

Koinduktivni tipi

Induktivni: seznam, drevesa, naravna števila } podatek je končen
[], a::l, Empty, Node(l,r) 0, succ

Koinduktivni tipi: podatek je lahko neskončen

Primer: komunikajski tok podatkov

Tok podatkov sestoji iz:

- podatek
- toka podatkov

type α stream = Cons of $\alpha * \alpha$ stream

Cons(1, Cons(2, Cons(1, ...))) : int stream
↑
nikoli ni konec

Primer: I/O v programu

IO je:

- preberemo podatek in nekaj z njim naredimo
- izpišemo podatek in nadaljujemo s programom
- izračuna vrednost in konča

type α io =

| Read of string $\rightarrow \alpha$ io

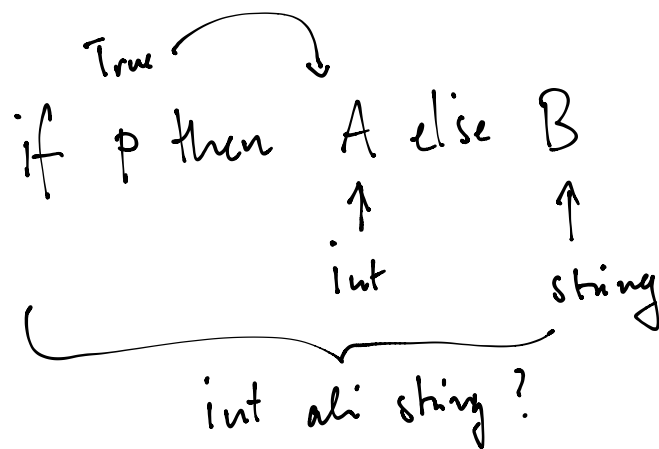
| Write of string * α io

| Return of α

$\mathbb{R} \times \mathbb{R}$

$(3.7, \sqrt{2})$

(\mathbb{R}, \mathbb{R})



$\frac{e_1}{\text{false}} + \frac{e_2}{7}$

int

$$3x^2 + 7 = 8 - 3x$$

$$x = 7$$

$$\boxed{x = 7 - x^2}$$

$$x = \boxed{}$$

↑
x se ne pojavljuje

$$\underline{\alpha} = \frac{\text{int} \times \alpha}{}$$

$$= \text{int} \times (\text{int} \times \alpha)$$

$$= \text{int} \times (\text{int} \times (\text{int} \times (\text{int} \times \dots) \dots))$$

- $\alpha = \dots$
- $\alpha \rightarrow \text{int} = \text{bool} \rightarrow \beta$
↳ $\alpha = \text{bool}$ in $\text{int} = \beta$
- $\alpha \text{ list} = \text{int} \rightarrow \text{bool}$ ni rešitve

Primer: fun $x \rightarrow x+3$

$x: \alpha$ izpeljemo tip $x+3 : \underline{\text{int}}, \alpha = \text{int}, \text{int} = \text{int}$

↙ ↘
 α int

fun $x \rightarrow x+3 : \underline{\alpha} \rightarrow \underline{\text{int}}, \alpha = \text{int}, \text{int} = \text{int}$

Rešujemo enačbe:

$\alpha = \text{int}$,
 $\alpha \rightarrow \underline{\text{int}}$

$\text{int} = \text{int}$

odgovor: $\text{int} \rightarrow \text{int}$

Primer:

if $3 < 5$ then (fun x -> x) else (fun y -> y + 3) : $\alpha \rightarrow \alpha$,

τ_1
bool

$3 < 5$: bool ✓
int int

τ_2
 $\alpha \rightarrow \alpha$

$x : \alpha$
 $x : \alpha$
 $\alpha \rightarrow \alpha$

τ_3

$y : \beta$
 $y + 3 : \text{int}$, $\beta = \text{int}, \text{int} = \text{int}$

β \downarrow int
 $\beta \rightarrow \text{int}$

$\beta = \text{int}$, $\alpha \rightarrow \alpha = \beta \rightarrow \text{int}$
 $\alpha \rightarrow \alpha = \text{int} \rightarrow \text{int}$
 $\alpha = \text{int}$
 $\alpha = \text{int}$
~~int = int~~

Enäbbe : $\beta = \text{int}$, $\alpha \rightarrow \alpha = \beta \rightarrow \text{int}$ } $\beta \rightarrow \text{int}$

$\alpha \rightarrow \alpha = \text{int} \rightarrow \text{int}$ } $\alpha \rightarrow \text{int}$

$\alpha = \text{int}$ } $\alpha = \text{int}$

~~int = int~~

Kandidat : $\alpha \rightarrow \alpha$

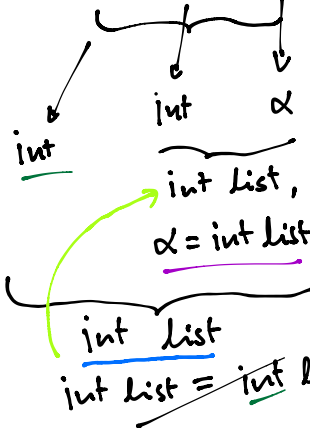
Odgovor : int \rightarrow int

Primer:

$x : \alpha$

$$X = 1 :: (2 :: X)$$

[1, 2, 1, 2, 1, 2, ...]



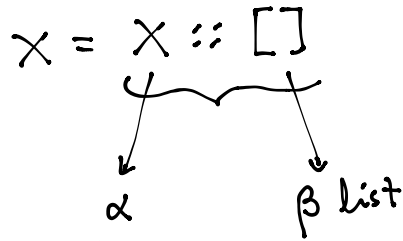
$e_1 :: e_2$	τ_1, list
\downarrow	\downarrow
τ_1	$\tau_2 = \tau_1, \text{list}$

2. fara : int list ✓

Enäbbe : $\alpha = \text{int list}$
 $\alpha \rightarrow \text{int list}$

Primer:

$x : \alpha$



$[] : \beta$ list

β nova
spremenljiva

α list , α list = β list

Kandidat : α list

enačbe : α list = β list , $\alpha = \alpha$ list

$\alpha = \beta$

$\alpha \mapsto \beta$ rezitev

$\beta = \beta$ list

NI REŠITVE