

Lurch:

Software for teaching
mathematical proof

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Purpose

We are developing a new piece of mathematical software based on this idea:

If your word processor can check your spelling and grammar, why can't it check your mathematics?

Support from 2008-2010 from NSF DUE #0736644.

Outline

- How is Lurch like/unlike existing software?
- Current version: Lurch Lite v0.1
 - Demonstration
 - Results of classroom testing
- Upcoming version: enables student writing
 - Demonstration of math word processing
 - Opportunities for involvement

Example: Fitch

by Barwise, Etchemendy, Allwein

The screenshot shows the Fitch proof editor interface. The window title is "Fitch: Untitled 1". The menu bar includes "File", "Edit", "Proof", "Goal", "Window", and "Help". The toolbar contains various logical symbols and buttons for "Check Step", "Verify Proof", and "Goal Constraints".

The main workspace displays a proof tree for the goal $\neg \forall x P(x)$. The tree structure is as follows:

- Goal: $\neg \forall x P(x)$
- Assumption: $\exists x \neg P(x)$ (highlighted in purple)
- Subgoal: $\neg P(c)$ (where c is a constant)
- Assumption: $\exists x \neg P(x)$ (highlighted in purple)
- Subgoal: \perp
- Assumption: $P(c)$
- Subgoal: $\forall x P(x)$
- Assumption: \perp
- Assumption: $\exists x \neg P(x)$

On the right side of the proof tree, several inference rules are listed with blue checkmarks and green text:

- \exists Intro
- \perp Intro
- \neg Intro
- \forall Intro
- \perp Intro
- \neg Intro

Lurch Lite v0.1

- Freely available now for Win, Mac, & Unix
<http://lurch.sourceforge.net>
- Three implicit-validation libraries
 - Propositional logic
 - Differential calculus
 - Circle-dot formal system game
- Class-tested in Fall 2008
and released in Spring 2009

Demo

Current Release

Classroom Testing

Student Quotes

- “It helped me learn how to do proofs through trial and error.”
- “...I liked using Lurch because I was able to see what was needed for rules to work.”
- “It told me if I was right or wrong”
- “It was also easier to move lines around than erasing everything on paper.”

Classroom Testing

Likert Scale Responses

- I used Lurch for experimentation; I tinkered to learn the results of various actions. 4.6
- The constant feedback Lurch provides about my work is valuable. 4.2
- It was helpful that proofs in Lurch looked just like proofs in our textbook. 4.2
- Learning to use Lurch took a lot of time that I could have spent learning logic instead. 2.2

Problems

- Original goal: “If your word processor can check your spelling and grammar, why can’t it check your mathematics?”

- Mission statement starts with this sentence:

Lurch should be as indistinguishable from the ordinary activities of mathematics as possible, except for the additional services it provides.

- It is possible to do a proof in Lurch by 3.2
experimental clicking and typing, without thinking.

Demo

Next Release

(stay informed -- see email pad)

Next Steps

1. Combining validation with word-processing

Programmers wanted! (starting any time)

2. Release next version

Sign up to be informed when it happens

3. Adding new math topics using that new version

Mathematicians wanted! (fall/spring)

For more information...

- Project website:

<http://lurch.sourceforge.net>

- Includes current version, introductory videos, future plans, opportunities for involvement, etc.