ソフトウェア基礎科学：Coq 演習課題

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Exercise 1-1

Enter the following proofs in Coqide, and see how the proofs proceed.

```
Theorem ex1_1a: forall A:Prop, A -> A.
Proof.
intro.
intro H.
exact H.
Qed.

Theorem ex1_1b: forall A B: Prop, A /\ B -> A.
Proof.
intros.
case H.
intro X.
intro.
exact X.
Qed.
```

Exercise 1-2

Complete the following proofs.

```
Theorem ex1_2a: forall A B: Prop, A -> B -> A/\B.
Proof.
intros.
split.
...
Qed.
```

```
Theorem ex1_2b: forall A B: Prop, A -> A\/ B.
Proof.
intros.
left.
...
Qed.
```

Exercise 1-3

Prove the theorems below in Coq, using only the following tactics.

```
-----------------------
exact <term>.
intro.
apply <term>.
case <term>.
left.
right.
-----------------------

Theorem ex1_3a: forall A:Prop, A->A.
Theorem ex1_3b: forall A B:Prop, A->(A->B)->B.
Theorem ex1_3c: forall A B:Prop, A/\B -> A.
Theorem ex1_3d: forall A B:Prop, A/\(A->B)->B.
Theorem ex1_3e: forall A B C:Prop, (A->B)/\(B->C) ->(A->C).
Theorem ex1_3f: forall A B:Prop, A -> A\/B.
Theorem ex1_3g: forall A B:Prop, A\/B -> (A->B) -> B.
Theorem ex1_3h: forall A:Prop, A -> ~~A.
Theorem ex1_3i: forall A:Prop, ~~(A\/~A).
Theorem ex1_3j: forall A B:Prop, A\/B -> ~A -> B.
```

Exercise 1-4 (Advanced)

Prove the theorems in Exercise 1-3 only by using the tactic “exact”.