

Mizar Mathematical Library in Education

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Content

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- Our conception of teaching university mathematics
- Formalization of Mathematics – the first experimental course
- Present and Future

Mizar in education from historical point of view

- Mizar-MSE

1983-1984 - an introduction to logic for secondary school student

1985-1986 – elementary logic, foundations of geometry

Mizar in education from historical point of view

- Mizar-4
 - Introduction to mathematics
 - Lattice theory
- PC-Mizar
 - „indirectly” in teaching topology

Our conception of teaching university mathematics

- Three stages of instruction

Freschmen level

Intermediate level

Research level

The main question

- How should students use MML repository?

Should they work on the whole MML?

Should they work only on its part?

Should they work on special prepared Mizar environments?

Decision

Freschmen level – special prepared Mizar environments

Intermediate level – only indicated MML articles

Research level – the whole MML repository

FM – the setting of the course

- The spring semester of the academic year 2003-2004
- First-year students of the Institute of Computer Science, University of Białystok
- 30 hours of lecture+30 hours of laboratory classes
- FM followed „Introduction to Logic and Set Theory”


The main goal

- Extending student's deduction skills by selecting exercises, within the scope of the preselected areas of mathematics, requiring the usage of more advanced proof techniques

The theory chosen for the course

- Criteria:
 - ★ Interpreted theory
 - ★ Enough rich
- Our choice:
Theory of binary relations

Environments

- 
- RELAT_AB
 - RELATION
 - ENUMSET

Created successively on top of previous ones

- SEPARATE
 - INDUCT

Not integrated with the previous ones

Software for the students

- Editor:
 - GNU Emacs with J.Urban's MizarMode for Emacs
- The Mizar system:
 - version 7.0.02
- Software for using the Internet:
 - Prepared by A.Naumowicz specially for the course

Some examples of the students' tasks

Property of relation	<ul style="list-style-type: none"> ■ $P \subseteq R$ & R is irreflexive implies P is irreflexive ■ P is transitive implies P^{\sim} is transitive ■ $(R \circ S) \circ T = R \circ (S \circ T)$
„per cases”	<ul style="list-style-type: none"> ■ $\text{dom } R = \{\}$ or $\text{rng } R = \{\}$ implies $R = \{\}$ ■ $R^{\sim} \cup S^{\sim} \subseteq (R \cup S)^{\sim}$
counterexamples	<p>ex R, S st R is asymmetric & S is asymmetric & not $R \circ S$ is asymmetric</p>
Scheme of separation	<p>for A, B being set ex C being set st for x being set holds $x \in C$ iff $x \in A$ & $x \in B$</p>
Scheme of induction	<p>For i, j, k being natural number holds $i \cdot (j+k) = i \cdot j + i \cdot k$</p>

Conclusions

- Didactical effect was caused by the factors:
 - ✓ Individual students' work under control of the teacher
 - ✓ A comprehensive set of relatively easy tasks
 - ✓ The ability of individual work at home
- Students' problems
 - ✓ Errors reported by Mizar
 - ✓ Not enough skill in constructing the skeletons of proofs
 - ✓ At the beginning problems with Mizar syntax and the editor used during classes

Present and Future

- Two courses:
 - ❖ „Introduction to Mathematics” (present semestre)
 - ❖ FM (next semestre)
- 30 hours of lecture + 30 hours of laboratory classes