

# Type Systems for the Relational Verification of Higher Order Programs

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## Abstract

Relational program verification is a variant of program verification where one focuses on guaranteeing properties about the executions of two programs, and as a special case about two executions of a single program on different inputs. Relational verification becomes particularly interesting when non-functional aspects of a computation, like probabilities or resource cost, are considered. Several approaches to relational program verification have been developed, from relational program logics to relational abstract interpretation. In this talk, I will introduce two approaches to relational program verification for higher-order computations based on the use of type systems. The first approach consists in developing a powerful type system where a rich language of assertions can be used to express complex relations between two programs. The second approach consists in developing more restrictive type systems enriched with effects expressing in a lightweight way relations between different runs of the same program. I will discuss the pros and cons of these two approaches on a concrete example: relational cost analysis, which aims at giving a bound on the difference in cost of running two programs, and as a special case the difference in cost of two executions of a single program on different inputs.

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