mechanized reasoning mathematics

favonia













Peace of Mind

*photo credit: voltamax@pixabay

Dream Everyone can (easily) check their work in computers

Notable Projects

Four-color theorem Odd-order (Feit-Thompson) theorem Kepler's conjecture (now theorem)

Challenges

The **difficulty** and **length** of formal proofs are certainly a major cause of the absence of any widespread adoption by mathematicians of automated proof checkers. — *Mechanizing Proof by Donald MacKenzie*

Theory Good language (abstraction) Engineering Good editor Efficient checker





0, 1, 2, 3, ...

 $0, 1, 2, 3, \dots \\ \{, \{\}\}, \{\}, \{\}\}, \{\}, \{\}, \{\}\}, \{\}, \{\}\}, \dots$

 $\begin{array}{l} 0, 1, 2, 3, ... \\ \left\{, \left\{\right\}, \left\{\left\{\right\}, \left\{\left\{\right\}\right\}, \left\{\left\{\right\}, \left\{\left\{\right\}\right\}\right\}, \left\{\left\{\right\}, \left\{\left\{\right\}\right\}\right\}\right\}, ... \\ (2, 0) \\ \left\{\left\{\left\{\right\}, \left\{\left\{\right\}\right\}\right\}, \left\{\left\{\right\}, \left\{\left\{\right\}\right\}\right\}\right\}\right\}\end{array}\right\}\end{array}$

$\begin{array}{l} 0, 1, 2, 3, ... \\ \left\{, \left\{\right\}, \left\{\left\{\right\}, \left\{\right\}\right\}, \left\{\left\{\right\}, \left\{\left\{\right\}, \left\{\left\{\right\}\right\}\right\}\right\}, ... \\ (2, 0) \\ \left\{\left\{\left\{\right\}, \left\{\left\{\right\}\right\}\right\}, \left\{\left\{\right\}, \left\{\left\{\right\}\right\}\right\}\right\}\right\}\end{array}\right\}\end{array}$

Need structural set theory, type theory, or something Think about Euclid's Elements.

classical mathematics

(material) set theory







Homotopy Type Theory

Univalent Foundations of Mathematics



Homotopy Type Theory



Did we address the issues?

The **difficulty** and **length** of formal proofs are certainly a major cause of the absence 12 of any widespread adoption by mathema-

Did we address the issues?

Many results were mechanized, some done without paper proofs.

The **difficulty** and **length** of formal proofs are certainly a major cause of the absence 12 of any widespread adoption by mathema-

Did we address the issues?

Many results were mechanized, some done without paper proofs. Mechanized proofs are not longer.

The **difficulty** and **length** of formal proofs are certainly a major cause of the absence 12 of any widespread adoption by mathema-

Full mechanization of Blakers-Massey in Agda (2013) [Licata?] [Favonia]

Un-mechanization into classical theory unpublished [Rezk] (2014)

Full mechanization of Blakers-Massey in Agda (2013) [Licata?] [Favonia]

Un-mechanization into classical theory unpublished [Rezk] (2014)

Generalization [Anel, Biedermann, (2016 or earlier) Finster, Joyal]

Generalization available on arXiv 1703.09050 (2017)

Full mechanization of Blakers-Massey in Agda (2013) [Licata?] [Favonia]

Un-mechanization into classical theory unpublished [Rezk] (2014)

Generalization [Anel, Biedermann, (2016 or earlier) Finster, Joyal]

Generalization available on arXiv 1703.09050 (2017)

Full mechanization of Blakers-Massey in Agda (2013) [Licata?] [Favonia]

Mechanization published (2016) [FFLL]

Un-mechanization into classical theory unpublished [Rezk] (2014)

Generalization [Anel, Biedermann, (2016 or earlier) Finster, Joyal]

Generalization available on arXiv 1703.09050 (2017)

Full mechanization of Blakers-Massey in Agda (2013) [Licata?] [Favonia]

Mechanization published (2016) [FFLL]

Mechanization of the generalization in Agda? (2017-?)



Charles Rezk +6Oct 29,
2014So, I believe I understand the proof of Blakers-Massey as coded2014by +favonia mlatus . At least, I understand enough of it that I
can fill in the rest.

It is a most excellent proof!

Here are a few things I've learned.

1. The theorem involves the pushout P of a diagram X <-- f -- 0

https://plus.google.com/+UrsSchreiber/posts/Zzjd8KM7K5s

Mechanize more theorems Design new languages Develop new tools (RedPRL, ...)

Mechanize more theorems Design new languages Develop new tools (RedPRL, ...)

You can...

Teach me the theorems you want me to mechanize!

Mechanize more theorems Design new languages Develop new tools (RedPRL, ...)

You can...

Teach me the theorems you want me to mechanize! Try a modern mechanization tool

Mechanize more theorems Design new languages Develop new tools (RedPRL, ...)

You can...

Teach me the theorems you want me to mechanize! Try a modern mechanization tool Send me an email by TODAY if you want to play Hanabi