

# SOEN331: Introduction to Formal Methods for Software Engineering

## Assignment 4 on algebraic specifications

Author's name

March 28, 2019

**Spec:** Location;

**Sort:** Location;

**Imports:**String, Point

**Description:** A location contains a description

**Operations:**

newLocation:  $\text{String} \times \text{Point} \rightarrow \text{Location}$ ;

setDescription:  $\text{String} \times \text{Location} \rightarrow \text{Location}$ ;

getDescription :  $\text{Location} \rightarrow \text{String}$ ;

setPoint :  $\text{Point} \times \text{Location} \rightarrow \text{Location}$ ;

getPoint :  $\text{Location} \rightarrow \text{Point}$ ;

**Variables:**

newDesc, d: String; newPoint, p: Point;

**Axioms:**

[A1]  $\text{getDescription}(\text{newLocation}(d, p)) = d$ ;

[A2]  $\text{getDescription}(\text{setDescription}(\text{newDesc}, \text{newLocation}(d, p))) = \text{newDesc}$ ;

[A3]  $\text{getDescription}(\text{setPoint}(\text{newPoint}, \text{newLocation}(d, p))) = d$ ;

[A4]  $\text{getPoint}(\text{newLocation}(d, p)) = p$ ;

[A5]  $\text{getPoint}(\text{setPoint}(\text{newPoint}, \text{newLocation}(d, p))) = \text{newPoint}$ ;

[A6]  $\text{getPoint}(\text{setDescription}(\text{newDesc}, \text{newLocation}(\text{d}, \text{p}))) = \text{p};$   
 [A7]  $\text{setDescription}(\text{newDesc}, \text{newLocation}(\text{d}, \text{p})) = \text{newLocation}(\text{newDesc}, \text{p});$   
 [A8]  $\text{setDescription}(\text{getDescription}(\text{newLocation}(\text{d}, \text{p})), \text{newLocation}(\text{d}, \text{p})) = \text{newLocation}(\text{d}, \text{p});$   
 [A9]  $\text{setPoint}(\text{newPoint}, \text{newLocation}(\text{d}, \text{p})) = \text{newLocation}(\text{d}, \text{newPoint});$   
 [A10]  $\text{setPoint}(\text{getPoint}(\text{newLocation}(\text{d}, \text{p})), \text{newLocation}(\text{d}, \text{p})) = \text{newLocation}(\text{d}, \text{p});$

**Spec:** Map;

**Sort:** Map;

**Imports:** String, Point, Location;

**Description:** A map contains locations

**Operations:**

$\text{newmap} \rightarrow \text{Map};$   
 $\text{addlocation} : \text{Map} \times \text{Location} \rightarrow \text{Map};$   
 $\text{removelocation} : \text{Map} \times \text{Description} \rightarrow \text{Map};$   
 $\text{containsdescription} : \text{Map} \times \text{Description} \rightarrow \text{Boolean};$   
 $\text{containspoint} : \text{Map} \times \text{Point} \rightarrow \text{Boolean};$   
 $\text{findlocation} : \text{Map} \times \text{Description} \rightarrow \text{Point};$   
 $\text{isempty} : \text{Map} \rightarrow \text{Boolean};$   
 $\text{clear} : \text{Map} \rightarrow \text{Map};$

**Variables:**

$\text{d} : \text{String}; \text{p} : \text{Point}; \text{loc} : \text{Location}; \text{map} : \text{Map}$

**Axioms:**

[A1]  $\text{isempty}(\text{newmap}) = \text{true};$   
 [A2]  $\text{isempty}(\text{clear}(\text{map})) = \text{true};$   
 [A3]  
 [A4]  
 [A5]  
 [A6]  
 [A7]

[A8] findlocation(newmap) = undefined;

[A9] deletelocation(newmap) = undefined;