

Funcons-beta: Sets *

The P_LanCompS Project

Sets.cbs | PLAIN | PRETTY

Sets

```
[ Type sets
  Funcon set
  Funcon set-elements
  Funcon is-in-set
  Funcon is-subset
  Funcon set-insert
  Funcon set-unite
  Funcon set-intersect
  Funcon set-difference
  Funcon set-size
  Funcon some-element
  Funcon element-not-in ]
```

Meta-variables $GT <: \text{ground-values}$

Built-in Type $\text{sets}(GT)$

$\text{sets}(GT)$ is the type of possibly-empty finite sets $\{V_1, \dots, V_n\}$ where $V_1 : GT, \dots, V_n : GT$.

Built-in Funcon $\text{set}(_ : (GT)^*) : \Rightarrow \text{sets}(GT)$

The notation $\{V_1, \dots, V_n\}$ for $\text{set}(V_1, \dots, V_n)$ is built-in.

Assert $\{V^* : (GT)^*\} == \text{set}(V^*)$

Note that $\text{set}(\dots)$ is not a constructor operation. The order and duplicates of argument values are ignored (e.g., $\{1, 2, 1\}$ denotes the same set as $\{1, 2\}$ and $\{2, 1\}$).

Built-in Funcon $\text{set-elements}(_ : \text{sets}(GT)) : \Rightarrow (GT)^*$

For each set S , the sequence of values V^* returned by $\text{set-elements}(S)$ contains each element of S just once. The order of the values in V^* is unspecified, and may vary between sets (e.g., $\text{set-elements} \{1, 2\}$ could be $(1, 2)$ and $\text{set-elements} \{1, 2, 3\}$ could be $(3, 2, 1)$).

*Suggestions for improvement: plancomps@gmail.com.
Reports of issues: <https://github.com/plancomps/CBS-beta/issues>.

Assert `set(set-elements(S)) == S`

Built-in Funcon `is-in-set(_ : GT, _ : sets(GT)) : => booleans`

`is-in-set(GV, S)` tests whether GV is in the set S .

Assert `is-in-set(GV : GT, { }) == false`

Assert `is-in-set(GV : GT, {GV} : sets(GT)) == true`

Built-in Funcon `is-subset(_ : sets(GT), _ : sets(GT)) : => booleans`

`is-subset(S1, S2)` tests whether S_1 is a subset of S_2 .

Assert `is-subset({ }, S : sets(GT)) == true`

Assert `is-subset(S : sets(GT), S) == true`

Built-in Funcon `set-insert(_ : GT, _ : sets(GT)) : => sets(GT)`

`set-insert(GV, S)` returns the set union of $\{GV\}$ and S .

Assert `is-in-set(GV : GT, set-insert(GV : GT, S : sets(GT))) == true`

Built-in Funcon `set-unite(_ : (sets(GT))*) : => sets(GT)`

`set-unite(...)` unites a sequence of sets.

Assert `set-unite(S : sets(GT), S) == S`

Assert `set-unite(S1 : sets(GT), S2 : sets(GT)) == set-unite(S2, S1)`

Assert `set-unite(S1 : sets(GT), set-unite(S2 : sets(GT), S3 : sets(GT)))
== set-unite(set-unite(S1, S2), S3)`

Assert `set-unite(S1 : sets(GT), S2 : sets(GT), S3 : sets(GT))
== set-unite(S1, set-unite(S2, S3))`

Assert `set-unite(S : sets(GT)) == S`

Assert `set-unite() == { }`

Built-in Funcon `set-intersect(_ : (sets(GT))^+) : => sets(GT)`

`set-intersect(GT, ...)` intersects a non-empty sequence of sets.

Assert `set-intersect(S : sets(GT), S) == S`

Assert `set-intersect(S1 : sets(GT), S2 : sets(GT)) == set-intersect(S2, S1)`

Assert `set-intersect(S1 : sets(GT), set-intersect(S2 : sets(GT), S3 : sets(GT)))
== set-intersect(set-intersect(S1, S2), S3)`

Assert `set-intersect(S1 : sets(GT), S2 : sets(GT), S3 : sets(GT))
== set-intersect(S1, set-intersect(S2, S3))`

Assert `set-intersect(S : sets(GT)) == S`

Built-in Funcon `set-difference`(`_ : sets(GT)`, `_ : sets(GT)`) : \Rightarrow `sets(GT)`

`set-difference`(S_1, S_2) returns the set containing those elements of S_1 that are not in S_2 .

Built-in Funcon `set-size`(`_ : sets(GT)`) : \Rightarrow `natural-numbers`

Assert `set-size`($S : \text{sets}(GT)$) == `length`(`set-elements`(S))

Funcon `some-element`(`_ : sets(GT)`) : \Rightarrow `GT?`

Assert `some-element`($S : \text{sets}(GT)$) == `index`(1, `set-elements`(S))

Assert `some-element` { } == ()

Built-in Funcon `element-not-in`(`GT : types`, `_ : set(GT)`) : \Rightarrow `GT?`

`element-not-in`(GT, S) gives an element of the type GT not in the set S , or () when S is empty. When the set of elements of GT is infinite, `element-not-in`(GT, S) never gives ().