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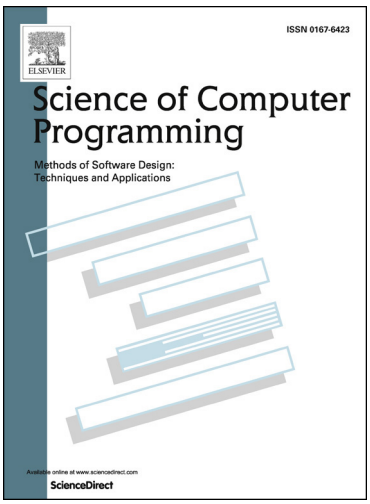

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A Unified View of Monadic and Applicative Non-determinism

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Abstract

It is well-known that monads are monoids in the category of endofunctors, and in fact so are applicative functors. Unfortunately, monoids do not have enough structure to account for computational effects with non-determinism operators.

This article recovers a unified view of computational effects with non-determinism by extending monoids to near-semirings with both additive and multiplicative structure. This enables us to generically define free constructions as well as a novel double Cayley representation that optimises both left-nested sums and left-nested products.

Keywords: monoid, near-semiring, monad, monadplus, applicative functor, alternative, free construction, Cayley representation

1. Introduction

Both monads [21] and applicative functors [20] have been successful in structuring and modularising programs, and there is a considerable amount of research on techniques and properties for programming with either of them. Through a unified view it is possible to leverage the knowledge of one

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