[AI\_21.pdf - Google Drive](https://drive.google.com/file/d/13S4kSwV6MU3zWNKV2nKc81MW0ndBs0eP/view)

## Z3

Software by Microsoft Research, not a commercial product

Low level tool: used as a kernel (core, center) for more complicated calculations

no graphical interface, it is a professional tool

COMPUTATIONAL LOGIC

Logic: vague word, can mean anything.

Syllogism: logical argument that applies deductive reasoning to arrive at a conclusion based on two propositions that are asserted or assumed to be true.

all humans are mortal,

Socrates is a human

↓

Socrates is mortal

G. Boule, G. Frege found symbolic logic

Logic should he a kind of calculus you should be able to use computations in logic

foundations of mathematics: find the basic of math from which you could develop all the mathematics that we know

Logic

↓

started with philosophy

↓

renaissance of symbolic logic, logic is a branch of mathematics

↓

1960 math in programming DPLL

DPLL (Davis-Putnam-Logemann-Loveland), show how to find a boolean assignment that satisfy a formula

Propositional Logic: logic where you consider statements like blocks and you can connect them with prepositions (and, not, or). Could solve very limited problems

DPLL are now very commonly used, evolve in in DPLL MODULO THEORIES (known also as DPLL(T) )

SMT-solvers (*Satisfiability Modulo Theories*) : Tools implemented with DPLL(T)

SMT-lib2: uniform way (it is a standard) to write specification files

SMT-solvers are good for:

* Puzzle
* Constraint solving problems. When you have to build a time table or Games (like sudoku)
* Planning problem. Typical for AI, what action to do to get a precise goal
* Verification problem. Correction of circuit, programs or internet protocols… what to do be sure that your software/hardwares don’t have bugs

**Creative approach:**

For sudoku

Write down precisely the rule of the game in the format that is accepted by Z3 in such way that the system can find the solution by itself

You don’t write down the program for solving, you just say the rules

The system using the SMT-solvers is behaving depending of the situation