Programming with handlers in Links[1]

A brief introduction @ St. Andrews

Daniel Hillerström
s1467124@sms.ed.ac.uk

School of Informatics
The University of Edinburgh

August 5, 2015

Based on work by Plotkin and Pretnar [1] and Kammar et al. [2].

[1] Excerpt from my dissertation "Handlers for Algebraic Effects in Links"

A compelling programming model

Handlers for algebraic effects provide a compelling alternative to monads as a basis for effectful programming.

- **Key idea:** Separate effect signatures from their implementation.
- **"The effect":** High-degree of modularity.

Effects and handlers

Algebraic effect

An effect is a collection of abstract operations, e.g. $\{Op_i : a_i \to b_i\}$

Abstract computation

An abstract computation is composed from abstract operations.

Computations have type $() \xrightarrow{\{Op_i : a_i \to b_i \mid \rho\}} c$

Handler

A handler interprets an abstract computation m.

```
handler(m) {
  case Op_i(p_i,k_i)  → body_i
  case Return(x)      → x
}
```

Typing: $(() \xrightarrow{\{Op_i : a_i \to b_i\}} c) \to d$

Effects and handlers

Algebraic effect

An effect is a collection of abstract operations, e.g. $\{Op_i : a_i \to b_i\}$

Abstract computation

An abstract computation is composed from abstract operations.

Computations have type $() \xrightarrow{\{Op_i : a_i \to b_i \mid \rho\}} c$

Handler

A handler interprets an abstract computation m.

```
open handler(m) {
  case Op_i(p_i,k_i)  → body_i
  case Return(x)      → x
}
```

Typing: $(() \xrightarrow{\{Op_i : a_i \to b_i \mid \rho\}} c) \to () \xrightarrow{\{Op_i : \alpha \mid \rho\}} \to d$

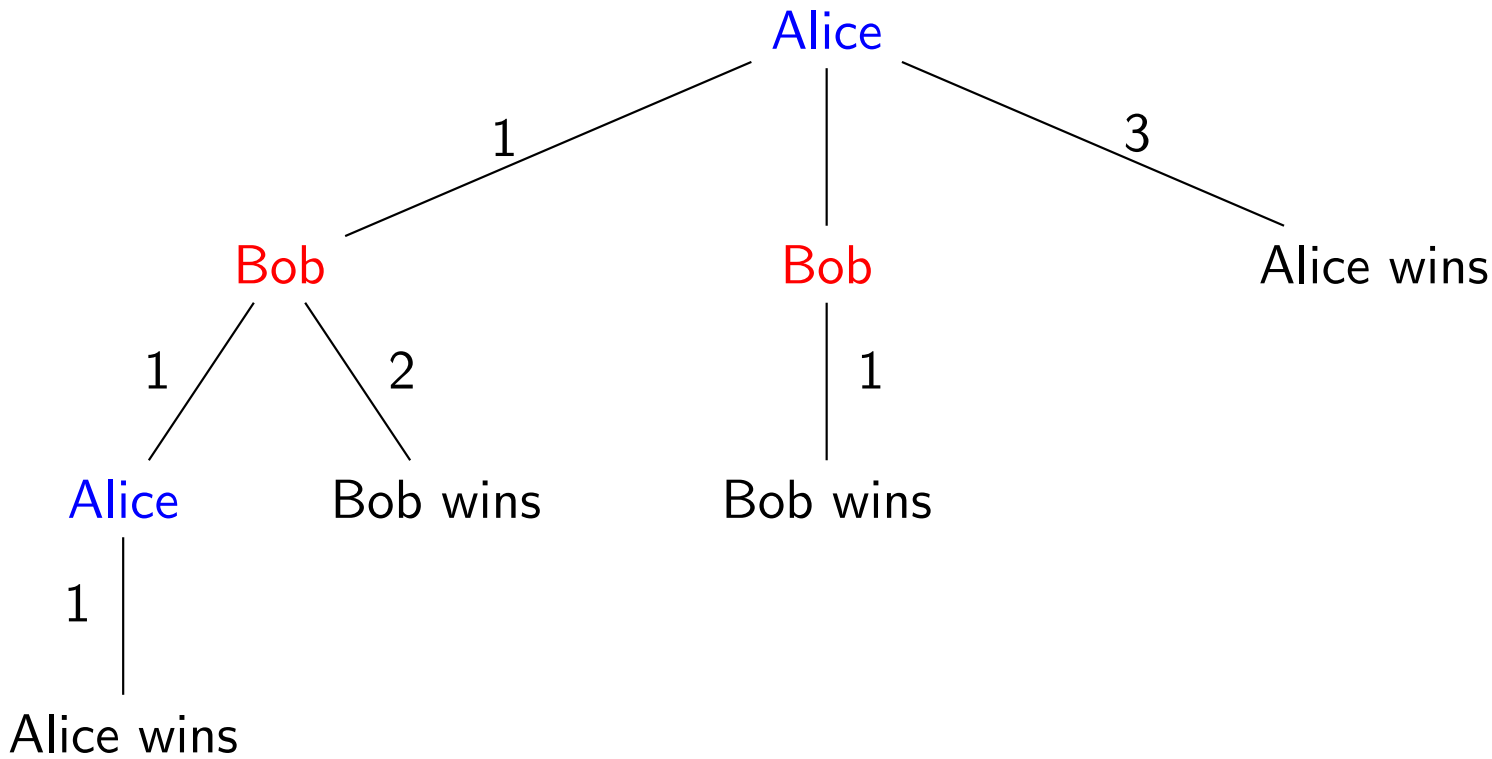
Nim: A game with sticks

Set-up

- Two players: Alice and Bob; Alice always starts.
- One heap of n sticks.
- Turn-based. Each player take between 1-3 sticks.
- The one, who takes the last stick, wins.

We'll demonstrate how to encode strategic behaviour, compute game data, and cheat using handlers.

Game tree generated by `mtGen` with $n = 3$



References


Gordon D. Plotkin and Matija Pretnar.
Handling algebraic effects.
Logical Methods in Computer Science, 9(4), 2013.


Ohad Kammar, Sam Lindley, and Nicolas Oury.
Handlers in action.
In *ICFP'13*, pages 145–158, 2013.