The UTMOST Sage Cell Repository

Thomas W. Judson

Stephen F. Austin State University

judsontw@sfasu.edu

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The first UTMOST (Undergraduate Teaching in Mathematics with Open Software and Textbooks) project was a National Science Foundation CCLI Type 2 grant (2010–2014) that promoted open-source software and open-source curriculum in the undergraduate mathematics classroom. The players were:

- American Institute of Mathematics (DUE–1022574)
- Drake University (DUE–1022036),
- Stephen F. Austin State University (DUE–1020957),
- University of Colorado Boulder (DUE–1020687)
- University of Washington (DUE–1020378)
The products for the first UTMOST grant included:

- CoCalc (formerly SageMathCloud): a comprehensive cloud computing environment for education and scientific computing.
- Sage Cell Server: a mechanism to embed live computations into any webpage.
- PreTeXt (formerly MathBook XML): a framework for writing mathematics that can be published in a variety of formats.
- Sage Education Workshops: workshops for learning how to use Sage for the teaching and learning of mathematics.
- AIM Open Textbook Initiative: an editorial board to identify and support quality open-source textbooks.
The second phase of UTMOST was launched in Fall 2016 and supported by the National Science Foundation as a two-year IUSE grant. The players are:

- American Institute of Mathematics (DUE–1626455): Rob Beezer, David Farmer, Kent Morrison
- Stephen F. Austin State University (DUE–1625223): Thomas Judson
- University of Colorado Boulder (DUE–1624998): Susan Lynds
- University of Michigan (DUE–1624634): Vilma Mesa
Highlights of UTMOST 2.0

- We are investigating how students and instructors use textbooks.
- We are further developing and supporting PreTeXt, including an author’s workshop in May 2017.
- We are advancing the AIM open textbook initiative.
- We are developing and will maintain a repository of Sage cells.
William Stein founded SageMath in 2005. Rather than reinventing the wheel, Sage (which is written mostly in Python and Cython) integrates many specialized mathematics software packages into a common interface, for which a user needs to know only Python.

The Sage community has been the driving force for developing Sage. Developers include both students and professionals.

The philosophy of SageMath is to use existing open-source libraries wherever they exist, including Maxima, R, GAP, and NumPy to name only a few.

In 2013, Stein launched SageMathCloud (now CoCalc), a web-based cloud computing and course management platform for computational mathematics.
Learning Sage

- **Sage is for gearheads??** Although Sage has extensive documentation and examples on the Internet, a student (and a few faculty) have expressed frustration learning Sage.

- **Sage cells make life easy.** Sage cells are self-contained Sage calculations that can be embedded in any web page. This allows Sage commands to be executed on a remote server. See [http://utmost-sage-cell.org](http://utmost-sage-cell.org).
Sage Cell Origins

- In 2011, William Stein and Jason Grout implemented a proof-of-concept “Single Cell” server designed to be a web interface for a single Sage computation. A team led by Jason (with UTMOST NSF funding and a Drake University grant) designed and implemented the first version of SageMathCell in the summer of 2011.

- Ira Hanson worked with Michael Gage, Jason Aubrey, Davide Cervone, and John Travis to allow Sage cells to be embedded in WeBWorK problems and other external pages.

- The Android and iOS apps, which relied on SageMathCell, were built by Ivan Andrus and Volker Braun.

- SageMathCell is now supported by CoCalc and the NSF UTMOST Project and is currently maintained by Andrey Novoseltsev (University of Alberta).
A Look at Sage Cells

- **A Sage cell repository.** Project UTMOST is creating a repository of Sage cells organized by mathematical topic to help authors work more efficiently and to allow authors with minimal Sage knowledge to incorporate Sage into their documents ([http://utmost-sage-cell.org](http://utmost-sage-cell.org)).


Resources

- PreTeXt—A lightweight XML application for authors of scientific articles, textbooks and monographs by R. Beezer (http://mathbook.pugetsound.edu).
- The Sage cell repository—a repository of Sage cells at the CuratedCourses project: http://utmost-sage-cell.org
- SageMath—a free open-source mathematics software system licensed under the GPL (http://www.sagemath.org).
- UTMOST—An NSF project that promotes open-source software and open-source curriculum in the undergraduate mathematics classroom (http://utmost.aimath.org/).
Thank You for Listening

Thomas W. Judson, Associate Professor
Department of Mathematics and Statistics
Stephen F. Austin State University
P.O. Box 13040–3040 SFA Station
Nacogdoches, TX 75962
EMAIL: judsontw@sfasu.edu
WEB PAGE: http://faculty.sfasu.edu/judsontw/