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# Formal Concept Analysis

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Proceedings

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# Preface

This volume contains the Proceedings of ICFCA 2005, the 3rd International Conference on Formal Concept Analysis. The ICFCA conference series aims to be the premier forum for the publication of advances in applied lattice and order theory, and in particular scientific advances related to formal concept analysis.

Formal concept analysis is a field of applied mathematics with its mathematical root in order theory, in particular in the theory of complete lattices. Researchers had long been aware of the fact that these fields have many potential applications. Formal concept analysis emerged in the 1980s from efforts to restructure lattice theory to promote better communication between lattice theorists and potential users of lattice theory. The key theme was the mathematization of *concept* and *conceptual hierarchy*. Since then, the field has developed into a growing research area in its own right with a thriving theoretical community and an increasing number of applications in data and knowledge processing, including data visualization, information retrieval, machine learning, data analysis and knowledge management.

ICFCA 2005 reflected both practical benefits and progress in the foundational theory of formal concept analysis. Algorithmic aspects were discussed as well as efforts to broaden the field. All regular papers appearing in this volume were refereed by at least two, in most cases three independent reviewers. The final decision to accept the papers was arbitrated by the Program Chairs based on the referee reports. It was the involvement of the Program Committee and the Editorial Board that ensured the scientific quality of these proceedings.

The Organizing Chair of the ICFCA 2005 conference, held at the Université d'Artois, Lens, France, was Engelbert Mephu Nguifo. The success of the conference was the result of many hours of tireless planning and work by many volunteers, including the Conference Organization Committee, the Editorial Board and the Program Committee, to whom we convey our sincerest gratitude.

February 2005

Bernhard Ganter
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# Glossary

- A *formal context* $(G, M, I)$ consists of two sets $G$, $M$, and a binary relation $I \subseteq G \times M$ between these two sets.
  The elements of $G$ are usually called the *objects* of the formal context $(G, M, I)$, while those of $M$ are the *attributes*.
  We write $g\ I\ m$ or $(g, m) \in I$ to express that $g$ and $m$ are in relation $I$.
  $g\ I\ m$ may be read as "the object $g$ *has* the attibute $m$".
- If $A \subseteq G$ is a set of objects, then

  $$A' := \{m \in M \mid g\ I\ m \text{ for all } g \in A\}$$

  is the set of attributes that are common to all objects in $A$. Dually, if $B \subseteq M$ is a set of attributes, then

  $$B' := \{g \in G \mid g\ I\ m \text{ for all } m \in B\}$$

  is the set of those objects in $G$ that have all the attributes from $B$.
- The two operators

  $$A \mapsto A' \qquad \text{and} \qquad B \mapsto B'$$

  form a *Galois connection*. Their compositions

  $$A \mapsto A'' \qquad \text{and} \qquad B \mapsto B''$$

  form *closure operators* on $G$ and $M$, respectively.
- A *formal concept* of a formal context $(G, M, I)$ is a pair $(A, B)$ of sets $A \subseteq G$, $B \subseteq M$, with $A' = B$ and $A = B'$.
  The set $A$ is called the *extent* of the formal concept $(A, B)$. The set $B$ is its *intent*.
- Formal concepts are naturally ordered by the *subconcept-superconcept relation* defined as follows:

  $$(A_1, B_1) \leq (A_2, B_2) :\iff A_1 \subseteq A_2 \quad (\iff B_2 \subseteq B_1).$$

- The set $\underline{\mathfrak{B}}(G, M, I)$ of all formal concepts of a formal context $(G, M, I)$ with this order is called the *concept lattice* of $(G, M, I)$.
  It is indeed a complete lattice in the sense of mathematical order theory.
  Some authors use the name *Galois lattice of the relation I* instead of "concept lattice of $(G, M, I)$".