UNIVERSITY OF WESTMINSTER

# 6SENG005W Formal Methods

**Coursework -** B specification of a very simple version of the old Asteroids arcade game, using the B tools Atelier B & ProB

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# Table of Contents

*1. The Structure Diagram of Spaceship & Asteroids System B machine .....2*

*2. Description of the state invariants of the system .....3*

# Table of Figures

*Figure 1 - B Specification Structure Diagram .....2*

# 1. The Structure Diagram of Spaceship & Asteroids System B machine

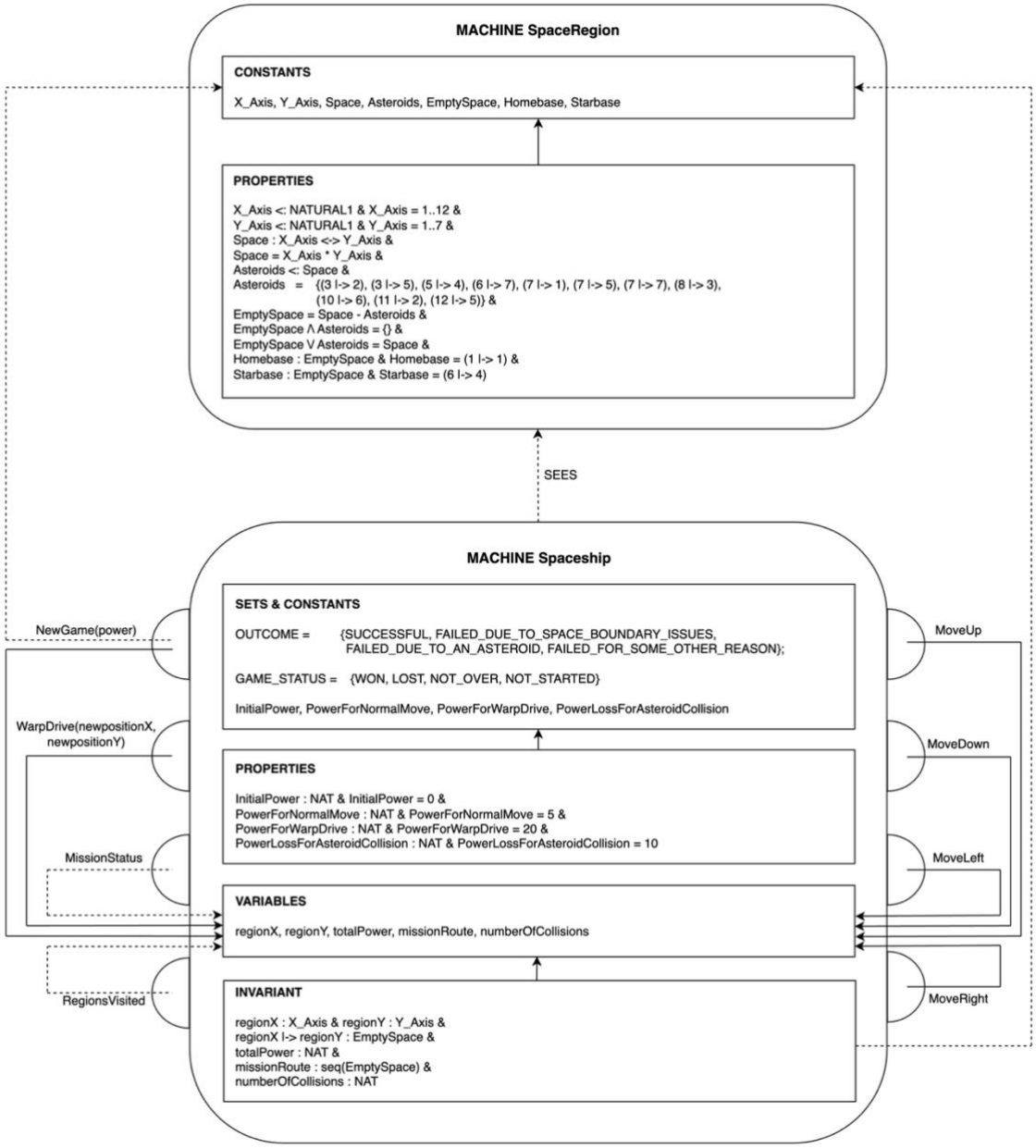


*Figure 1 - B Specification Structure Diagram*

## 2. Description of the state invariants of the system

| Invariant | Explanation |
|---|---|
| **regionX : X_Axis &**<br>**regionY : Y_Axis** | Spaceship is on a grid, and regionX and regionY are the spaceship's location on the X (horizontal) and Y (vertical) axes.<br>The spaceship's X-coordinate (regionX) must be part of a set called X_Axis.<br>Similarly, the spaceship's Y-coordinate (regionY) must be part of another set called Y_Axis.<br>Coordinates should be NATURAL1. Axis x should be within 1 to 12 and axis y should be within 1 to 7. |
| **regionX \|-> regionY : EmptySpace** | The spaceship has to be in an empty space on the grid. So the tuple with regionX as its first element and regionY as its second element (regionX, regionY) should belong to the set EmptySpace. |
| **totalPower : NAT** | The total power of the spaceship is a score, and it cannot be negative. It's a whole number (non-negative integer). For example, it can be 0, 1, 2, and so on. |
| **missionRoute : seq(EmptySpace)** | Think of the spaceship's journey as a sequence of steps.<br>missionRoute is like a list of these steps, and each step should be in an empty space on the grid. |
| **numberOfCollisions : NAT** | This is about how many times the spaceship bumps into asteroid.<br>The number of collisions (numberOfCollisions) can't be negative; it's a whole number. |