INFORMATICS INSTITUTE OF TECHNOLOGY

UNIVERSITY OF WESTMINSTER

Informatics Institute of Technology

Department of Computing

(B.Eng.) in Software Engineering

Module: 6SENG003C.1 Reasoning about Programs

Coursework 01 : B Specification Structure Diagram

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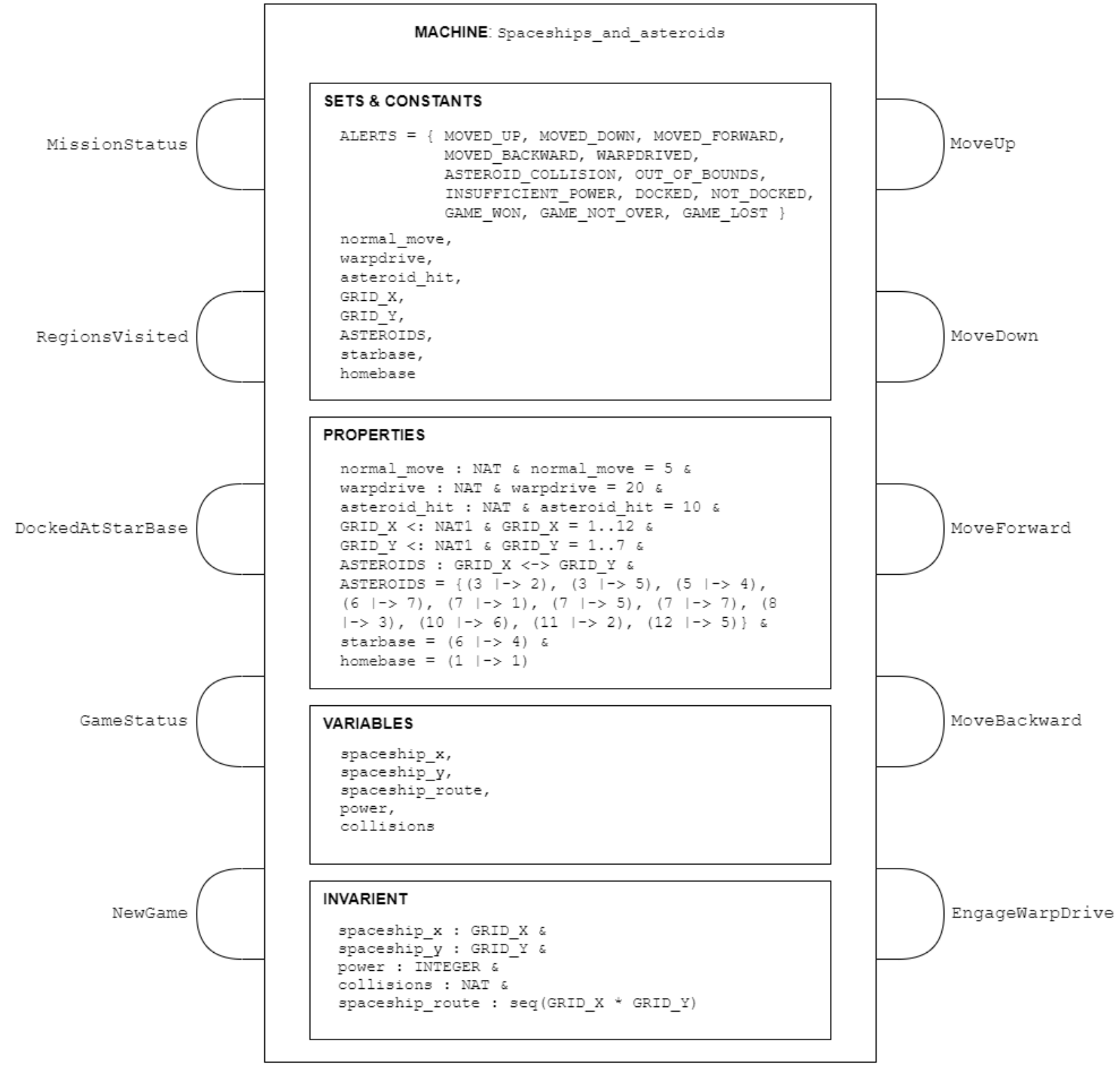
MissionStatus
RegionsVisited
DockedAtStarBase
GameStatus
NewGame
MoveUp
MoveDown
MoveForward
MoveBackward
EngageWarpDrive
MACHINE: Spaceships_and_asteroids
SETS & CONSTANTS
ALERTS = { MOVED_UP, MOVED_DOWN, MOVED_FORWARD,
MOVED_BACKWARD, WARPDRIVED,
ASTEROID_COLLISION, OUT_OF_BOUNDS,
INSUFFICIENT_POWER, DOCKED, NOT_DOCKED,
GAME_WON, GAME_NOT_OVER, GAME_LOST }
normal_move,
warpdrive,
asteroid_hit,
GRID_X,
GRID_Y,
ASTEROIDS,
starbase,
homebase
PROPERTIES
normal_move : NAT & normal_move = 5 &
warpdrive : NAT & warpdrive = 20 &
asteroid_hit : NAT & asteroid_hit = 10 &
GRID_X <: NAT1 & GRID_X = 1..12 &
GRID_Y <: NAT1 & GRID_Y = 1..7 &
ASTEROIDS : GRID_X <-> GRID_Y &
ASTEROIDS = {(3 |-> 2), (3 |-> 5), (5 |-> 4),
(6 |-> 7), (7 |-> 1), (7 |-> 5), (7 |-> 7), (8
|-> 3), (10 |-> 6), (11 |-> 2), (12 |-> 5)} &
starbase = (6 |-> 4) &
homebase = (1 |-> 1)
VARIABLES
spaceship_x,
spaceship_y,
spaceship_route,
power,
collisions
INVARIENT
spaceship_x : GRID_X &
spaceship_y : GRID_Y &
power : INTEGER &
collisions : NAT &
spaceship_route : seq(GRID_X * GRID_Y)

State invariants

There are 5 state invariants that I have used in the system. Namely,

1. spaceship_x
2. spaceship_y
3. spaceship_route
4. power
5. collisions

The variable spaceship_x holds the "x" coordinate of the current position of the spaceship. Its invariants show us that it is an element of the GRID_X set, where GRID_X is a set that holds numbers from 1 to 12 inclusively, and that variable spaceship_x could only hold a value between 1 to 12, inclusive, at a given time.

The variable spaceship_y holds the "y" coordinate of the current position of the spaceship. Its invariants show us that it is an element of the GRID_Y set, where GRID_Y is a set that holds numbers from 1 to 7 inclusively, and that variable spaceship_y could only hold a value between 1 to 7, inclusive, at a given time.

The variable spaceship_route holds the route of the spaceship, and its invariant shows us that it is a sequence holding maplets of relation set of GRID_X and GRID_Y as "x |-> y", where x is an element of GRID_X and y is an element of GRID_Y. A sequence was used since the numbe of the elements decrease and/or increase dynamically during the runtime of the program.

The variable power holds the total power the spaceship has to make a move. Its invariant shows us that it holds an element of the integer set, INTEGER, which means it can hold any negative or positive whole number. Use of INTEGER instead of NAT or NAT1 is because the power can be negative if there is an asteroid collision while the current power of the spaceship between 5 and 9 inclusively.

$$power = power - asteroid\_hit$$
$$power = 5 - 10$$
$$power = -5$$

The variable collisions hold the count of the number of times the spaceship collides with an asteroid. Its invariant shows us that it is an element of the natural number set, NAT, which means it can hold any value in the range of 0 to n.