形式化方法导引——作业九

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ext1

整体代码：

```
Lemma ex1: forall A, ~~~A -> ~ A.
Proof.
unfold not.
intros.
apply H.
intros.
apply H1.
exact H0.
Qed.
```

分步运行：
输入

```
Lemma ex1: forall A, ~~~A -> ~ A.
Proof.
```

输出

```
1 goal
______________________________________(1/1)
forall A : Prop, ~ ~ ~ A -> ~ A
```

输入

```
unfold not.
```

输出

```
1 goal
______________________________________(1/1)
forall A : Prop,
```

```
(((A -> False) -> False) -> False) ->
A -> False
```

输入

```
intros.
```

输出

```
1 goal
A : Prop
H : ((A -> False) -> False) -> False
H0 : A
_____________________________________(1/1)
False
```

输入

```
apply H.
```

输出

```
1 goal
A : Prop
H : ((A -> False) -> False) -> False
H0 : A
_____________________________________(1/1)
(A -> False) -> False
```

输入（此处相当于使用演绎定理）

```
intros.
```

输出

```
1 goal
A : Prop
H : ((A -> False) -> False) -> False
H0 : A
H1 : A -> False
```

```
_____________________________________(1/1)
False
```

输入

```
apply H1.
```

输出

```
1 goal
A : Prop
H : ((A -> False) -> False) -> False
H0 : A
H1 : A -> False
_____________________________________(1/1)
A
```

输入

```
exact H0.
```

输出

```
No more goals.
```

ext2

整体代码:

```
Lemma ex2: forall A B, A \/ B -> ~ (~ A /\ ~ B).
Proof.
unfold not.
intros.
destruct H0 as [H1 H2].
destruct H as [H3 | H3].
apply H1.
exact H3.
apply H2.
exact H3.
Qed.
```

分步运行：
输入

```
Lemma ex2: forall A B, A \/ B -> ~ (~ A /\ ~ B).
Proof.
```

输出

```
1 goal
_____________________________________(1/1)
forall A B : Prop,
A \/ B -> ~ (~ A /\ ~ B)
```

输入

```
unfold not.
```

输出

```
1 goal
_____________________________________(1/1)
forall A B : Prop,
A \/ B ->
(A -> False) /\ (B -> False) -> False
```

输入

```
intros.
```

输出

```
1 goal
A, B : Prop
H : A \/ B
H0 : (A -> False) /\ (B -> False)
_____________________________________(1/1)
False
```

输入

```
destruct H0 as [H1 H2].
```

输出

```
1 goal
A, B : Prop
H : A \/ B
H1 : A -> False
H2 : B -> False
_____________________________________(1/1)
False
```

输入

```
destruct H as [H3 | H3].
```

输出

```
2 goals
A, B : Prop
H3 : A
H1 : A -> False
H2 : B -> False
_____________________________________(1/2)
False
_____________________________________(2/2)
False
```

输入

```
apply H1.
```

输出

```
2 goals
A, B : Prop
H3 : A
H1 : A -> False
H2 : B -> False
_____________________________________(1/2)
A
```

```
_____________________________________(2/2)
False
```

输入

```
exact H3.
```

输出

```
1 goal
A, B : Prop
H3 : B
H1 : A -> False
H2 : B -> False
_____________________________________(1/1)
False
```

输入

```
apply H2.
```

输出

```
1 goal
A, B : Prop
H3 : B
H1 : A -> False
H2 : B -> False
_____________________________________(1/1)
B
```

输入

```
exact H3.
```

输出

```
No more goals.
```

ext3

整体代码：

```
Lemma ex3: forall T (P:T -> Prop),
(~exists x, P x) -> forall x, ~ P x.
Proof.
unfold not.
intros.
apply H.
exists x.
exact H0.
Qed.
```

分步运行：

```
Lemma ex3: forall T (P:T -> Prop),
(~exists x, P x) -> forall x, ~ P x.
Proof.
```

输出

```
1 goal
_____________________________________(1/1)
forall (T : Type) (P : T -> Prop),
~ (exists x : T, P x) ->
forall x : T, ~ P x
```

输入

```
unfold not.
```

输出

```
1 goal
_____________________________________(1/1)
forall (T : Type) (P : T -> Prop),
((exists x : T, P x) -> False) ->
forall x : T, P x -> False
```

输入

```
intros.
```

输出

```
1 goal
T : Type
P : T -> Prop
H : (exists x : T, P x) -> False
x : T
H0 : P x
______________________________________(1/1)
False
```

输入

```
apply H.
```

输出

```
1 goal
T : Type
P : T -> Prop
H : (exists x : T, P x) -> False
x : T
H0 : P x
______________________________________(1/1)
exists x0 : T, P x0
```

输入

```
exists x.
```

输出

```
1 goal
T : Type
P : T -> Prop
H : (exists x : T, P x) -> False
x : T
H0 : P x
______________________________________(1/1)
P x
```

输入

```
exact H0.
```

输出

```
No more goals.
```