

Coq quick reference

Coq 8.2pl2

Starting the system

coqtop or coqide
use coqc to compile a file

Quitting the system

Quit.

Starting a proof

Lemma the_name : forall x y, x < x + y.

Finishing a proof

Abort.
Qed.

Libraries

Loading libraries
Require Import ...
Important libraries
Arith, ZArith, List, Wellfounded, Reals

Gathering information

Locate "_ /\ _".
SearchAbout name.
Search name.
SearchPattern (_ <= _ * _).
SearchRewrite (_ * (_ + _)).

Defining a datatype

```
Inductive tree (A : Type) : Type :=  
  L (a : A) | N (t1 t2 : tree A).
```

Programming

```
Fixpoint ev (n:nat) : bool :=  
  match n with  
  | 0 => true  
  | 1 => false  
  | S (S p) => ev p  
  end.
```

```
Fixpoint revt A (l1 l2 : list A) :=  
  match l1 with  
  | nil => l2  
  | a::t1 => revt A t1 (a::l2)  
  end.
```

```
Definition rev' A l := revt A l nil.
```

Computing values

```
Eval vm_compute in ev 3.
```

Basic tactics

Simple goals

`trivial`, `assumption`, `exact H`

Adding intermediate facts

`assert (H : formula),`
`assert (H := theorem a b)`

universal quantification `forall x:T, A` (conclusion)
implication `A -> B` (conclusion)

`intros a b c`

universal quantification (hypothesis)
implication (hypothesis)

`apply H`

equality `A = B` (conclusion)

`reflexivity`, `trivial`, `ring`

equality, universally quantified equality (hypothesis)

`rewrite H`

equality between constructors

`injection H`, `discriminate`

conjunction, `A /\ B` (conclusion)

`split`

conjunction (hypothesis)

`destruct H as [H1 H2]`

disjunction, `A \/ B` (conclusion)

`left`, `right`

disjunction (hypothesis)

`destruct H as [H1 | H2]`

existential quantification
`exists a:T, P a` (conclusion)

`exists e`

existential quantification (hypothesis)

`destruct H as [x Px]`

negation `~A` (conclusion)

`intros H`

negation (hypothesis)

`case H`

case analysis

`destruct (f x) as [v1 | v2 v3]`
`case_eq (f x), case (f x)`

computation and replacement

`unfold f, fold a, simpl, simpl f, simpl (f x)`
`change (f x) with (g x), replace (f x) with (g x)`

Proof by induction

`elim x, elim H, induction x,`
`functional induction f x`

Automatic proof tactics

`tauto`, `firstorder`, `omega`, `ring`