First-Order Logic = FOL = $\mathscr{L}_1$, Part 2

Selmer Bringsjord

Rensselaer AI & Reasoning (RAIR) Lab
Department of Cognitive Science
Department of Computer Science
Lally School of Management & Technology
Rensselaer Polytechnic Institute (RPI)
Troy, New York 12180 USA

Intro to Logic-based AI
10/3/2024

Logic-&-AI In The News

Ambulance Chasing and AI

Wouldn't the wiser, more humane course be to regulate before a catastrophe?

The language program developed by OpenAI uses artificial intelligence to write a random binary code, Aug. 7. (PHOTO: FRANK RUMPENHORST/ZUMA PRESS)

Oct 02, 2024 10:40 a.m. ET

Listen to this article
1 minute

Under Ketan Ramakrishnan's preferred means of regulating artificial intelligence ("Tort Law Is the Best Way to Regulate AI," op-ed, Sept. 25), "bioterrorist attacks or other grievous harm" are prerequisites to action. As he concedes, tort law purports to compensate the damaged after the damage has already occurred.

Sadly, the only ones truly compensated are the tort lawyers. Wouldn't the wiser, more humane course be to regulate before a catastrophe? If he knows, as he claims, that a company has already "released a powerful new artificial-intelligence model this month that modestly but meaningfully increases the risk of catastrophic bioterrorism," why wait for catastrophe? That's rather coldblooded, as if one is after the contingency fee.

Christopher C. Spencer

Logic-&-AI In The News

Ambulance Chasing and AI

Wouldn't the wiser, more humane course be to regulate before a catastrophe?

The language program developed by OpenAI uses artificial intelligence to write a random binary code, Aug. 7. (PHOTO: FRANK RUMPENHORST/ZUMA PRESS)

Oct 02, 2024 10:40 a.m. ET

Listen to this article
1 minute

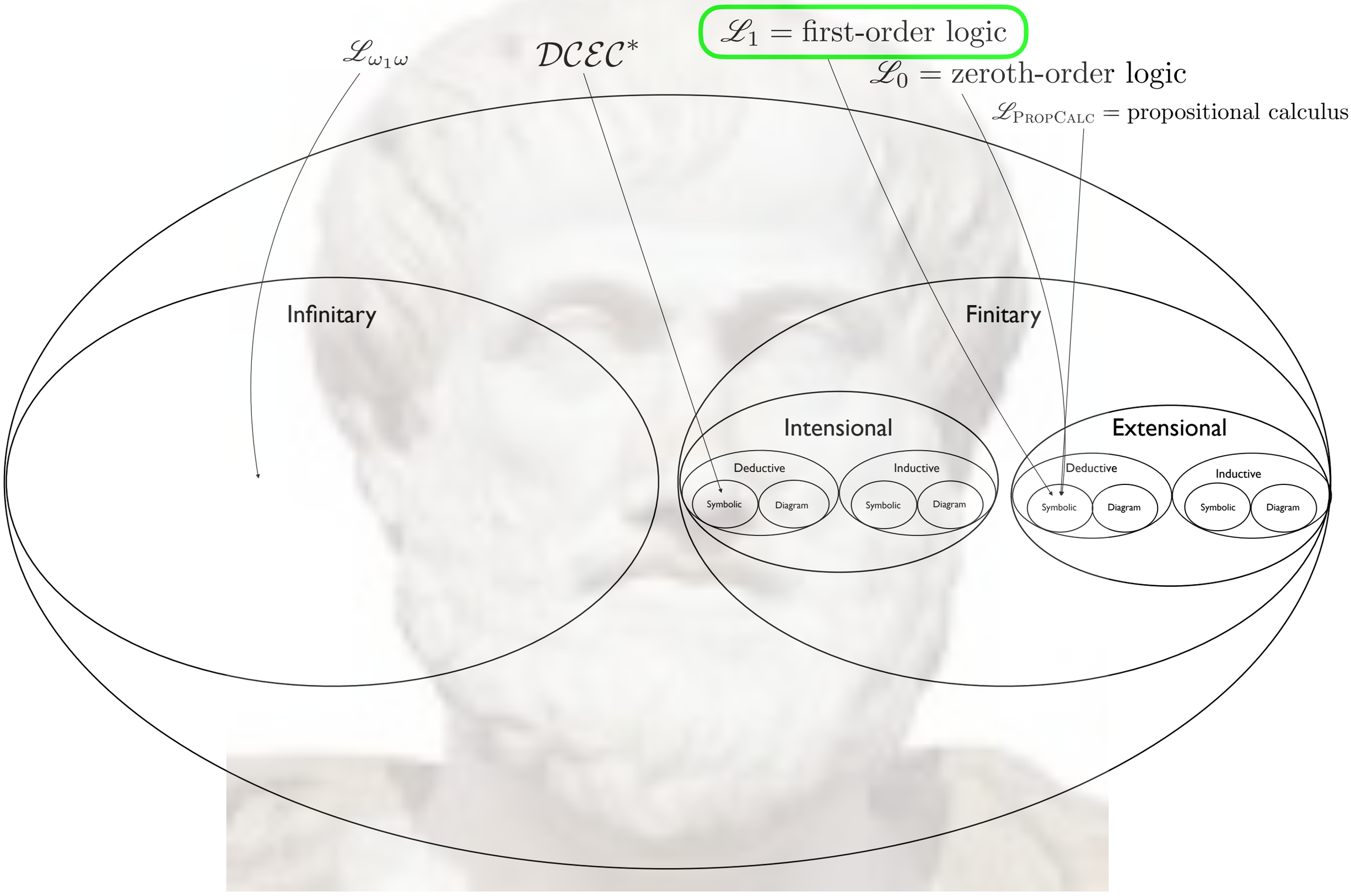
Under Ketan Ramakrishnan's preferred means of regulating artificial intelligence ("Tort Law Is the Best Way to Regulate AI," op-ed, Sept. 25), "bioterrorist attacks or other grievous harm" are prerequisites to action. As he concedes, tort law purports to compensate the damaged after the damage has already occurred.

Sadly, the only ones truly compensated are the tort lawyers. Wouldn't the wiser, more humane course be to regulate before a catastrophe? If he knows, as he claims, that a company has already "released a powerful new artificial-intelligence model this month that modestly but meaningfully increases the risk of catastrophic bioterrorism," why wait for catastrophe? That's rather coldblooded, as if one is after the contingency fee.

Christopher C. Spencer

You're right! We'll get to the engineering into AI's ethical/legal control later in the course.

The Universe of Logics



Let's dive in, discuss, win some trophies, and learn …

Let's dive in, discuss, win some trophies, and learn …

(First, two Required prop-calc problems; then DFT fun …)

Next New (*Not*-So-Easy!) Inference Rule in FOL

Next New (*Not*-So-Easy!) Inference Rule in FOL

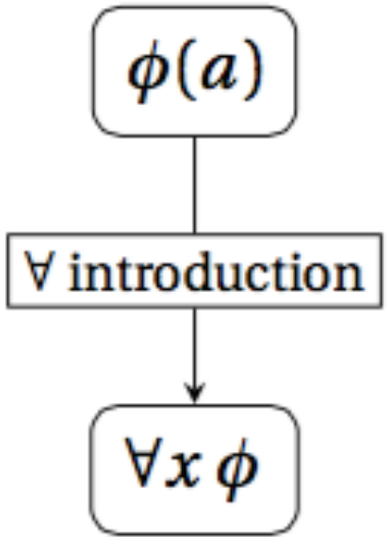
- `universal introduction`

Next New (*Not*-So-Easy!) Inference Rule in FOL

- `universal introduction`
  - If something *a* is an *R*, and the constant/name *a* is *genuinely arbitrary*, then we can deduce that everything is an *R*.

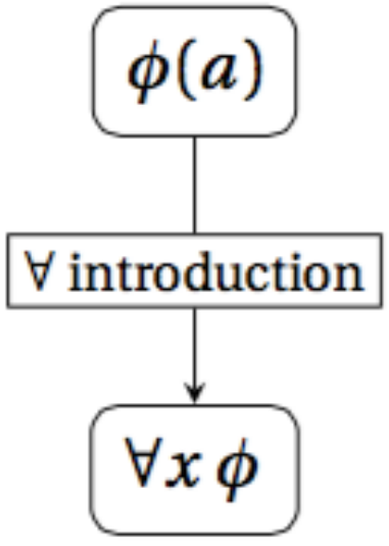
The Inference Schema

The Inference Schema



provided that a does not appear free in any in-scope assumption of ϕ, and that no occurrence of a appear in the inferred $\forall x\,\phi$ (3.16)

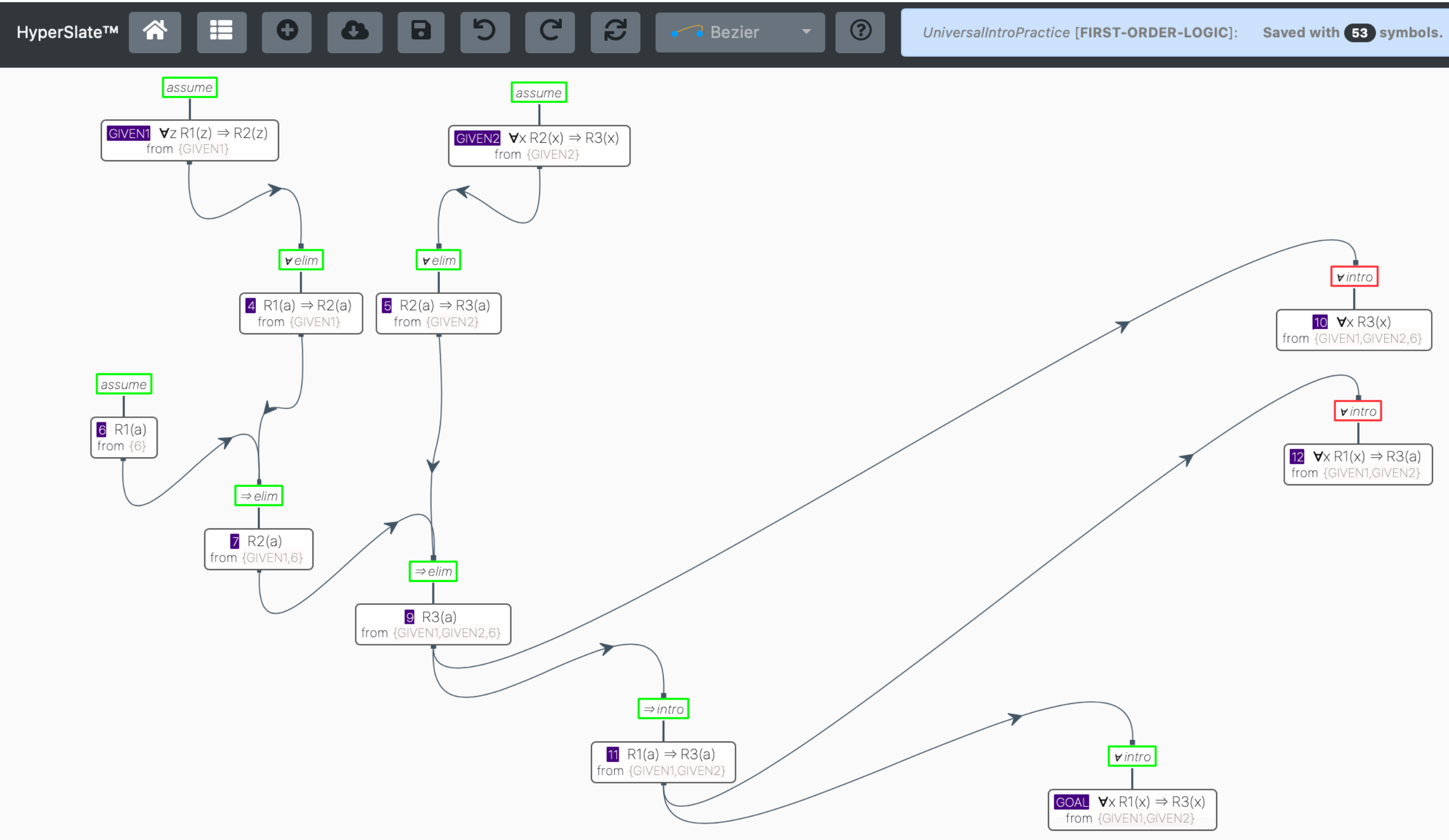
The Inference Schema



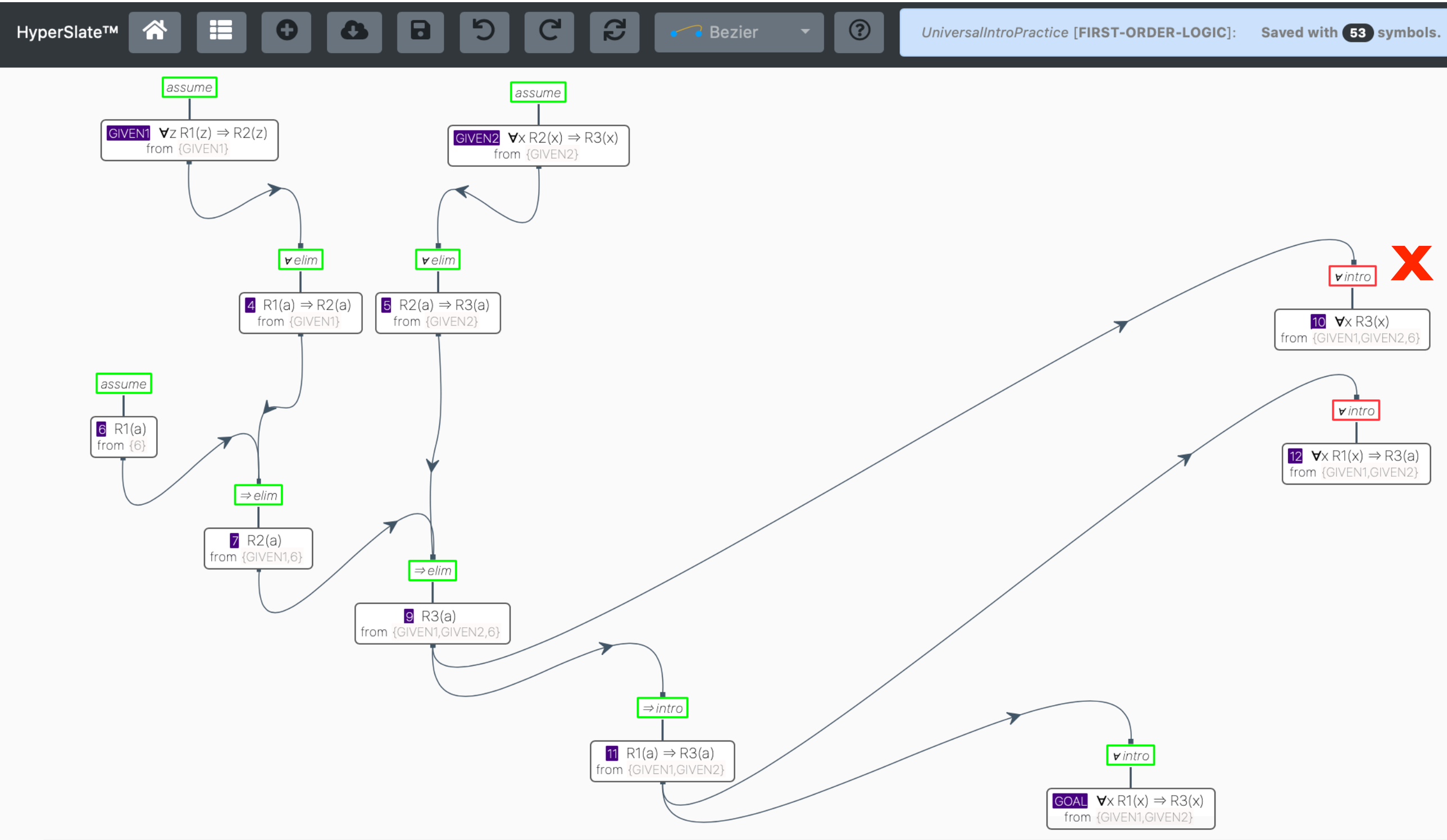
provided that a does not appear free in any in-scope assumption of ϕ, and that no occurrence of a appear in the inferred $\forall x\,\phi$ (3.16)

(Why the provisos?)

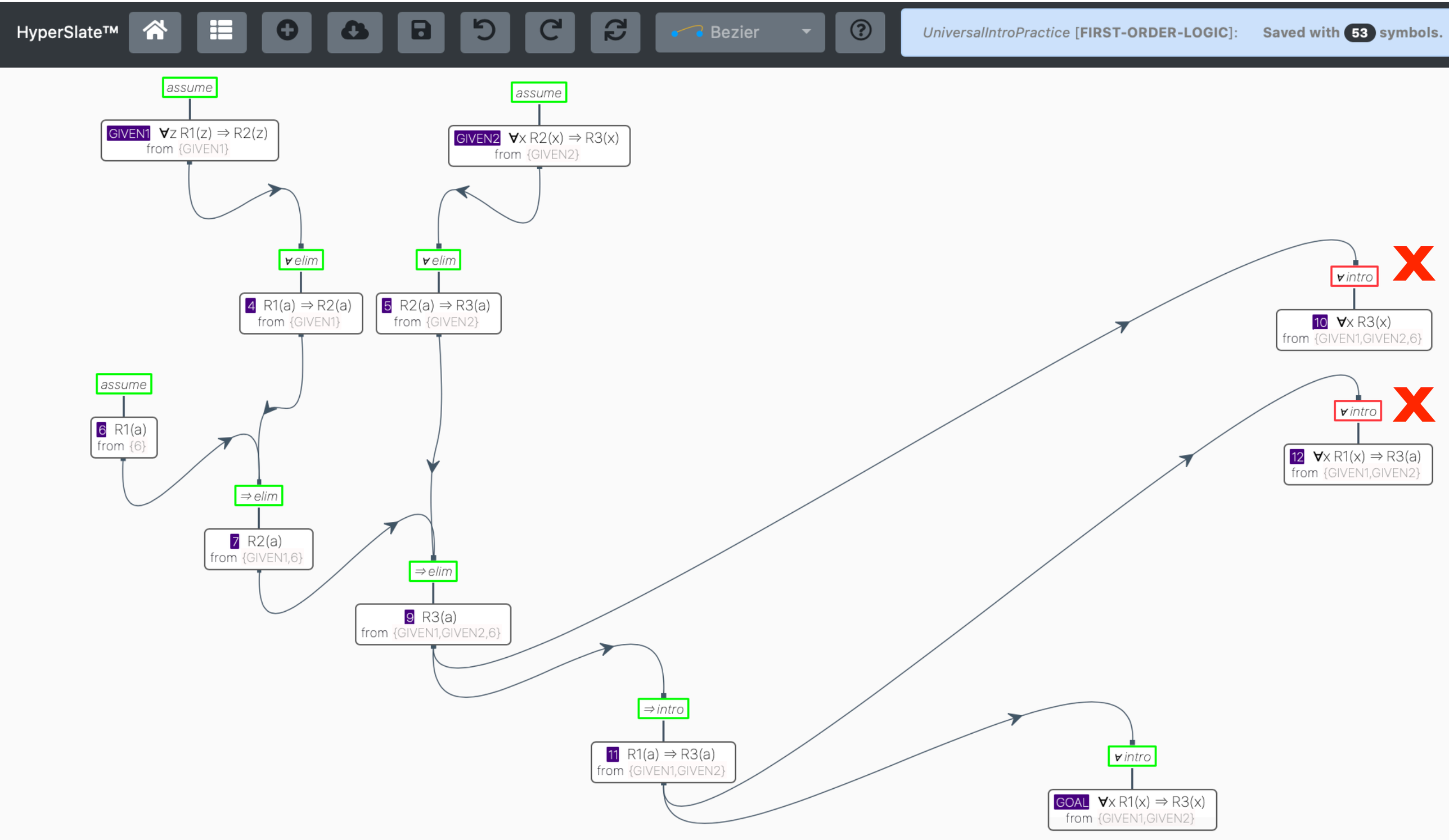
universal intro Example/Tutorial



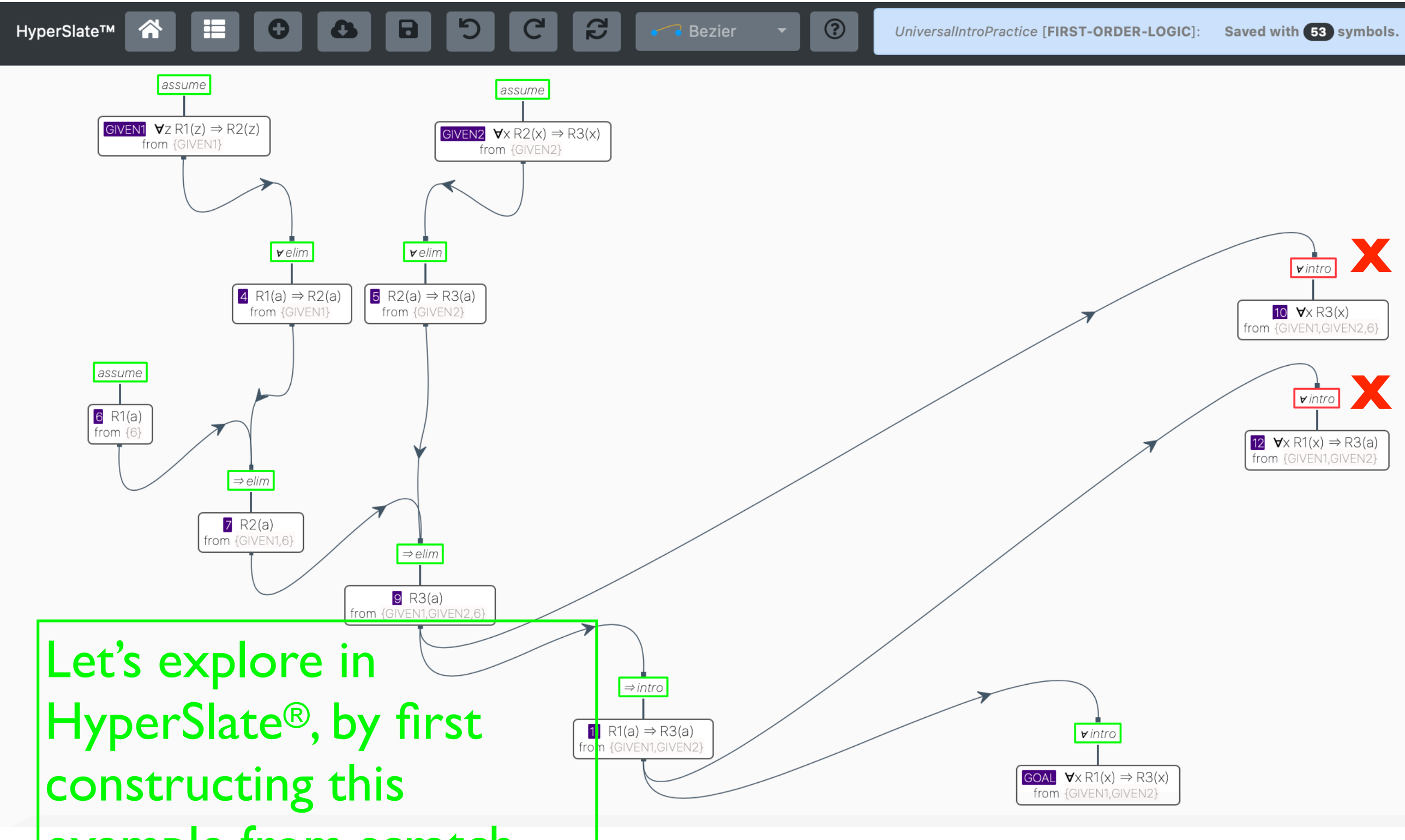
universal intro Example/Tutorial



universal intro Example/Tutorial

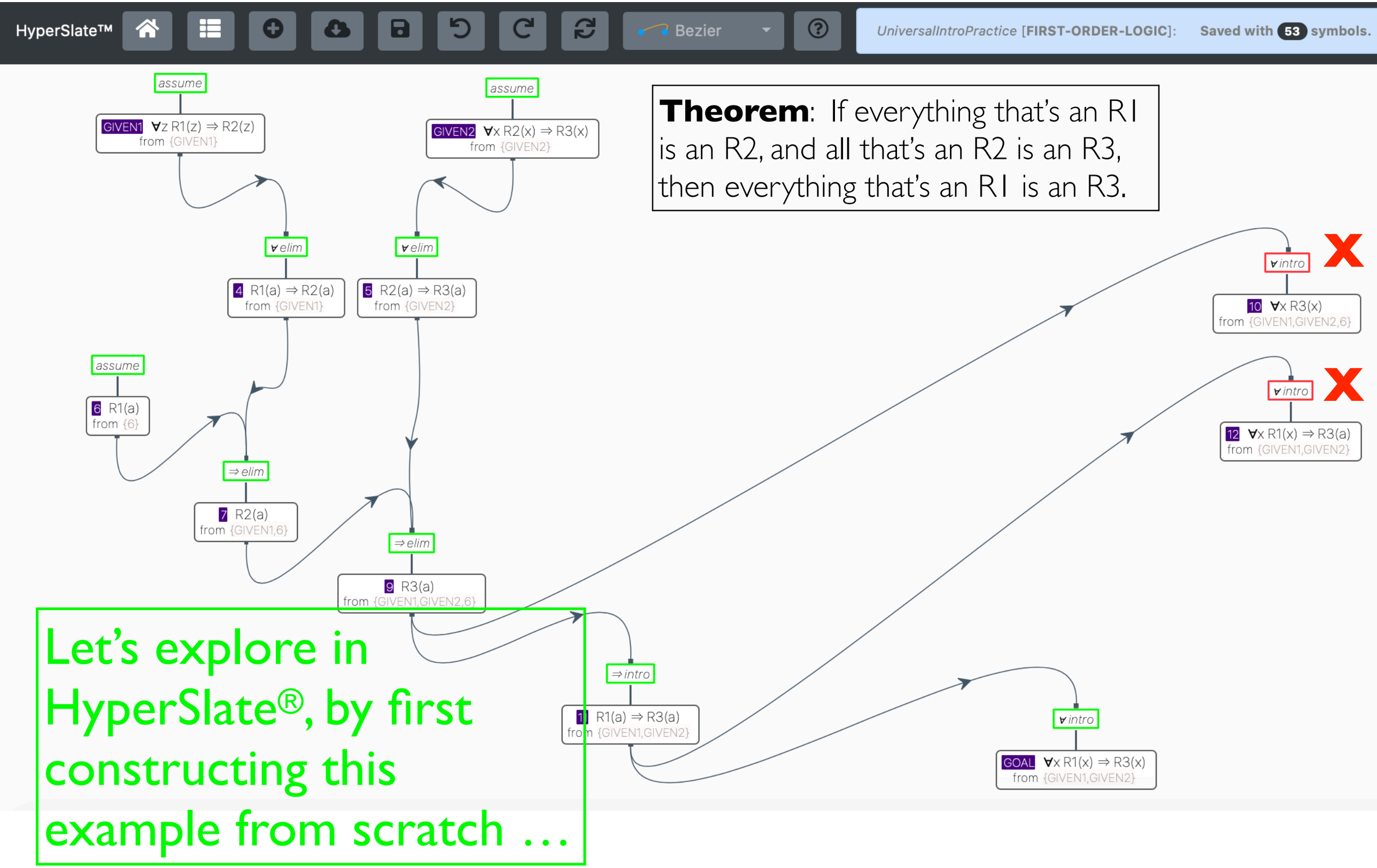


universal intro Example/Tutorial



Let's explore in HyperSlate®, by first constructing this example from scratch …

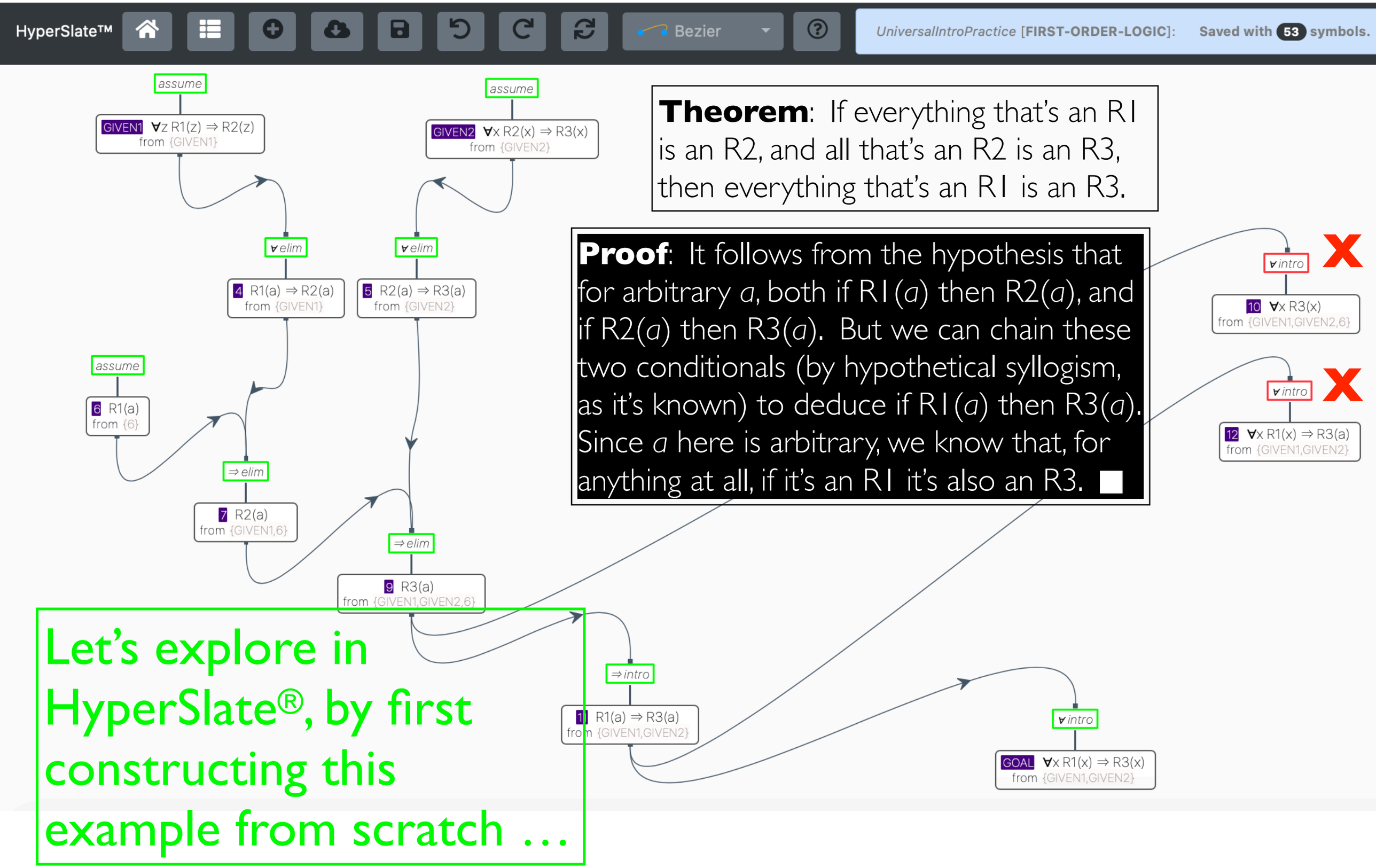
universal intro Example/Tutorial



Theorem: If everything that's an R1 is an R2, and all that's an R2 is an R3, then everything that's an R1 is an R3.

Let's explore in HyperSlate®, by first constructing this example from scratch …

universal intro Example/Tutorial

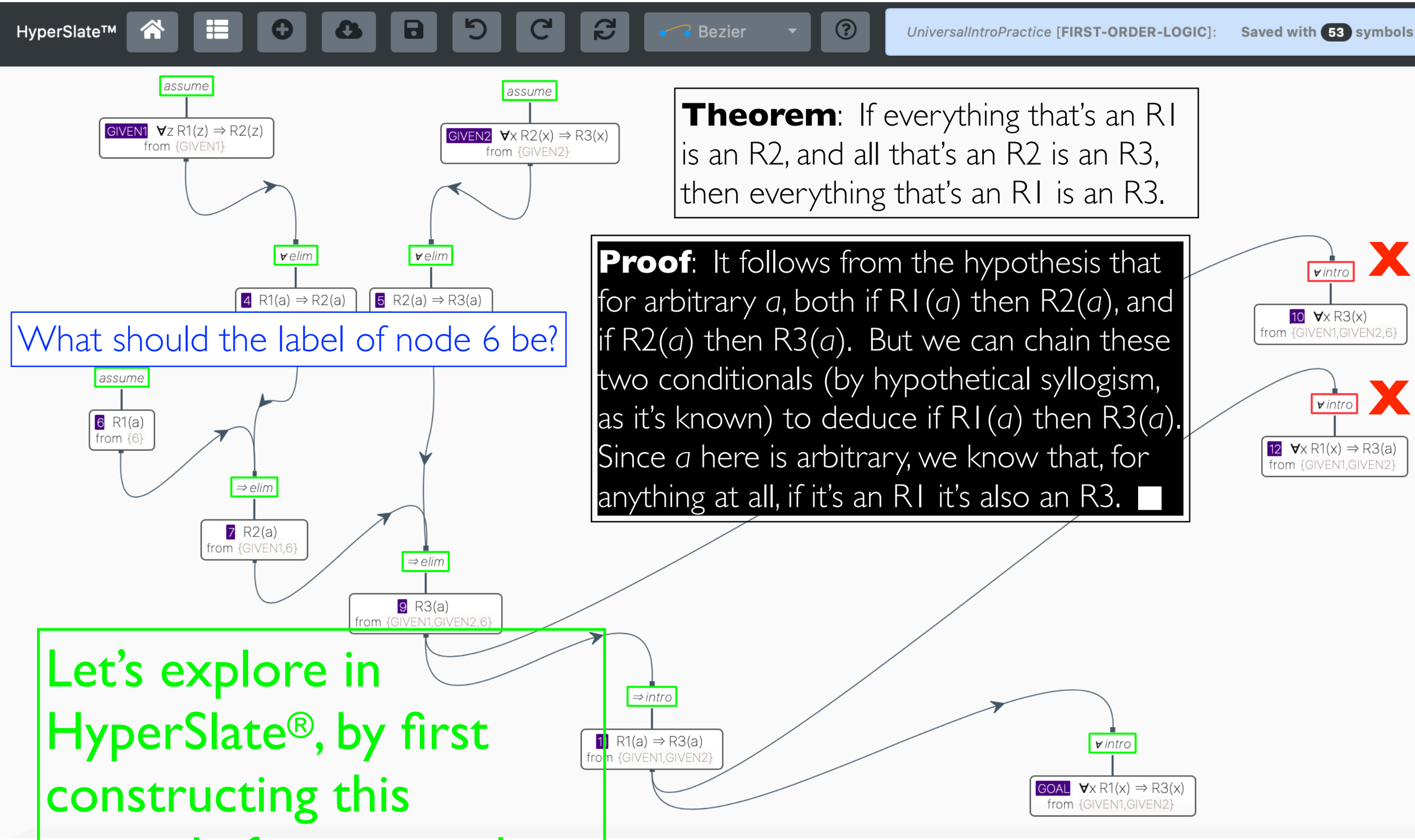


Theorem: If everything that's an R1 is an R2, and all that's an R2 is an R3, then everything that's an R1 is an R3.

Proof: It follows from the hypothesis that for arbitrary *a*, both if R1(*a*) then R2(*a*), and if R2(*a*) then R3(*a*). But we can chain these two conditionals (by hypothetical syllogism, as it's known) to deduce if R1(*a*) then R3(*a*). Since *a* here is arbitrary, we know that, for anything at all, if it's an R1 it's also an R3. ■

Let's explore in HyperSlate®, by first constructing this example from scratch …

universal intro Example/Tutorial



Theorem: If everything that's an R1 is an R2, and all that's an R2 is an R3, then everything that's an R1 is an R3.

Proof: It follows from the hypothesis that for arbitrary *a*, both if R1(*a*) then R2(*a*), and if R2(*a*) then R3(*a*). But we can chain these two conditionals (by hypothetical syllogism, as it's known) to deduce if R1(*a*) then R3(*a*). Since *a* here is arbitrary, we know that, for anything at all, if it's an R1 it's also an R3. ■

Let's explore in HyperSlate®, by first constructing this example from scratch …

Hvis du forstår det, kan du bevise det.