Concordia University

Department of Computer Science and Software
Engineering

SOEN 331 - S and U

Introduction to Formal Methods
for Software Engineering

Assignment 2 - Solutions

The Object-Z specification language

Team 19 - Section U

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Due Date: March 11, 2021

1 Contact management

1.1 State

1.2   Class Contacts

Contacts

$\upharpoonright$ (*MakeNewContact, AddNumber, SearchForNumber, DeleteNumber*)

$numbers : \mathbb{P}\,PhoneNumberType$
$recorded : PhoneNumberType \nrightarrow NameType$
$count : \mathbb{N}$

$numbers = dom\ recorded$
$count >= 0$

INIT

$recorded = \varnothing$
$count = 0$

MakeNewContactOK

$\Delta(recorded, count)$
$number? : PhoneNumberType$
$name? : NameType$

$number? \notin numbers$
$name? \notin ran\ recorded$
$recorded' = recorded \cup \{number? \mapsto name?\}$
$count' = count + 1$

AddNumberOK

$\Delta(recorded)$
$number? : PhoneNumberType$

$count > 0$
$number? \notin numbers$
$name? \in ran\ recorded$
$recorded' = recorded \cup \{number? \mapsto name?\}$

SearchForNumberOK

$\Xi Contacts$
$name? : NameType$
$numbers! : \mathbb{P}\,number$

$count > 0$
$numbers! = \{n : number \mid recorded(n) = name?\}$

...

3

_____ Contacts/cont. _____

...

   _____ DeleteNumberOK _____
   | $\Delta(recorded, count)$
   | $number? : PhoneNumberType$
   | $name! : NameType \rhd \{number?\}$
   |_____
   | $count > 0$
   | $number? \in numbers$
   | $recorded' = \{number?\} \lhd recorded$
   | $\textbf{if}\ \#(recorded \rhd \{name!\}) = 0\ \textbf{then}\ count' = count - 1\ \textbf{else}\ count' = count$

   _____ NameUnknown _____
   | $name? : NameType$
   | $response! : Message$
   |_____
   | $name? \notin ran\ recorded$
   | $response! = {}'Name\ unknown'$

   _____ NumberUnknown _____
   | $number? : PhoneNumberType$
   | $response! : Message$
   |_____
   | $number? \notin dom\ recorded$
   | $response! = {}'Number\ unknown'$

   _____ NameExists _____
   | $name? : NameType$
   | $response! : Message$
   |_____
   | $name? \in ran\ recorded$
   | $response! = {}'Name\ already\ exists'$

   _____ NumberExists _____
   | $number? : PhoneNumberType$
   | $response! : Message$
   |_____
   | $number? \in dom\ recorded$
   | $response! = {}'Number\ already\ exists'$

   _____ ContactsEmpty _____
   | $response! : Message$
   |_____
   | $count = 0$
   | $response! = {}'Contacts\ is\ empty'$

   _____ Success _____
   | $response! : Message$
   |_____
   | $response! = {}'Success'$

...

Contacts/cont.

...

$MakeNewContact \mathrel{\widehat{=}} (MakeNewContactOK \wedge Success) \oplus (NameExists \vee NumberExists)$

$AddNumber \mathrel{\widehat{=}} (AddNumberOK \wedge Success) \oplus (NameUnknown \vee NumberExists)$

$SearchForNumber \mathrel{\widehat{=}} (SearchForNumberOK \wedge Success) \oplus (NameUnknown \vee ContactsEmpty)$

$DeleteNumber \mathrel{\widehat{=}} (DeleteNumberOK \wedge Success) \oplus (NumberUnknown \vee ContactsEmpty)$

1.3 Class Contacts2