Introduction to Haskell & some category theory

Wellington Functional Programming

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26 March 2015

DRAGONFLY
Data Science

Introduction

Haskell is strange ?

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A functional programming language

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With lazy evaluation

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Pure, with no side effects

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Fairly old

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With lazy evaluation

Pure, with no side effects

Fairly old, fairly odd

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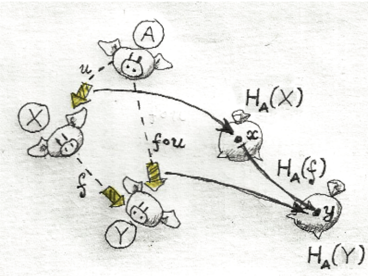
Huh ?



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Is Haskell impractical ?

- Hackage has thousands of libraries
- Haskell is fast, and getting faster

To learn Haskell,
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Actually, I reckon you already know category theory!

Anatomy of a function

```python
def capitalise(name):
    f = name[0].upper()
    r = name[1:].lower()
    return f+r
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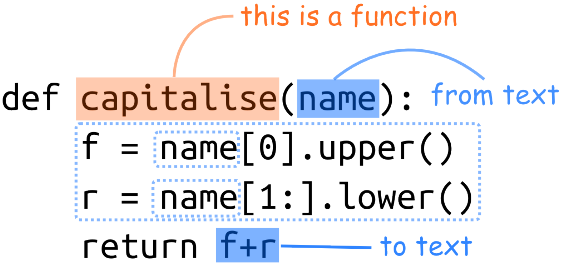

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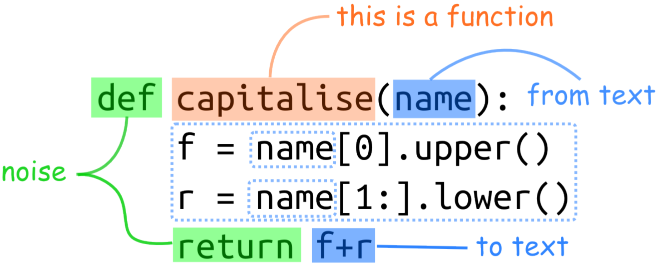

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from text

noise

to text

```haskell
capitalise :: String -> String
capitalise [] = []
capitalise (a:as)
  = (toUpper a : map toLower as)
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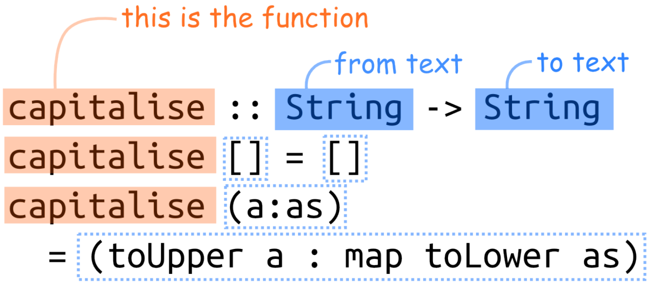

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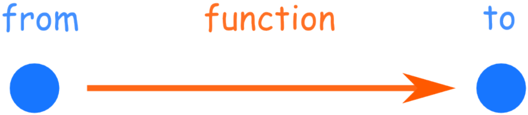
no noise now !

A little category theory



from

function

to

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There are some rules, more on that later.

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Haskell emphasises category theory aspect of programming.

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A category defines some kind of objects, and the way we can transform these objects into each other. It is a very general concept, and so almost completely vacuous.

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As is often the case with mathematical concepts, there is nothing more than the definitions.

Definition

A category C consists of:

- A class of objects $Obj(C)$,
- $\forall X, Y \in Obj(C)$, $\exists$ a class of arrows $C(X, Y)$.
- $\forall f : X \to Y$, and $g : Y \to Z$, $\exists g \circ f : X \to Z$.

$$\begin{tikzcd}
X \arrow[r, "f"] \arrow[dr, "g \circ f"'] & Y \arrow[d, "g"] \\
& Z
\end{tikzcd}$$

Such that

- $\forall X \in Obj(C)$, $\exists\, id_X : X \to X$,
- $\forall f : X \to Y$, then

$$f \circ id_X = f = id_Y \circ f$$

- $\forall f : X \to Y$, $g : Y \to Z$, and $h : Z \to W$, then

$$(h \circ g) \circ f = h \circ (g \circ f)$$

Programming patterns

Functors

Monads