

[*NAME*]

[*SURNAME*]

[*TELEPHONE*]

<i>TelephoneDirectory</i>
$persons : NAME \rightarrow SURNAME$ $phoneNumbers : NAME \rightarrow TELEPHONE$
$\text{dom } phoneNumbers = \text{dom } persons$

<i>InitTelephoneDirectory</i> <i>TelephoneDirectory'</i>
$persons' = \{\}$

<i>AddPerson</i> $\Delta TelephoneDirectory$ $name? : NAME$ $surname? : SURNAME$ $phone? : TELEPHONE$
$name? \mapsto surname? \notin persons$ $persons' = persons \cup \{name? \mapsto surname?\}$

<i>AddNumber</i> $\Delta TelephoneDirectory$ $m : NAME$ $p? : TELEPHONE$
$m \notin \text{dom } persons$ $p? \notin \text{ran } phoneNumbers$ $phoneNumbers' = phoneNumbers \cup \{m \mapsto p?\}$

<i>RemovePerson</i> $\Delta TelephoneDirectory$ $n : NAME$ $s : SURNAME$ $p? : TELEPHONE$
$n \mapsto s \in persons$ $n \mapsto p? \in phoneNumbers$ $phoneNumbers' = phoneNumbers \setminus \{n \mapsto p?\}$ $persons' = persons \setminus \{n \mapsto s\}$

<i>RemoveNumber</i>
$\Delta TelephoneDirectory$
$n : NAME$
$s : SURNAME$
$p? : TELEPHONE$
$p? \in \text{ran } phoneNumbers$
$\text{ran } phoneNumbers' = \text{ran } phoneNumbers \setminus \{p\}$

$OUTPUT ::= success \mid alreadyInDirectory \mid nameNotInDirectory \mid numberInUse \mid numberDoesntExist$

<i>Success</i>
$message! : OUTPUT$
$n : NAME$
$s : SURNAME$
$message! = success$

<i>AlreadyInDirectory</i>
$\exists TelephoneDirectory$
$message! : OUTPUT$
$n : NAME$
$s : SURNAME$
$n \mapsto s \in persons$
$message! = alreadyInDirectory$

<i>NameNotInDirectory</i>
$\exists TelephoneDirectory$
$message! : OUTPUT$
$n : NAME$
$s : SURNAME$
$n \mapsto s \notin persons$
$message! = nameNotInDirectory$

<i>NumberInUse</i>
$message! : OUTPUT$
$p? : TELEPHONE$
$p? \in \text{ran } phoneNumbers$
$message! = numberInUse$

<i>NumberDoesntExist</i>
<i>message!</i> : <i>OUTPUT</i>
<i>p?</i> : <i>TELEPHONE</i>
<i>p?</i> $\notin \text{ran } \textit{phoneNumbers}$
<i>message!</i> = <i>numberDoesntExist</i>

TotalAddPerson == (*AddPerson* \wedge *Success*) \vee *AlreadyInDirectory*

TotalRemovePerson $\hat{=}$ (*RemovePerson* \wedge *Success*) \vee *NameNotInDirectory*

TotalAddNumber $\hat{=}$ (*AddNumber* \wedge *Success*) \vee *NameNotInDirectory* \vee *NumberInUse*

TotalRemoveNumber $\hat{=}$ (*RemoveNumber* \wedge *Success*) \vee *NumberDoesntExist* \vee *NameNotInDirectory*

TotalPhone $\hat{=}$ *TotalAddPerson* \vee *TotalRemovePerson* \vee *TotalAddNumber* \vee *TotalRemoveNumber*