SOEN331: Introduction to Formal Methods for Software Engineering

Assignment 4 on algebraic specifications

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Spec: Location;

Sort: Location;

Imports:String, Point

Description: A location contains a description

Operations:

 newLocation: String $\times$ Point $\to$ Location;

 setDescription: String $\times$ Location $\to$ Location;

 getDescription : Location $\to$ String;

 setPoint : Point $\times$ Location $\to$ Location;

 getPoint : Location $\to$ Point;

Variables:

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

Axioms:

 [A1] getDescription(newLocation(d, p)) = d;

 [A2] getDescription(setDescription(newDesc, newLocation(d, p))) = newDesc;

 [A3] getDescription(setPoint(newPoint, newLocation(d,p))) = d;

 [A4] getPoint(newLocation(d, p)) = p;

[A5] getPoint(setPoint(newPoint, newLocation(d,p))) = newPoint;

[A6] getPoint(setDescription(newDesc, newLocation(d,p))) = p;

[A7] setDescription(newDesc, newLocation(d,p)) = newLocation(newDesc, p);

[A8] setDescription(getDescription(newLocation(d,p)), newLocation(d,p)) = newLocation(d,p);

[A9] setPoint(newPoint, newLocation(d,p)) = newLocation(d, newPoint);

[A10] setPoint(getPoint(newLocation(d,p)), newLocation(d,p)) = newLocation(d, p);

Spec: Map(Location);

Sort: Map;

Imports: String, Point, Boolean, Location;

Description: A map contains locations

Operations:

newmap: $\rightarrow$ Map;

addlocation: Map $\times$ Location $\rightarrow$ Map;

deletelocation : Map $\times$ String $\rightarrow$ Map;

containsdescription : Map $\times$ String $\rightarrow$ Boolean;

containspoint : Map $\times$ Point $\rightarrow$ Boolean;

findlocation : Map $\times$ String $\rightarrow$ Point;

isempty : Map $\rightarrow$ Boolean;

clear : Map $\rightarrow$ Map;

Variables:

d: String; p, q: Point; loc: Location; map: Map

Axioms:

[A1] isempty(newmap) = true;

[A2] isempty(clear(map)) = true;

[A3] containsdescription(addlocation(map, loc), getDescription(loc)) = true;

[A4] addlocation(map, newLocation(d,p)) and containdescription(map, d) and not(p == findlocation(map, d) $\rightarrow$ findlocation(map, getDescription(loc)) = p;

[A5] deletelocation(addlocation(addlocation(newmap, newLocation(d, p)),newLocation(d,q)),d)

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$\rightarrow$ newmap

[A6]

[A7] findlocation(map, getDescription(loc)) = getPoint(loc)

[A8] findlocation(newmap) = undefined;

[A9] deletelocation(newmap) = undefined;