# Contents

**CONTEXT** VelibContext

**SETS**

PERSONNES

VELOS

SITES

PLACES

**AXIOMS**

axm1: $finite(PERSONNES)$

axm2: $finite(VELOS)$

axm3: $finite(SITES)$

**END**

**MACHINE** Velib
**SEES** VelibContext
**VARIABLES**

abonnes
velos
sites
nbplaces
velos_in_site
emprunts

**INVARIANTS**

inv1: $abonnes \subseteq PERSONNES$
inv2: $velos \subseteq VELOS$
inv3: $sites \subseteq SITES$
inv8: $nbplaces \in sites \to \mathbb{N}$
inv10: $velos\_in\_site \in sites \to \mathbb{P}(velos)$
inv14: $\forall s \cdot s \in SITES \Rightarrow (s \in sites \Rightarrow nbplaces(s) \geq card(velos\_in\_site(s)))$
inv11: $emprunts \in abonnes \rightarrowtail velos$
inv12: $\forall s1, s2 \cdot ((s1 \in sites \land s2 \in sites \land s1 \neq s2) \Rightarrow (velos\_in\_site(s1) \cap velos\_in\_site(s2)) = \varnothing)$
inv13: $\forall v, s \cdot v \in velos \land s \in sites \land v \in ran(emprunts) \Rightarrow (v \notin velos\_in\_site(s))$

**EVENTS**

**Initialisation**

**begin**

act1: $abonnes := \varnothing$
act2: $velos := \varnothing$
act3: $sites := \varnothing$
act4: $nbplaces := \varnothing$
act5: $velos\_in\_site := \varnothing$
act6: $emprunts := \varnothing$

**end**

**Event** AddSite ⟨ordinary⟩ $\widehat{=}$

**any**

site
nb_places
init_velos

**where**

grd1: $site \in SITES \setminus sites$
grd2: $nb\_places \in \mathbb{N} \land nb\_places > 0$
grd3: $init\_velos \subseteq velos \land card(init\_velos) > 0$
grd6: $init\_velos \cap ran(emprunts) = \varnothing$
grd4: $nb\_places \geq card(init\_velos)$
grd5: $\forall v, s \cdot v \in velos \land s \in sites \land v \in velos\_in\_site(s) \Rightarrow (v \notin init\_velos)$

**then**

act1: $sites := sites \cup \{site\}$
act2: $nbplaces(site) := nb\_places$
act3: $velos\_in\_site(site) := init\_velos$

**end**

**Event** AcheterVelos ⟨ordinary⟩ $\widehat{=}$

**any**

v

**where**

grd1: $v \subseteq VELOS \setminus velos$
grd2: $card(v) > 0$

**then**

act1: $velos := velos \cup v$

**end**

**Event** DeplacerVelos ⟨ordinary⟩ $\widehat{=}$

**any**
site_a
site_b
velos_a
**where**
grd1: $site\_a \in sites$
grd2: $site\_b \in sites$
grd5: $site\_a \neq site\_b$
grd3: $velos\_a \subseteq velos\_in\_site(site\_a)$
grd6: $card(velos\_a) > 0$
grd4: $nbplaces(site\_b) - (card(velos\_in\_site(site\_b))) \geq card(velos\_a)$
**then**
act2: $velos\_in\_site := velos\_in\_site \lhd \{site\_a \mapsto velos\_in\_site(site\_a) \setminus velos\_a, site\_b \mapsto velos\_in\_site(site\_b) \cup velos\_a\}$
**end**

**Event** RemoveSite ⟨ordinary⟩ $\widehat{=}$
**any**
s
**where**
grd1: $s \in sites$
grd2: $card(velos\_in\_site(s)) = nbplaces(s) \lor (\exists s2 \cdot s2 \in sites \land s2 \neq s \land nbplaces(s2) > card(velos\_in\_site(s2)))$
**then**
act1: $velos\_in\_site := velos\_in\_site \setminus \{s \mapsto velos\_in\_site(s)\}$
act2: $nbplaces := nbplaces \setminus \{s \mapsto nbplaces(s)\}$
act3: $sites := sites \setminus \{s\}$
**end**

**Event** AddVelosToSite ⟨ordinary⟩ $\widehat{=}$
**any**
new_velos
site
**where**
grd1: $site \in sites$
grd2: $new\_velos \subseteq velos \land card(new\_velos) > 0$
grd4: $new\_velos \cap ran(emprunts) = \varnothing$
grd5: $\forall v, s \cdot v \in velos \land v \in new\_velos \land s \in sites \Rightarrow v \notin velos\_in\_site(s)$
grd3: $nbplaces(site) \geq card(new\_velos) + card(velos\_in\_site(site))$
**then**
act1: $velos\_in\_site(site) := velos\_in\_site(site) \cup new\_velos$
**end**

**Event** AddAbonne ⟨ordinary⟩ $\widehat{=}$
**any**
new_abonne
**where**
grd1: $new\_abonne \in PERSONNES \setminus abonnes$
**then**
act1: $abonnes := abonnes \cup \{new\_abonne\}$
**end**

**Event** RemoveAbonne ⟨ordinary⟩ $\widehat{=}$
**any**
a
**where**
grd1: $a \in abonnes$
grd2: $a \notin dom(emprunts)$
**then**
act1: $abonnes := abonnes \setminus \{a\}$
**end**

**Event** EmprunterVelo ⟨ordinary⟩ $\widehat{=}$

**any**
abonne
site
velo
**where**
grd1: $abonne \in abonnes$
grd4: $abonne \notin dom(emprunts)$
grd3: $site \in sites$
grd2: $velo \in velos \land velo \in velos\_in\_site(site)$
**then**
act1: $emprunts(abonne) := velo$
act2: $velos\_in\_site(site) := velos\_in\_site(site) \setminus \{velo\}$
**end**

**Event** RendreVelo ⟨ordinary⟩ $\widehat{=}$
**any**
abonne
site
**where**
grd1: $abonne \in abonnes$
grd2: $site \in sites$
grd3: $abonne \in dom(emprunts)$
grd4: $nbplaces(site) \geq card(velos\_in\_site(site)) + 1$
**then**
act2: $velos\_in\_site(site) := velos\_in\_site(site) \cup \{emprunts(abonne)\}$
act1: $emprunts := emprunts \setminus \{abonne \mapsto emprunts(abonne)\}$
**end**

**END**