$$\beta \equiv x \Rightarrow ((y \Rightarrow z) \Rightarrow x)$$

Model

Truth table

MATHEMATICAL LOGIC

Informal natural deduction

a	b	$a \Rightarrow b$
1	1	1
1	0	0
0	1	1
0	0	1

Syntaxe and semantic

The connectives

$$\forall x \in \mathbb{R} \quad \exists y > 0 \quad (x + y > 10)$$

Predicate Logic

Well-Formed Formula-WFF

a	b	$a \wedge b$
1	1	1
1	0	0
0	1	0
0	0	0

Propositional Logic

- Course Presentation
- Introduction

COURSE PRESENTATION

- **Level:** 2nd year Licence
- **Unit:** UEM (Mehodology)
- **Credits :** 4
- **Coefficient :** 2
- **Evaluation :** Coursework (**40%**) + Final Exam (**60%**)
- **Coursework :**
  - Interrogation: 10,
  - Attendance: 5,
  - Participation: 5

COURSE PRESENTATION

- **Course Description**
- This course aims to provide the basic notions of formal logic, mainly the syntax and semantics of propositional logic and first-order predicate logic.
- At the end of the course, the student will be able to manipulate logical expressions, check their well-formedness and deduce new expressions.
- The student will also be able to analyse the truth or falsity of a statement using the notions of satisfiability and model theory as well as verifying the validity of reasoning through systems of formal proof.

COURSE PRESENTATION

- **Course Content:**
  - Introduction
  - Propositional logic
    - Syntax
    - Semantic
    - Resolution
  - Predicate Logic
    - Syntax
    - Semantic

COURSE PRESENTATION

- **Bibliography**

  - J.L. Krivine. Elements of Mathematical Logic. North-Holland Publishing Company Amsterdam, 1967.
  - Ian Chiswell. Mathematical Logic. Oxford University Press. 2007
  - Shawn Hedman. A first course in logic : an introduction to model theory, proof theory, computability, and complexity, Oxford: Oxford University Press, 2004
  - Eliot Mendelson. Introduction to logic. Chapman & Hall, Fourth edition, 1997

COURSE PRESENTATION

- **Webography:**

1. R.A.G. Seely. Principles of mathematics and logic. A course for Liberal Arts students. Mathematics Department. John Abbott College, 2020 [Download]
2. M. Walicki. A history of logic. Chapater in Introduction to Mathematical Logic. 2011. [Download]
3. M. Mezghiche. Notes de Cours: LOGIQUE MATHÉMATIQUE [Download]
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MOODLE

https://elearning.univ-msila.dz/moodle/course/view.php?id=3923

INTRODUCTION

Mathematical Logic?

INTRODUCTION

- "Logic" has been defined as the science of right reasoning.
- The science of logic begins with a value-judgment: "what is right reasoning?"

Logic = reasoning = truth

- Reasoning is a discourse that establishes the truth of a fact.
- **Reasoning:** A series of arguments or propositions linked to each other, and organized in such a way as to lead to a conclusion.

INTRODUCTION

- Mathematical logic is based on a set of rules and a formal language.
- The main components of mathematical logic are the formulas representing the statements.

INTRODUCTION

- **Examples:**

Premises	If he deliberates the exam scores, the year is over
	he deliberates the exam scores
Conclusion	the year is over

Premises	All students are registered
	Amine is a student
Conclusion	Amine is registered

MATHENATICAL LOGIC AND COMPUTER SCIENCES

- Logic circuits are dependent on Boolean calculus.
- Logic is used in several branches of CS, such as:
  - Software Engineering: modeling tools for developing applications and in the problems of specification and verification of programs.
  - Databases: query languages.
  - Artificial Intelligence (AI): logic is used to represent facts and to infer conclusions.

TERMINOLOGY

- Language
- Syntax
- Semantic

LANGUAGE OF LOGIC

- It is a non-natural language constituted to avoid the ambiguity of the natural language by using different logical structures.
- "A sentence is lexically ambiguous when a word — or sequence of words — offers two distinct meanings"*.
- Example: He looks at someone with brown glasses.
  - He looks **at someone with brown glasses**.
  - He looks at someone **with brown glasses**.

SYNTAX AND SEMANTIC

- To formally and properly define the language of logic, we must distinguish syntax and semantics.

SYNTAX

- Syntax in English is the arrangement of words and phrases in a specific order. If you change the position of even one word, it's possible to change the meaning of the entire sentence.

Syntax defines how to write language formulas.

SYNTAX

- ***Only*** *Policeman fights crime.*
- *Policeman fights* ***only*** *crime.*

SEMANTIC

- **Semantics** is the study of linguistic meaning.
- Formal semantics relies on logic and mathematics to provide precise frameworks of the relation between **language** and **meaning**.

DISCIPLINES OF LOGIC