

# Interactive Algebra Course with Formalised

## Proofs and Definitions

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## Wanted Features of a Mathematical Document

- \* trustworthy mathematics
- \* interaction with a proof assistant
- \* intelligent searching
- \* readable proofs

## Needed for a Mathematical Document

- \* trustworthy mathematics → formal mathematics
- \* interaction with a proof assistant → formal mathematics
- \* intelligent searching → semantical mark-up
- \* readable proofs → presentational mark-up

## IDA: Interactive Document on Algebra

Cohen, Cuypers, Sterk

- \* theory enriched with links
- \* multiple choice exercises
- \* various ways to experiment with the theory

But

- \* No formal mathematics
- \* Not yet a semantical mark-up

# IDA: Interactive Document on Algebra

Cohen, Cuypers, Sterk

## Chapter 6 Monoids and Groups

E.g.

**Lemma 6.** A semi-group has at most one unit.

**Proof**

Suppose that  $e$  and  $f$  are units of the semi-group  $(S, *)$ . Then we have

$$e = e * f = f.$$

## C-CoRN

# Constructive Coq Repository at Nijmegen

- \* library of formal mathematics

- algebra

- analysis

But

- \* no mark-up

- \* proofs are not readable

## C-CoRN

### Constructive Coq Repository at Nijmegen

Lemma cs\_unique\_unit :

forall (S:CSemiGroup) (e f:S),

(is\_unit e) /\ (is\_unit f) -> e[=]f.

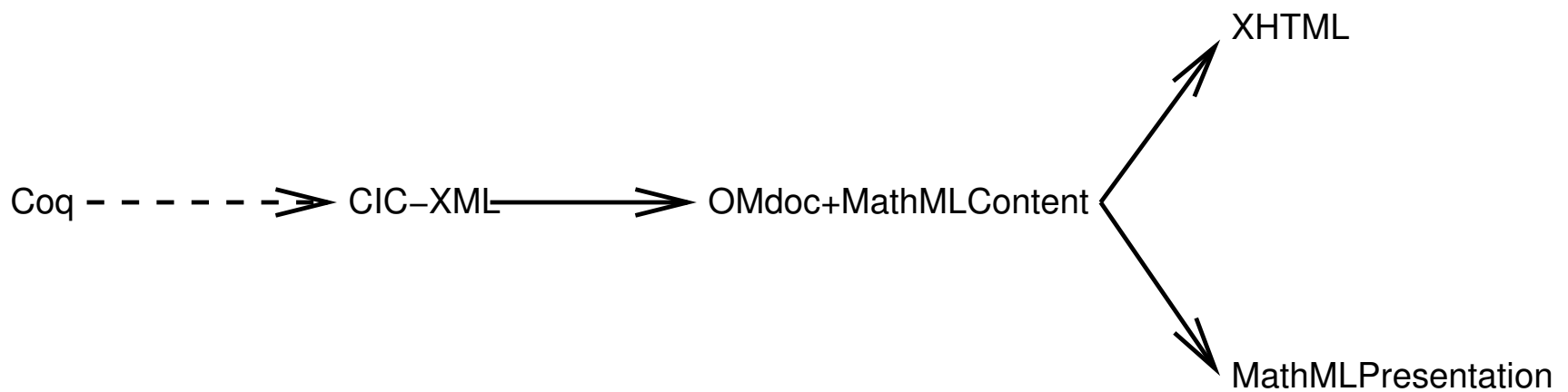
Proof.

```
intros S e f.
unfold is_unit.
intros H.
elim H.
clear H.
intros H0 H1.
elim (H0 f).
clear H0.
```

```
intros H2 H3.
elim (H1 e).
clear H1.
intros H4 H5.
astepr (e[+]f).
astepl (e[+]f).
apply eq_reflexive.
Qed.
```

HELM

Hypertextual Electronic Library of Mathematics





Demo

`<http://helm.cs.kun.nl>`

## Encountered Problems

- \* context dependent rendering of mathematics
- \* links
- \* inline rendering
- \* moving mathematical objects

## Conclusions

- \* Proof display is not satisfactory: maybe proof-trees?
- \* XSLT is too weak to program in a straightforward way.