Type Inference

Functional Programming SS2007

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The correct way of labeling

$$\mathsf{letrec}\ all = \mathsf{fun}\, l \to \mathsf{match}\, l\ \mathsf{with}|\ [] \to \mathsf{true} \mid \mathsf{true} :: xs \to all\, xs \mid \mathsf{false} :: xs \to \mathsf{false}\ ;;$$

is

$$\mathsf{letrec}\ \underbrace{all}_{\alpha_1} = \overbrace{\mathsf{fun}\ \underbrace{l}_{\alpha_2} \to \overbrace{\mathsf{match}\ \underbrace{l}_{\alpha_2}\ \mathsf{with}|\ \underbrace{[]}_{\alpha_3} \to \underbrace{\mathsf{true}}_{\alpha_4} \mid \underbrace{\underbrace{\mathsf{true}}_{\alpha_5} :: \underbrace{xs}_{\alpha_6}}_{\alpha_7} \to \underbrace{\underbrace{all}_{\alpha_8}\ \underbrace{xs}_{\alpha_6}}_{\alpha_9} \mid \underbrace{\underbrace{\mathsf{false}}_{\alpha_{10}} :: \underbrace{xs}_{\alpha_{11}}}_{\alpha_{12}} \to \underbrace{\mathsf{false}}_{\alpha_{13}}}^{\alpha_{14}}}^{\alpha_{15}}\ ;;$$

The first two of occurrences of xs get the label α_6 because the second occurrence is bound to the first. The third occurrence is independant of the other two, so it gets a fresh label.

Similarly, a correct labeling of

$$\mathsf{letrec}\ s = (\lambda x.x\, z)\, (\lambda x.x\, z)\ ;;$$

is

$$\mathsf{letrec}\ \underbrace{s}_{\alpha_1} = \overbrace{(\lambda \underbrace{x}_{\alpha_2} . \underbrace{\underbrace{x}_{\alpha_2}\ \underbrace{z}_{\alpha_4}}_{\alpha_5})\, (\lambda \underbrace{x}_{\alpha_3} . \underbrace{\underbrace{x}_{\alpha_2}\ \underbrace{z}_{\alpha_6}}_{\alpha_7})}^{\alpha_8}\ ;;$$

The first and second occurrences of x are independant of the third and fourth. The occurrences of z are dependant, but z is global and therefore get new labels for every occurrence.