Type-based Exception Analysis for Non-strict Higher-order Functional Languages with Imprecise Exception Semantics

(Abstract)

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Abstract

Most statically typed functional programming languages allow programmers to write partial functions: functions that are not defined on all the elements of the domain they are claimed to work on by their type. Thus in practise, well-typed programs can—and *do*—still go wrong. A compiler should warn the programmer about the places in the program where such wrongness may occur.

Contemporary compilers for functional languages employ a local and purely syntactic analysis to detect incomplete **case**-expressions—those that do not cover all possible patterns of constructors allowed for by the type of the scrutinee, the source of most partiality in a program. As programs often maintain invariants on their data—restricting the potential values of the scrutinee to a subtype of its given or inferred type—many of these incomplete **case**-expressions are in actuality completely benign. Such an analysis will thus report many false positives, overwhelming the programmer.

We develop and prove the correctness of a constraint-based type system that detects harmful sources of partiality by accurately tracing the flow of both exceptions—the manifestation of partiality gone wrong—and ordinary data through the program, as well as the dependencies between them. The latter is crucial for usable precision, but has been omitted from previously published exception analyses.

References

- R. Koot and J. Hage. Type-based exception analysis for non-strict higher-order functional languages with imprecise exception semantics. Submitted to the *41st ACM SIGPLAN-SIGACT Symposium on Principles of Programming Languages*, POPL '14.

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