Formal Proofs and their Lengths

Topic 1. *Problem with too many pigeons.* Failure of Haken's lower bound for weaker version of pigeonhole principle. Based on a section from P. Pudlák's paper *Proofs as Games*.

Topic 2. *DPLL procedure I.* Definition of DPLL procedure. DPLL computation tree viewed as a solver for the search problem related to SAT. Based on section 5.2 of J. Krajícek's book *Proof Complexity* and notes from our website.

Topic 3. *DPLL procedure II.* Definition of $R^\star$. Correspondence between $R^\star$-proofs and DPLL computations. Based on Section 5.2 of J. Krajícek's book *Proof Complexity* and notes from our website.

Topic 4. *Extended Frege.* Definition of EF. Short EF-proofs of the pigeonhole principle. Based on Lemma 2.4.1 of J. Krajícek's book *Proof Complexity*.

Topic 5. *Substitution Frege.* Defintion of SF. Linear size SF-proofs of $\neg\neg...\neg 1$. Based on Corollary 2.5.5 of J. Krajícek's book *Proof Complexity*.

Topic 6. *Reckhow's Theorem.* Equivalence between all Frege systems over the same language. Based on Lemma 2.3.1 of J. Krajícek's book *Proof Complexity*.