

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**

<b>Samuel Boaknin</b>	<b>Ryan Leyland</b>	<b>Saleha Tariq</b>
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40009692

40015165

40006997

**Meng Susana Ung**

40099729

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# 1 Contact management

## 1.1 State

## 1.2 Class Contacts

*Contacts*

$\uparrow (MakeNewContact, AddNumber, SearchForNumber, DeleteNumber)$

$numbers : \mathbb{P} PhoneNumberType$   
 $recorded : PhoneNumberType \leftrightarrow NameType$

$numbers = dom\ recorded$

*INIT*

$recorded = \emptyset$

*MakeNewContactOK*

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

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

*AddNumberOK*

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

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

*SearchForNumberOK*

$\exists Contacts$   
 $name? : NameType$   
 $numberset! : \mathbb{P} numbers$

$name? \in ran\ recorded$   
 $numberset! = \{n : numbers \mid recorded(n) = name?\}$

*DeleteNumberOK*

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

$number? \in numbers$   
 $recorded' = \{number?\} \triangleleft recorded$

...

*Contacts/cont.*

...

*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*'

*Success*

*response!* : *Message*

*response!* = '*Success*'

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

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

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

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

### 1.3 Class Contacts2

*Contacts2*

$\uparrow (MakeNewContact, AddNumber, SearchForNumber, DeleteNumber, SearchForPerson)$

*Contacts*

*SearchForPersonOK*

$\exists Contacts2$

$number? : PhoneNumberType$

$name! : NameType$

$number? \in numbers$

$name! = recorded(number?)$

$SearchForPerson \hat{=} (SearchForPersonOK \wedge Success) \oplus (NumberUnknown)$