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 $\rightarrow$ Location;

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

getDescription : Location $\rightarrow$ String;

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

getPoint : Location $\rightarrow$ Point;

Variables:

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

Axioms:

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

[A2] getPoint(newLocation(d, p)) = p;

[A3] setDescription(newDesc, newLocation(d,p)) = newLocation(newDesc, p);

[A4] setPoint(newPoint, newLocation(d,p)) = newLocation(d, newPoint);

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;

size : Map $\rightarrow$ N

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] containsdescription(map,d) $\rightarrow$ findlocation(addlocation(map, newlocation(d,q)), d)
== q

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

[A5] size (addlocation(addLocation(map, newLocation(d,q)), newLocation(d,p))) = size(map)

[A6] isempty(deleteLocation(addlocation(newmap, newlocation(d,p)), d)) = true

[A7] findlocation(addlocation(newmap, newlocation(d,p)), d) = p

[A8] findlocation(newmap) = undefined;

[A9] deletelocation(newmap) = undefined;

preconditions:

pre : deletelocation(map, d) = not isempty(map);

pre : findlocation(map, d) = not isempty(map);

end: