Introducing the Theory of Computation
Edition: 1 Year: 2008
Local:
Publisher: Jones & Bartlett Publishers

Author(s): Hopcroft, John E.
Title: Introdução à teoria de autômatos, linguagens e computação
Edition: Year: 2003
Local:
Publisher: Ed Campus

24. Complementary Bibliography

Author(s): C. H. Papadimitriou, H. R. Lewis.
Title: Elements of the Theory of Computation
Edition: Year:
Local:
Publisher: Prentice Hall

Author(s): Susan Rodger and Thomas Finley
Title: JFLAP Version 7.1
Edition: Year:
Local: On-line
Publisher: <https://www.jflap.org/>



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Ficha técnica MIP / MIP Datasheet	
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