University Mohamed Khider - Biskra
Faculty of Exact Sciences and Natural Sciences
Department of Computer Science

COURSE PLAN: Rewriting Logic and Its Applications

Dr.Mohamed RAMDANI
2023-2024

Contents

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1 Course Informations

This section allows you to provide all the basic information relating to the course:

- *Faculty of Exact Sciences and Natural Sciences*
- *Department of Computer Sciences*
- *Course Title:* Rewriting Logic and Its Applications.
- *Semester:* S3
- *EU title:* Formalisms and high-level development
- *Credits :* 06
- *Coefficient :* 03
- *Duration :* 14 weeks
- *Time :* Tuesday 8h- 9h30
- *Place:* Room B11
- *Instructor: Dr. Mohamed RAMDANI.*
- *Mail:* mohamed.ramdani@univ-biskra.dz
- *Contact Hours:*

  In the office, laboratory number 20: Sunday, Monday and Tuesday.

  On the forum and by email I undertake to answer questions relating to the course to the best of my ability.

2 Course Presentation

This course provides an in-depth exploration of rewriting logic and its applications in various fields of computer science, mathematics, and software engineering. Rewriting logic is a powerful formalism that serves as a foundation for specifying, modeling, and reasoning about complex systems. It has found applications in areas such as programming language semantics, formal methods, software verification, and the modeling of concurrent and distributed systems.

3 Prerequisites

To take this course, it is typically beneficial to have a strong foundation in certain prerequisite subjects. These may include:

- **Basic Logic:** A fundamental understanding of propositional and predicate logic is essential.
- **Mathematical Reasoning:** Proficiency in mathematical concepts and reasoning, including set theory, relations, and functions, is recommended.
- **Computer Science Fundamentals**: Familiarity with basic computer science concepts, such as data structures, algorithms, and programming languages, can be advantageous.
- **Discrete Mathematics:** Knowledge of discrete structures like graphs, trees, and discrete probability is often helpful.
- **Formal Methods:** Understanding formal methods and their applications in software engineering and computer science is beneficial.

Additionally, a passion for problem-solving, and critical thinking, and an eagerness to explore the practical applications of logic rewriting can significantly enhance the learning experience.

4 Learning Objectives:

At the end of this course, the learner will be able to:

1. **In terms of Knowledge:**

- Acquire a deep understanding of rewriting logic and its theoretical foundations.
- Demonstrate knowledge of various practical applications of rewriting logic in different domains.

2. **In terms of Skills:**
   - Apply rewriting logic to solve complex problems effectively.
   - Develop software and systems using rewriting logic as a modeling and specification technique.
   - Analyze and evaluate existing systems using rewriting logic to identify potential improvements.
3. **In terms of Attitudes and Behaviors:**
   - Cultivate a problem-solving mindset, utilizing rewriting logic as a tool to approach challenges.
   - Foster a collaborative and innovative approach to problem-solving within the field of rewriting logic.
   - Embrace a continuous learning attitude to stay updated with the latest developments in rewriting logic and related technologies.

5 Course Outline

The course is divided into six learning units, each of which is covered through pedagogical sequences aimed at facilitating the understanding of the intended concepts. This understanding is reinforced through learning activities and practice sessions where these concepts are implemented. The description of all the learning units is as follows:

1. **Unit 01: Introduction to Rewriting Logic**

   Definition and historical perspective

   Applications in software development and programming languages.
2. **Unit 02: Equational Specifications and Analysis**
3. **Unit 03: Modeling Distributed Systems in Rewriting Logic**

   Basics of Rewriting Logic in Distributed Systems Modeling.

   Formal Specification of Distributed Systems

4. **Unit 04: Modeling Concurrent Objects in Rewriting Logic**

   Basics of Rewriting Logic in Modeling Concurrent Objects.

   Formal Specification of Concurrent Objects.

5. **Unit 05: Application of Communication Protocol Modeling in Maude**

   Modeling Communication Protocols and Synchronization

   Modeling Secure Communication Protocols in Maude

6. **Unit 06: Case Study**

Throughout the course, practical exercises, case studies, and group projects will be employed to reinforce the understanding of the concepts and their real-world applications. The sequencing of units ensures a comprehensive grasp of concurrent object modeling using rewriting logic.

6 Teaching & Examination

1.30 hours 30 of lecture and 1.30 hours 30 of laboratory session (seminar) each week.

1. **Continued Evaluation:**
   - Practical Exercise Completion: 50%
   - Case Study and Implementation: 25%
   - Verification and Validation Task: 25%
2. **Final examination:** 1.30 hours written exam/semester.
3. **Grading Scale:** 67% Final examination + 33% continued evaluation.

7 Course Placement in the Program

Teaching unit : Formalisms and high-level development
Credits : 6
Coefficient : 3

8 Support Resources

- Maude: Specification and Programming in Rewriting Logic, Computer Science Laboratory, SRI International, 2005.
- Ölveczky, P. C. (2017). Designing Reliable Distributed Systems. Springer London.