

BACHELOR THESIS  
COMPUTING SCIENCE



RADBOUD UNIVERSITY

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# Iris or something

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## **Abstract**

This is an abstract. It is very abstract. And now a funny pun about Iris from github copilot: "Why did the mathematician bring Iris to the formal methods conference? Because they wanted to be a 'proof-essional' with the most 'Irisistible' Coq proofs!"

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# Chapter 1

## Elpi tactic for iIntros

### 1.1 Intros

In coq proofs onften start with the same few tactics. They start with some forall introductions, some implication introductions and some destructs of existential quantifiers,  $\forall$ ,  $\wedge$  and others. Because these happen so often, a little DSL has been made to quickly write these steps down, and are called intro patterns. These intro patterns are included in many tactics to quickly deal with the result of these tactics, but we will focus on **intros**.

#### 1.1.1 Coq intros

We look at a subset of the total intro pattern syntax that is used in coq. Our subset is shown here

$$\begin{aligned} \langle \text{intropattern} \rangle & ::= '*' \\ & \quad | '**' \\ & \quad | \langle \text{simple\_intropattern} \rangle \\ \\ \langle \text{simple\_intropattern} \rangle & ::= \langle \text{naming\_intropattern} \rangle \\ & \quad | '-' \\ & \quad | \langle \text{or\_and\_intropattern} \rangle \\ & \quad | \langle \text{equality\_intropattern} \rangle \\ \\ \langle \text{naming\_intropattern} \rangle & ::= \langle \text{ident} \rangle \\ & \quad | '?' \\ & \quad | '?' \langle \text{ident} \rangle \\ \\ \langle \text{or\_and\_intropattern} \rangle & ::= '[' ( \langle \text{intropattern} \rangle^* )_{i|}^*, '[' \\ & \quad | '(' \langle \text{intropattern} \rangle_{i\&}^*, '(' \end{aligned}$$

$$\begin{aligned} \langle \text{equality\_intropattern} \rangle &::= \text{'->'} \\ &| \text{'<-'} \\ &| \text{'[='} \langle \text{intropattern} \rangle^* \text{' ]'} \end{aligned}$$

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### 1.1.2 Iris iIntros

Iris has in its logic several more connectives that behave like  $\wedge$  and  $\vee$ , but are not them. This combined with the separate environments that iris adds, result in us not being able to use the coq **intros** tactic. Thus we have written our own tactic that can deal with the Iris logic. We call this tactic **iIntros**.

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### 1.1.3 Elpi implementation of iIntros

We implement our tactic in the meta programming language Elpi [1], while making use of the elpi coq connector coq-elpi [2].

$$\begin{aligned} \langle \text{intropattern} \rangle &::= \text{'*'} \\ &| \text{'**'} \\ &| \langle \text{simple\_intropattern} \rangle \end{aligned}$$

$$\begin{aligned} \langle \text{simple\_intropattern} \rangle &::= \langle \text{naming\_intropattern} \rangle \\ &| \text{'_'} \\ &| \text{'['} \langle \text{or\_and\_intropattern} \rangle \\ &| \langle \text{equality\_intropattern} \rangle \end{aligned}$$

$$\begin{aligned} \langle \text{naming\_intropattern} \rangle &::= \langle \text{ident} \rangle \\ &| \text{'?'} \\ &| \text{'?' } \langle \text{ident} \rangle \end{aligned}$$

$$\begin{aligned} \langle \text{or\_and\_intropattern} \rangle &::= \text{'['} \\ &| \langle \text{simple\_intropattern} \rangle \text{'|'} \langle \text{or\_and\_intropattern} \rangle \\ &| \langle \text{simple\_intropattern} \rangle \langle \text{or\_and\_intropattern} \rangle \end{aligned}$$

# Bibliography

- [1] Cvetan Dunchev et al. “ELPI: Fast, Embeddable,  $\lambda$ Prolog Interpreter”. In: *Log. Program. Artif. Intell. Reason.* Lecture Notes in Computer Science. 2015, pp. 460–468. DOI: 10.1007/978-3-662-48899-7\_32.
- [2] Enrico Tassi. “Elpi: An Extension Language for Coq (Metaprogramming Coq in the Elpi  $\lambda$ Prolog Dialect)”. Jan. 2018. URL: <https://inria.hal.science/hal-01637063>.



