# Automated Reasoning

## - A Comprehensive Collection -

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# Contents

# Introduction

Welcome to the seminar on Automated Reasoning. This document is a compilation of various seminar materials designed to provide a comprehensive overview of the field. Here, we explore the fundamental concepts, methodologies, and applications of automated reasoning in computer science and logic.

This is an example of referencing Section

# Chapter 1

# The Boolean Satisfiability Problem

> **Propositional Variable**
>
> **Definition 1.1.** A **propositional variable** is an input variable (that can either be true or false) of a truth function. Propositional variables are the *basic building-blocks* of propositional formulas, used in propositional logic and higher-order logics.

**Example 1.1.** For a statement variable, a lowercase letter is usually used, for example: $p, q, r, \ldots$, and so on or lowercase Greek letters, for example: $\phi, \psi, \chi, \ldots$ and so on.

**Remark 1.1.** The citing of a propositional variable can be interpreted as an assertion that the proposition represented by that symbol is true. That is:

"$p$" means "$p$ is true".

> **Propositional Function (Formula)**
>
> **Definition 1.2.** A **propositional variable** is an input variable (that can either be true or false) of a truth function. Propositional variables are the *basic building-blocks* of propositional formulas, used in propositional logic and higher-order logics.

The boolean satisfiability problem (SAT) is the following: given a formula $F$ on propositional variables, does there exists an assignment $\mathcal{A}$ on theses variables, such that $\mathcal{A}(F) = 1$.

Given a formula $F$ over a set of propositional variables $\{x_1, x_2, \ldots, x_n\}$,

$$\exists \mathcal{A} : \{x_1, x_2, \ldots, x_n\} \to \{0, 1\} : \mathcal{A}(F) = 1.$$