Chapter 1

Library phi

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Require Import Relations.Relation_Definitions.
Inductive Process :=
  | Nil : Process
  | Input : nat → (nat → Process) → Process
  | Output : nat → Process → Process
  | Sum : Process → Process → Process
  | Res : nat → Process → Process.
Definition small_step : relation Process :=
  fun p1 p2 ⇒
    match p1 with
    | Input x f ⇒
      ∃ v, p2 = f v
    | Output x p ⇒
      p2 = p
    | Sum p1' p2' ⇒
      p2 = Sum p1' p2' ∨ p2 = Sum p1 p2'
    | Res x p ⇒
      ∃ y, p2 = Res y p ∧ x ≠ y
    | _ ⇒ False
    end.
Inductive multi_step : relation Process :=
  | refl : ∀ p, multi_step p p
  | step : ∀ p1 p2 p3, small_step p1 p2 → multi_step p2 p3 → multi_step p1 p3.
Inductive bisim : relation Process :=
  | bisim_refl : ∀ p, bisim p p
  | bisim_trans : ∀ p1 p2 p3, bisim p1 p2 → small_step p2 p3 → bisim p1 p3
  | bisim_symm : ∀ p1 p2, bisim p1 p2 → bisim p2 p1.
Definition bisimulation (R : relation Process) :=
  ∀ p q, R p q → (∀ p', small_step p p' → ∃ q', R p' q' ∧ small_step q q') ∧
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(∀ q', small_step q q' → ∃ p', R p' q' ∧ small_step p p').
Definition bisimilarity (R : relation Process) :=
  ∀ p q, R p q → ∃ q', bisim q q' ∧ multi_step p q'.
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