软件科学基础

Maps: Total and Partial Maps

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复习：Lists章节的Map定义

```
Inductive id : Type :=
  | Id (n : nat).

Definition eqb_id (x1 x2 : id) :=
  match x1, x2 with
  | Id n1, Id n2 => n1 =? n2
  end.
```

复习：Lists章节的Map定义

```coq
Inductive partial_map : Type :=
  | empty
  | record (i : id) (v : nat) (m : partial_map).

Definition update (d : partial_map)
                  (x : id) (value : nat)
                  : partial_map :=
  record x value d.

Fixpoint find (x : id) (d : partial_map) : natoption :=
  match d with
  | empty          => None
  | record y v d' => if eqb_id x y
                     then Some v
                     else find x d'
  end.
```

问题：同样的映射可能对应多个map，未定义完全映射

重新用函数定义 Map

可以应用函数相关的定理，使得一些证明更简单

```coq
Definition eqb_string (x y : string) : bool :=
  if string_dec x y then true else false.

Definition total_map (A : Type) := string -> A.

Definition t_empty {A : Type} (v : A) : total_map A :=
  (fun _ => v).

Definition t_update {A : Type} (m : total_map A)
                    (x : string) (v : A) :=
  fun x' => if eqb_string x x' then v else m x'.
```

重新用函数定义Map

```coq
Notation "'_' '!->' v" := (t_empty v)
  (at level 100, right associativity).

Notation "x '!->' v ';' m" := (t_update m x v)
    (at level 100, v at next level, right associativity).

Definition examplemap' :=
  ( "bar" !-> true;
    "foo" !-> true;
    _       !-> false
  ).
```

重新用函数定义Map

```coq
Definition partial_map (A : Type) := total_map (option A
).

Definition empty {A : Type} : partial_map A :=
  t_empty None.

Definition update {A : Type} (m : partial_map A)
          (x : string) (v : A) :=
  (x !-> Some v ; m).

Notation "x '|->' v ';' m" := (update m x v)
  (at level 100, v at next level, right associativity).

Notation "x '|->' v" := (update empty x v)
  (at level 100).

Example examplepmap :=
  ("Church" |-> true ; "Turing" |-> false).
```

作业

- 完成Maps中2道standard非optional的习题
  - 请使用最新英文版教材