004

Investigation

C_{hail} more: Branching paths

The Office of the Commissioner (all hail)

Document information

C_{hail} more: Branching paths
Item 004*(Under review)*

> *"Esoteric Licence Section 4a "The word of the Office of the Commissioner (All Hail) is above all [...]" "*

Abstract

The conceptual expansion of the Commissioner (all-hail) has promted a change to the schema, broadining the C_{hail} scope to all possible outcomes while still containing a trivial path to the identity function.

The powerfull but fairly loosely defined *Version 3* has also been elaborated with further examples.

1 Changes

The previous itteration of *The Schema* will be refered to as *Version 3*, with this version refered to as *Version 4*.

$$\begin{aligned} \textit{Version 3}: &\quad R_n G_i \to_\beta R_{n+1} G_{i+1} \\ \textit{Version 4}: &\quad R_n G_i \to_\beta R_m G_j \end{aligned}$$

In previous versions of the schema, rule n (R_n below) directly evaluated to rule $n+1$ and the changed gamespace. By rules evaluating differently based on the input (the gamespace), C_{hail} contains not only each of the rules that will be applied in the current game (as in *version 3*), but every rule that could ever be applied in the context of the initial gamespace G_0.

2 Structure

Rules are defined by the following.

$$R_n = (\lambda x.(\texttt{COND}\ x)(\lambda y.R_a(\texttt{<expr>}\ y))(\lambda y.R_b x))x$$

COND evaulates to either TRUE or FALSE.

$$\begin{aligned} R_n[G_i := x] &\to_\beta (\texttt{COND}\ G_i)(\lambda y.R_a(\texttt{<expr>}\ y))(\lambda y.R_b G_i)G_i \\ &\to_\beta \texttt{TRUE}(\lambda y.R_a(\texttt{<expr>}\ y))(\lambda y.R_b G_i)G_i \\ &\to_\beta \lambda y.R_a(\texttt{<expr>}\ y)G_i \\ &\to_\beta R_a(\texttt{<expr>}\ G_i) \\ R_n G_i \to x[G_i := x] &= R_m G_j \end{aligned}$$

The gamespace could be structured in any way and this could change during the evaluation of C_{hail}.

t is the terminal state. R_t evaluates to the identity function and Church Numberal 0.

$$R_t G_t \to_\beta \lambda x.(\lambda y.y) = 0$$

The Commissioner (all hail) always exaluates to the identity function.

$$\begin{aligned} C_{hail} &= \lambda s.R_0 s \\ C_{hail} G_0 \to s[G_0 := s] &= R_t(...(R_n(R_0 G_0))) \\ &= R_t G_t = 0 \end{aligned}$$

3 Pick-up game

Let's consider an example where the gamespace represents the current number of cards in the single players hand, we will disregard the value of each card for the moment.

Some conventional definitions have been used where trivial. The number n is represented as the function f composed with itself n times with the shorthand $f^{(n)}$ and the function incrementing a numberal is represented as HIT (commonly named SUCC). See Appendix section A for further used definitions.

$$\begin{aligned}
\mathtt{BUST} &= R_t = \lambda x.x \\
\mathtt{HIT} &= \lambda x.\lambda y.\lambda z.y(xyz) \\
\mathtt{PLAYER} &= (\lambda x.(\mathtt{FREEWILL}\ x)(\mathtt{CHECK}(\mathtt{HIT}\ x))(\mathtt{PLAYER}\ x))x \\
\mathtt{CHECK} &= (\lambda x.(\mathtt{ISZERO}(\mathtt{SUB}\ x f^{(6)}))(\mathtt{PLAYER}\ x)(\mathtt{BUST}\ f^{(0)}))x \\
G_0 &= f^{(2)} \\
C_{hail} &= R_0 = \mathtt{PLAYER}
\end{aligned}$$

This example is a very simple, but playable, game. The player starts with 2 cards and has the choice to hit or stick. When the player has more than 5 cards, the player is bust and the game is over. Other than the function FREEWILL, representing the choice of the player, the game is trivially implemented.

If the player should keep "sticking", the game may not evaluate to R_t. This is solved for us cleanly by entropy which ties up loose ends, evaluating the player to R_t.

Lets evaluate the example game.

$$\begin{aligned}
C_{hail}G_0 &= f^{(2)}\mathtt{PLAYER} \\
&\rightarrow_\beta (\lambda x.(\mathtt{FREEWILL}\ x)(\mathtt{CHECK}(\mathtt{HIT}\ x))(\mathtt{PLAYER}\ x))f^{(2)} \\
&\rightarrow_\beta (\mathtt{FREEWILL}\ f^{(2)})(\mathtt{CHECK}(\mathtt{HIT}\ f^{(2)}))(\mathtt{PLAYER}\ f^{(2)})
\end{aligned}$$

Let's say the player decides to hit.

$$\begin{aligned}
&\rightarrow_\beta \mathtt{TRUE}(\mathtt{CHECK}(\mathtt{HIT}\ f^{(2)}))(\mathtt{PLAYER}\ f^{(2)}) \\
&\rightarrow_\beta \mathtt{CHECK}(\mathtt{HIT}\ f^{(2)}) \\
&\rightarrow_\beta \mathtt{CHECK}\ f^{(3)}
\end{aligned}$$

Let's check if the player is bust.

$$\begin{aligned}
&\rightarrow_\beta (\lambda x.(\mathtt{ISZERO}(\mathtt{SUB}\ x f^{(6)}))(\mathtt{PLAYER}\ x)(\mathtt{BUST}\ f^{(0)}))f^{(3)} \\
&\rightarrow_\beta (\mathtt{ISZERO}(\mathtt{SUB}\ f^{(3)} f^{(6)}))(\mathtt{PLAYER}\ f^{(3)})(\mathtt{BUST}\ f^{(0)}) \\
&\rightarrow_\beta (\mathtt{ISZERO}\ f^{(0)})(\mathtt{PLAYER}\ f^{(3)})(\mathtt{BUST}\ f^{(0)}) \\
&\rightarrow_\beta \mathtt{TRUE}(\mathtt{PLAYER}\ f^{(3)})(\mathtt{BUST}\ f^{(0)}) \\
&\rightarrow_\beta \mathtt{PLAYER}\ f^{(3)}
\end{aligned}$$

The player has successfully hit and the move is with the player again.

Appendix

A Common definitions

$$
\begin{aligned}
\texttt{PRED} &= \lambda n.(\lambda f.(\lambda x.n(\lambda g.\lambda h.h(gf))(\lambda u.x)(\lambda u.u))) \\
\texttt{SUB} &= \lambda m.(\lambda n.n\ \texttt{PRED}\ m) \\
\texttt{SUCC} &= \lambda n.(\lambda f.(\lambda x.f(nfx))) \\
\texttt{TRUE} &= \lambda x.(\lambda y.x) \\
\texttt{FALSE} &= \lambda x.(\lambda y.y) \\
\texttt{ISZERO} &= \lambda n.n(\lambda x.\texttt{FALSE})\texttt{TRUE}
\end{aligned}
$$

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For more information, see: `https://all-hail.co.uk`