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

**Samuel Boaknin**        **Ryan Leyland**        **Saleha Tariq**

40009692                40015165                40006997

**Meng Susana Ung**

40099729

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# 1 Contact management

## 1.1 State

## 1.2    Class Contacts

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**Contacts**

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

---

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

---

$numbers = dom \; recorded$

---

**INIT**

$recorded = \varnothing$

---

**MakeNewContactOK**

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

---

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

---

**AddNumberOK**

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

---

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

---

**SearchForNumberOK**

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

---

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

---

**DeleteNumberOK**

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

---

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

---

...

---

3

_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'
└────────────────────────────────────────────

┌─ _ContactsEmpty_ _____
│ response! : Message
├────────────────
│ count = 0
│ response! = 'Contacts is empty'
└────────────────────────────────────────────

┌─ _Success_ _____
│ response! : Message
├────────────────
│ response! = 'Success'
└────────────────────────────────────────────

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

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

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

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

## 1.3 Class Contacts2