SOEN 331-U: Introduction to Formal Methods for Software Engineering

for Software Engineering

Assignment 1 on Object-Z specification

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February 18, 2020

1 Parking Management

ParkingManagement

$\upharpoonright (AllocateVehicle, DeallocateVehicle, FindVehicle)$

$vehicles : LicencePlate \rightarrowtail ParkingSpot$

INIT

$vehicles = \varnothing$

AllocateVehicleOK

$\Delta(vehicles)$
$newCar? : LicencePlate$
$parkingSpot? : ParkingSpot$

$newCar? \notin dom\ vehicles$
$parkingSpot? \notin ran\ vehicles$
$vehicles' = vehicles \cup \{newCar? \rightarrowtail parkingSpot?\}$

DeallocateVehicleOK

$\Delta(vehicles)$
$carToRemove? : LicencePlate$

$carToRemove? \in dom\ vehicles$
$vehicles' = \{carToRemove?\} \lhd vehicles$

FindVehicleOK

$carToFind? : LicencePlate$
$spot! : ParkingSpot$

$carToFind? \in dom\ vehicles$
$spot! = vehicles\{carToFind?\}$

...

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┌─ ParkingManagement ──────────────────────────────────────────────┐
│ ...                                                               │
│ ┌─ ErrorAlreadyAssigned ────────────────────────────────────────┐│
│ │ licensePlate? : LicencePlate                                  ││
│ │ parkingSpot? : ParkingSpot                                    ││
│ │ alert! : Message                                              ││
│ ├───────────────────────────────────────────────────────────────┤│
│ │ licensePlate? ∈ dom vehicles                                  ││
│ │ parkingSpot? ∈ ran vehicles                                   ││
│ │ alert! = 'Error : License plate or parking spot was already assigned' ││
│ └───────────────────────────────────────────────────────────────┘│
│ ┌─ ErrorNotFound ───────────────────────────────────────────────┐│
│ │ carToFind? : LicencePlate                                     ││
│ │ alert! : Message                                              ││
│ ├───────────────────────────────────────────────────────────────┤│
│ │ carToFind? ∉ dom vehicles                                     ││
│ │ alert! = 'Error : License plate was not found'                ││
│ └───────────────────────────────────────────────────────────────┘│
├───────────────────────────────────────────────────────────────────┤
│ AllocateVehicle  ≙  AllocateVehicleOK ∨ ErrorAlreadyAssigned      │
│ DeallocateVehicle  ≙  DeallocateVehicleOK ∨ ErrorNotFound         │
│ FindVehicle  ≙  FindVehicleOK ∨ ErrorNotFound                     │
└───────────────────────────────────────────────────────────────────┘
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2 Parking Management 2

___ *ParkingManagement2* _____

$\upharpoonright$ (*AllocateVehicle*, *DeallocateVehicle*, *FindVehicle*, *GetNumberOfVehicles*, *ReallocateVehicle*)
ParkingManagement

> $numberOfVehicles = \mathbb{N}$
> _____
> $numberOfVehicles > 0$

> ___ *INIT* _____
> $numberOfVehicles = 0$

> ___ *AllocateVehicleOK* _____
> $\Delta(numberOfVehicles)$
> _____
> $numberOfVehicles' = numberOfVehicles + 1$

> ___ *DeallocateVehicleOK* _____
> $\Delta(numberOfVehicles)$
> _____
> $numberOfVehicles' = numberOfVehicles - 1$

> ___ *GetNumberOfVehicles* _____
> $AllVehicles! : \mathbb{N}$
> _____
> $AllVehicles! = numberOfVehicles$

> ___ *ReallocateVehicleOK* _____
> $\Delta(vehicles)$
> $carToFind? : LicencePlate$
> $newSpot? : ParkingSpot$
> _____
> $carToFind? \in dom\ vehicles$
> $newSpot? \notin ran\ vehicles$
> $vehicles' = vehicles \oplus \{carToFind? \rightarrowtail newSpot?\}$

> ___ *GetAllVehicles* _____
> $listOfVehicles! : LicencePlate \rightarrowtail ParkingSpot$
> _____
> $listOfVehicles! = vehicles$

ReallocateVehicle $\widehat{=}$ *ReallocateVehicleOK* $\vee$ *ErrorNotFound* $\vee$ *ErrorAlreadyAssigned*

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