

Space & Congruence  
Compression of ProofsMaster- /Diplomstudium:  
European Master in Computational Logic

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## Proof Compression

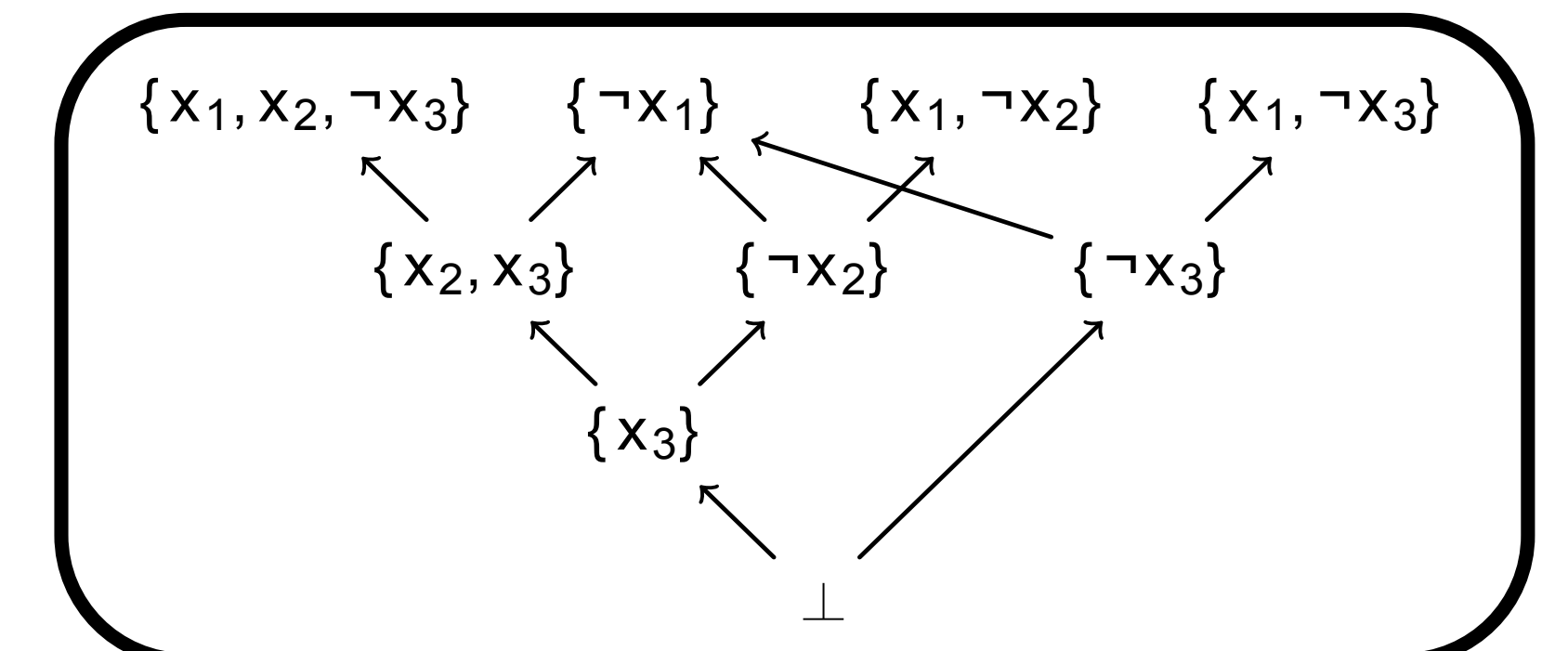
We present two methods for compression of formal proofs. Formal proofs are of great importance to modern computer science. They can be used to combine deductive systems, e.g. via the use of SAT Solvers.

Problems tackled by automated systems are huge and so are the produced proofs. Proof files easily reach many gigabytes in size. Processing such proofs even takes algorithms with low complexity in time and space to their limits. Usually there are many different proofs of one problem and the goal of proof compression is to construct proofs from existing ones that are better w.r.t. measures like length or space.

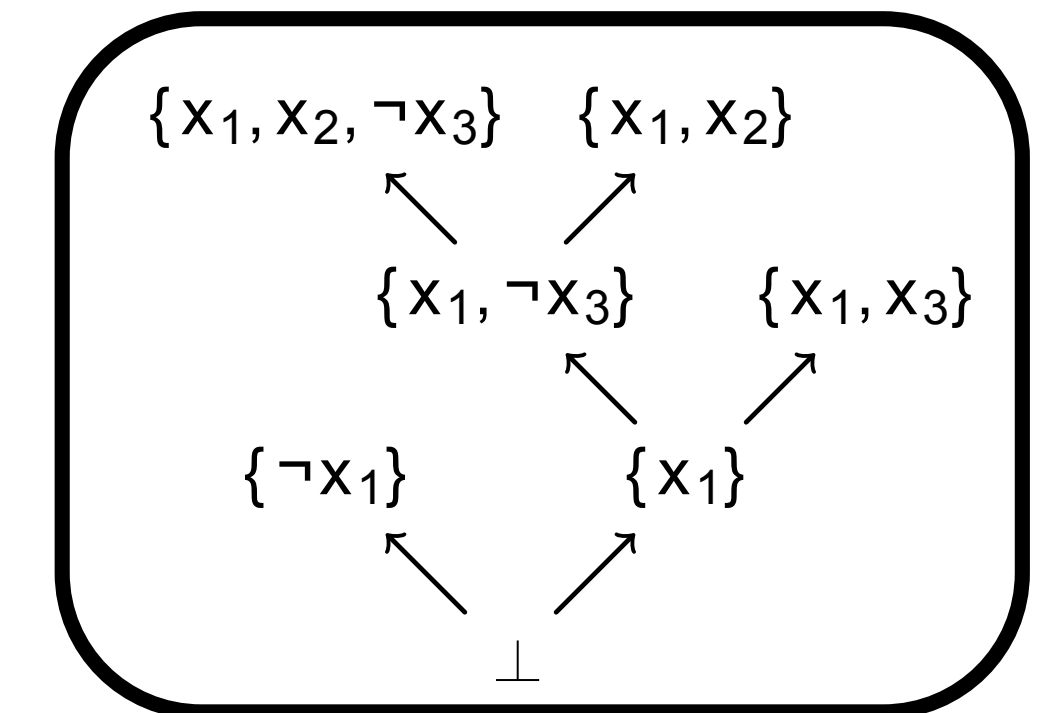
The Propositional Logic Resolution Calculus is a simple calculus with a single inference rule that is very popular in automated deduction. Its simplicity comes at the price that proofs tend to become large. These two properties make it a good target for proof compression.

Resolution Rule

$$\frac{C \vee x \quad D \vee \neg x}{C \vee D}$$



two proofs of unsatisfiability of  
 $(x_1 \vee x_2 \vee \neg x_3) \wedge (x_1 \vee x_2) \wedge (x_1 \vee x_3) \wedge (\neg x_1)$

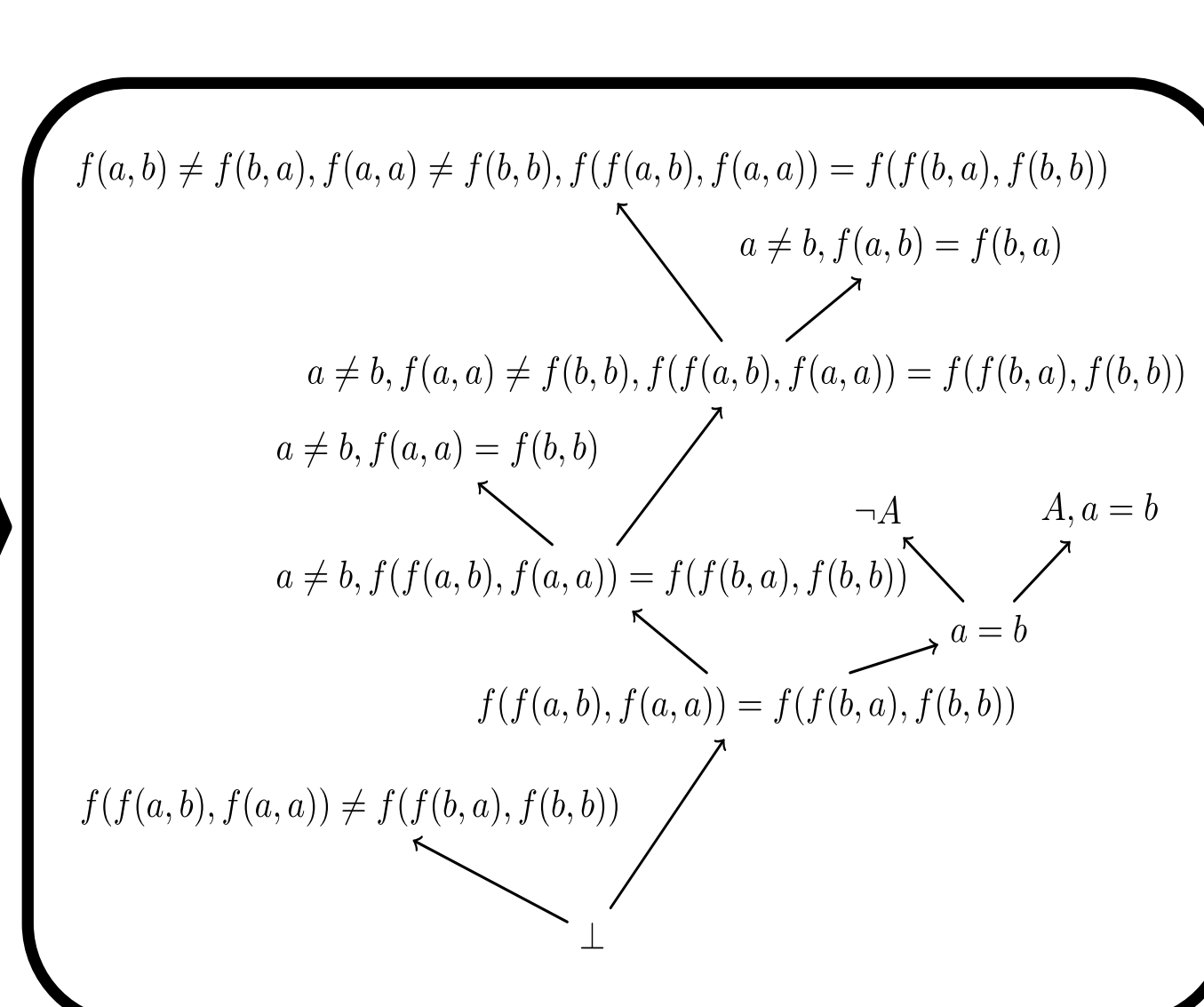
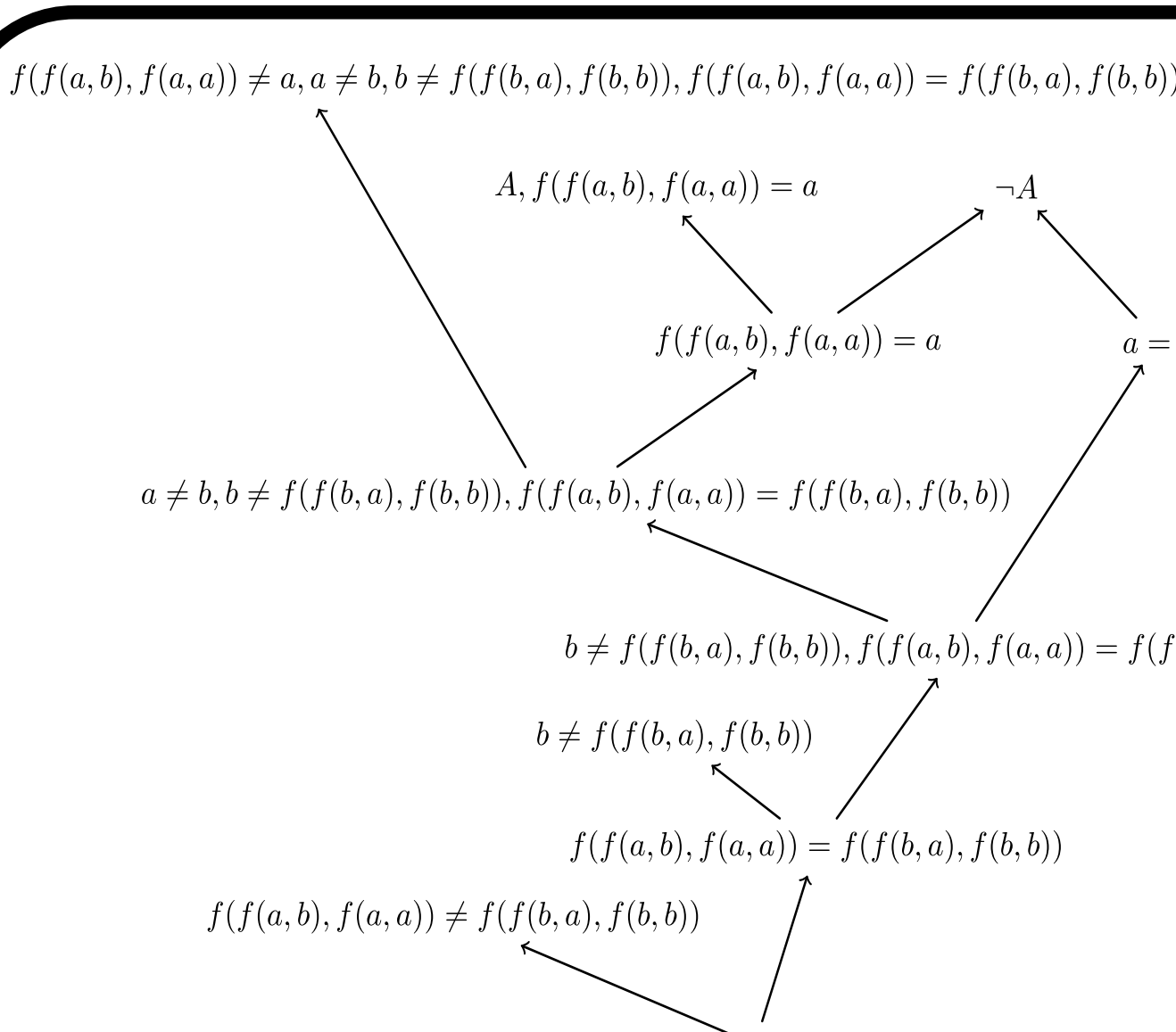


## Congruence Compression

Equality is a well studied and important topic in logic. Congruence reasoning derives new equalities on terms from a set of equations, using the axioms of equality:

We describe a calculus that is an extension of the propositional resolution calculus with equality. (In) Equalities are treated as (negated) propositional variables and four axioms of equality are introduced to the calculus.

These are reflexivity, symmetry, transitivity and compatibility



## Space

## Main References