**DANNY RORABAUGH**, Queen's University

*Logical Axioms and Computational Complexity: A Correspondence*

Relational structure $\mathbb{A}$ is compact provided for any structure $\mathbb{B}$ of the same signature, if every finite substructure of $\mathbb{B}$ has a homomorphism to $\mathbb{A}$ then so does $\mathbb{B}$. The Constraint Satisfaction Problem (CSP) for $\mathbb{A}$ is the computational problem of determining whether finite structures have homomorphisms into $\mathbb{A}$. We explore a connection between the hierarchy of logical axioms and the complexity hierarchy of CSPs: It appears that the complexity of CSP for $\mathbb{A}$ corresponds to the strength of the axiom "$\mathbb{A}$ is compact". At the top, the statement "$K_3$ is compacts" is logically equivalent to the compactness theorem. Thus the compactness of $K_3$ implies the compactness of all finite relational structures. Moreover, the CSP for $K_3$ is NP-complete. At the bottom are width-one structures; these are provably complete from ZF and their corresponding CPSs are polynomial-time solvable.

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