

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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1 Contact management

1.1 State

1.2 Class Contacts

| | |
|---|---|
| <i>Contacts</i> | $\uparrow (MakeNewContact, AddNumber, SearchForNumber, DeleteNumber)$ |
| $numbers : \mathbb{P}PhoneNumberType$ $recorded : PhoneNumberType \leftrightarrow NameType$ $count : \mathbb{N}$ | |
| $numbers = dom\ recorded$ $count \geq 0$ | |
| <i>INIT</i> | |
| $recorded = \emptyset$ $count = 0$ | |
| <i>MakeNewContactOK</i> | |
| $\Delta(recorded, count)$ $number? : PhoneNumberType$ $name? : NameType$ | |
| $number? \notin numbers$ $name? \notin ran\ recorded$ $recorded' = recorded \cup \{number? \mapsto name?\}$ $count' = count + 1$ | |
| <i>AddNumberOK</i> | |
| $\Delta(recorded)$ $number? : PhoneNumberType$ | |
| $count > 0$ $number? \notin numbers$ $name? \in ran\ recorded$ $recorded' = recorded \cup \{number? \mapsto name?\}$ | |
| <i>SearchForNumberOK</i> | |
| $\exists Contacts$ $name? : NameType$ $numbers! : \mathbb{P} number$ | |
| $count > 0$ $numbers! = \{n : number \mid recorded(n) = name?\}$ | |
| ... | |

Contacts/cont.

...

DeleteNumberOK

$\Delta(\text{recorded}, \text{count})$

$\text{number?} : \text{PhoneNumberType}$

$\text{count} > 0$

$\text{number?} \in \text{numbers}$

$\text{recorded}' = \{\text{number?}\} \triangleleft \text{recorded}$

???if name has no more phoneNumbers then $\text{count}' = \text{count} - 1$

NameUnknown

$\text{name?} : \text{NameType}$

$\text{response!} : \text{Message}$

$\text{name?} \notin \text{ran recorded}$

$\text{response!} = \text{'Name unknown'}$

NumberUnknown

$\text{number?} : \text{PhoneNumberType}$

$\text{response!} : \text{Message}$

$\text{number?} \notin \text{dom recorded}$

$\text{response!} = \text{'Number unknown'}$

NameExists

$\text{name?} : \text{NameType}$

$\text{response!} : \text{Message}$

$\text{name?} \in \text{ran recorded}$

$\text{response!} = \text{'Name already exists'}$

NumberExists

$\text{number?} : \text{PhoneNumberType}$

$\text{response!} : \text{Message}$

$\text{number?} \in \text{dom recorded}$

$\text{response!} = \text{'Number already exists'}$

ContactsEmpty

$\text{response!} : \text{Message}$

$\text{count} = 0$

$\text{response!} = \text{'Contacts is empty'}$

Success

$\text{response!} : \text{Message}$

$\text{response!} = \text{'Success'}$

...

Contacts/cont.

...

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

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

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

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

1.3 Class Contacts2