GaloisCalc - Program calculus based on Galois Connections

Paulo Filipe Araújo da Silva

January 2005

Abstract

About four decades ago, several major system failures led to the so-called "software crisis". Several approaches were proposed in order to solve it. One of these defends the use of theoretical models, based on mathematical concepts, in order to reason about software. The programs can be calculated based on algebraic techniques, mostly based on categories theory.

Although the use of these *formal methodologies* can improve the software quality, they are often limited to small scale examples. Since the logic complexity of a program can be arbitrarily complex, they are not well suited when building large systems. However, in the last years, attempts were made in order to structure the relational calculus using Galois Connections.

This project aims at exploring the algebraic properties of the programming logic (pre/post conditions, invariants, "business logic") using Galois Connections. A methodology which takes the Galois adjoints as major primitives should be developed, as well as an algebra of combinators that allows us to build new connections and to reason about them. One of the applications of this project is the reverse engineering area: trying to infer the specification from existing source code.