



# 6SENG001W Reasoning About Programs Coursework 1 (2021/22)

B.Eng. (Hons) Software Engineering

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#### 1. Structure Diagram

### **MACHINE** - spaceShip **SETS & CONSTANTS** RESPONSE = {MOVE\_IS\_SUCCESSFULLY, CANNOT\_MOVE\_OUT\_OF\_SPACE, POWER\_IS\_NOT\_ENOUGH, DONT\_MOVE\_HIT\_ASTEROID, CANNOT\_MOVE\_TO\_ASTEROID, CANNOT\_MOVE\_TO\_THE\_SAME\_POSITION, CANNOT\_IMMEDIATELY\_MOVE\_AS\_WARP\_INTO\_STARBASE} MoveUp {MOVE\_TO\_UP, MOVE\_TO\_DOWN, MOVE\_TO\_FORWARD, MOVE\_TO\_BACKWARD, MOVE\_AS\_WARP} DOCKED\_STATUS = {YES, NO} MissionRoute GAME\_STATUS = {YOU\_WON, YOU\_LOST, CONTINUE} xSpace, ySpace, space, asteroids, gridSpace, homeBase, starBase, initMovePower, warpMovePower, hitAsteroidPowerLoss, initialPower and the property of the prMoveDown **PROPERTIES** DockedAtStarbase // Grid space xSpace = 1..12 & ySpace = 1..7 & space = xSpace \* ySpace & // Empty Space gridSpace <: space & gridSpace ∧ asteroids = {} & gridSpace ∨ asteroids = space & MoveForward // Asteroids asteroids <: space & asteroids = {3i->2, 3i->5, 5i->4, 6i->7, 7i->1, 7i->5, 7i->7, 8i->3, 10i->6, 11i->2, 12i->5} & homeBase : gridSpace & homeBase = 11->1 & starBase : gridSpace & starBase = 61->4& GameStatus //movements properties initMovePower = 5 & warpMovePower = 20 & hitAsteroidPowerLoss = 10 & initialPower = 100 MoveBackward **VARIABLES** xPosition, yPosition, power, numOfCrashes, takenClearRoute, movements takenMovements **INVARIANT** xPosition: xSpace & yPosition: ySpace & xPosition: yPosition: gridSpace & EngageWarpDrive power : NAT & numOfCrashes : NAT & takenClearRoute : seq(gridSpace) & movements : seq(MOVEMENT) resetGame **INITIALISATION** power := initialPower || numOfCrashes := 0 || xPosition := prj1(xSpace, ySpace)(homeBase) || yPosition := prj2(xSpace, ySpace)(homeBase) || takenClearRoute := [homeBase] || movements := []

## 2. Invariants used in spaceship

- 1. xPosition Current x value in grid (space)
- 2. yPosition Current y value in grid (space)
- 3. gridSpace Space between x and y axes
- 4. power: NAT Power that spaceship has or expend
- 5. numOfCrashes: NAT Number of conflicts with Asteroid
- 6. takenClearRoute: seq(gridSpace) possible part to move in the grid
- 7. movements: seq(MOVEMENT) possible ways to move the spaceship