PlanetMath Redux: Web 2.0 infrastructure for mathematical problem solving

Conference or Workshop Item

PlanetMath Redux: Web 2.0 infrastructure for mathematical problem solving

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Abstract. This demo shows work in progress on a Web 2.0 infrastructure for mathematical problem solving. Our aim is to make undergraduate-level mathematics easier to learn: our strategy is to link problems and solved examples to prerequisite material drawn from an existing free/open mathematical knowledge repository, the encyclopedia at PlanetMath.org.

Keywords: mathematics, learning environments, problem solving

1 Overview

We are building a new web infrastructure for mathematical problem solving, with the aim of making undergraduate-level mathematics easier to learn. Our strategy is to build a layer of contributed problems and solutions that are linked into the peer-produced mathematics encyclopedia developed and hosted on PlanetMath.org[3]. PlanetMath has been an active content-producing community since 2001, with around 300 authors contributing to an encyclopedia defining more than 15000 mathematical concepts. Support for problem solving would alter the space significantly, making it easier for students to contribute, and opening up new channels for peer tutoring.

The knowledge rich, systematically constructed, peer reviewed encyclopedia will provide relevant material that undergraduate students would not find in online mathematics learning environments like OpenStudy[4], Khan Academy[5], MathOverflow[6], and Virtual Math Teams[7], though we can draw ideas and inspiration from all of these. Some of the core strengths of our system will be:

- A low floor (easy to participate just by asking a question: keywords will be automatically linked to their definitions) and a high ceiling (the possibility to explore advanced topics and help others);
- Simple models of learning (vocabulary acquisition, enactment of various mathematical roles) will help us keep track of students progress, making the system suitable for peer-supported self-study [1];

[3] `http://planetmath.org`
[4] `http://openstudy.com`
[5] `http://www.khanacademy.org`
[6] `http://mathoverflow.net`
[7] `http://vmt.mathforum.org/vmt/`

– Teachers will be able to use the site to run their own courses (cf. earlier classroom experiments by David Smith [4] and Robert Milson [5]);
– Solutions will be available to logged in users only; activity tracking can be used to discourage cheating, and data mined to generate recommendations.

After some initial prototyping [3], we decided to realize the system as a collection of plugins and modules for the popular open source content management system, Drupal. The current demo shows some of the core "Web 2.0" features, and provides a basis for subsequent semantic extensions (such as disambiguation and linking within formulas).

Concretely, in addition to a port of legacy PlanetMath content into the Drupal framework, our demo will show: (1) Autolinking of technical terms from problems and solutions into the PlanetMath encyclopedia (adapting [2]); and (2) learner profiles and basic activity logging (see Figure 1).

Fig. 1. A user's contributions as they appear within a learner profile

The realized system is anticipated to help cut time and other costs for both learners and teachers, by being a source of problems and solved examples, cross-referenced with prerequisite readings, all of which can be remixed in purpose-made study guides. We expect that our approach to knowledge reuse and peer-to-peer learning will be applicable in related technical fields.

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