

**Informatics Institute of Technology**

Department of Computing   
(B.Eng.) in Software Engineering

**Module: 6SENG003C Reasoning about Programs  
  
Report – State Invariants**

**& Structure Diagram**

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# State Invariants – Spaceship Machine

## spaceshipXPosition : XAxis

This invariant ensures that the spaceshipXPosition variable is always an element of the XAxis set. The XAxis set is defined in the Space Machine as a set that contains all the possible natural numbers in the x axis (1 to 12). This ensures that the spaceship is within the limits of the space.

## spaceshipYPosition : YAxis

This invariant ensures that the spaceshipYPosition variable is always an element of the YAxis set. The YAxis set is defined in the Space Machine as a set that contains all the possible natural numbers in the y axis (1 to 7). This ensures that the spaceship is within the limits of the space.

## remainingPower : NAT

This invariant ensures that the remainingPower is always an element of the natural set starting from 0. The smallest number for remainingPower is 0.

## numberOfCollisions : NAT

This invariant ensures that the numberOfCollisions is always an element of the natural set starting from 0. The numberOfCollisions should start with 0 initially, hence NAT was chosen over NAT1.

## spaceRegionsVisited : seq(space)

This invariant ensures that the spaceRegionsVisited should be a sequence of the space relations. The space relation is defined in the space machine as the 12x7 grid.

## gameStatus : STATUS

This invariant ensures that gameStatus should be an element of the STATUS set which has been declared in the Spaceship machine.

# State Invariants – Asteroids Machine

## asteroids : XAxis <-> YAxis &

The following invariant ensures that the maplets in the asteroids set are relations of elements in the XAxis and YAxis set. This ensures that the asteroids remain within the boundaries of the space.

## card(asteroids) = 11

The following invariant ensures that the cardinality of the asteroids set is always 11.

# Structure Diagrams

