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

Module Leader: Dr. Thilini Piyatilake

Coursework 2 – Structure Diagram

Date of Submission	: 29/01/2022
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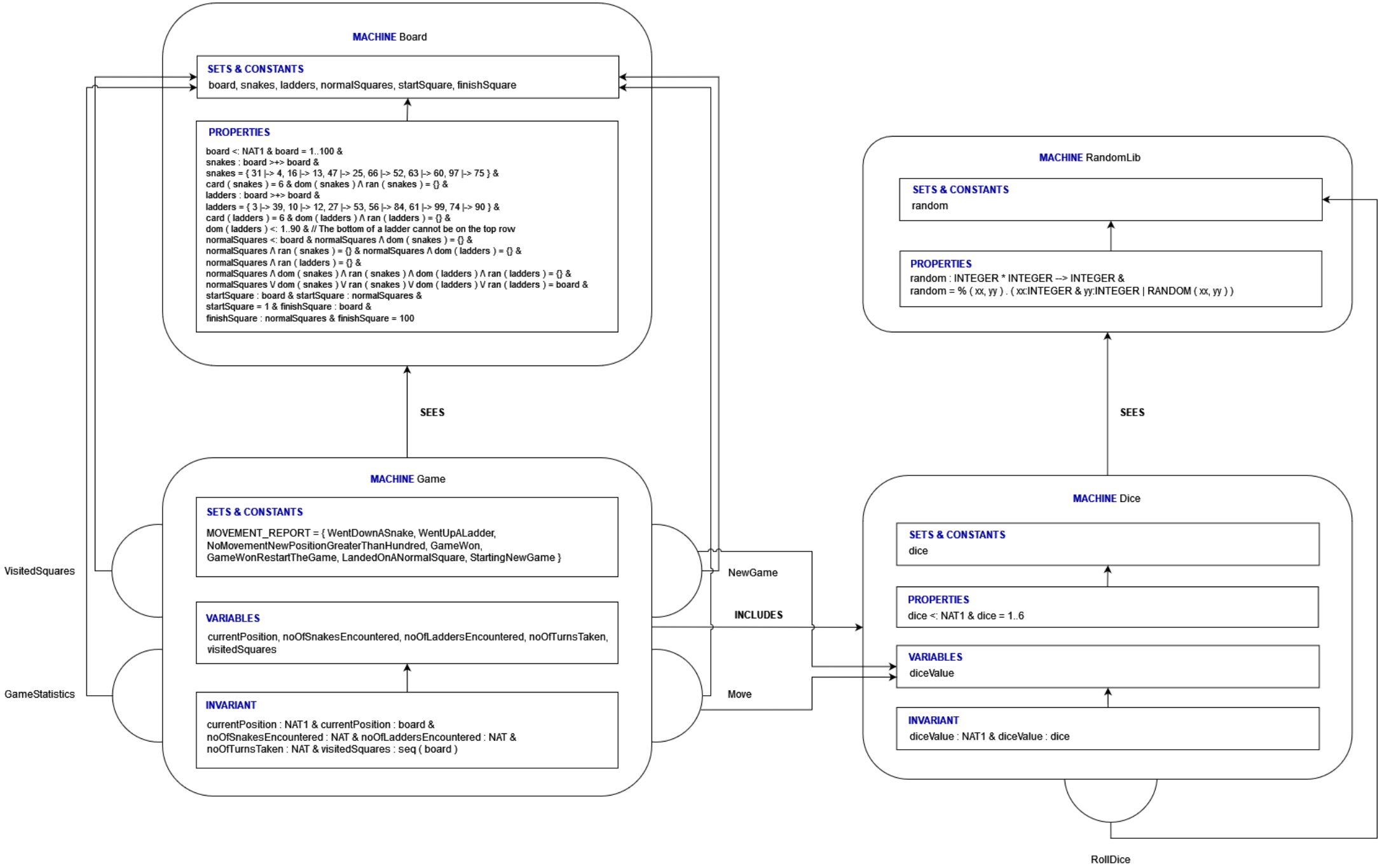
MACHINE Board
SETS & CONSTANTS
board, snakes, ladders, normalSquares, startSquare, finishSquare
PROPERTIES
board <: NAT1 & board = 1..100 &
snakes : board >+> board &
snakes = { 31 |-> 4, 16 |-> 13, 47 |-> 25, 66 |-> 52, 63 |-> 60, 97 |-> 75 } &
card (snakes) = 6 & dom (snakes) /\ ran (snakes) = {} &
ladders : board >+> board &
ladders = { 3 |-> 39, 10 |-> 12, 27 |-> 53, 56 |-> 84, 61 |-> 99, 74 |-> 90 } &
card (ladders) = 6 & dom (ladders) /\ ran (ladders) = {} &
dom (ladders) <: 1..90 & // The bottom of a ladder cannot be on the top row
normalSquares <: board & normalSquares /\ dom (snakes) = {} &
normalSquares /\ ran (snakes) = {} & normalSquares /\ dom (ladders) = {} &
normalSquares /\ ran (ladders) = {} &
normalSquares /\ dom (snakes) /\ ran (snakes) /\ dom (ladders) /\ ran (ladders) = {} &
normalSquares \/ dom (snakes) \/ ran (snakes) \/ dom (ladders) \/ ran (ladders) = board &
startSquare : board & startSquare : normalSquares &
startSquare = 1 & finishSquare : board &
finishSquare : normalSquares & finishSquare = 100
SEES
MACHINE Game
SETS & CONSTANTS
MOVEMENT_REPORT = { WentDownASnake, WentUpALadder,
NoMovementNewPositionGreaterThanHundred, GameWon,
GameWonRestartTheGame, LandedOnANormalSquare, StartingNewGame }
VARIABLES
currentPosition, noOfSnakesEncountered, noOfLaddersEncountered, noOfTurnsTaken,
visitedSquares
INVARIANT
currentPosition : NAT1 & currentPosition : board &
noOfSnakesEncountered : NAT & noOfLaddersEncountered : NAT &
noOfTurnsTaken : NAT & visitedSquares : seq (board)
VisitedSquares
GameStatistics
NewGame
INCLUDES
Move
MACHINE RandomLib
SETS & CONSTANTS
random
PROPERTIES
random : INTEGER * INTEGER --> INTEGER &
random = % (xx, yy) . (xx:INTEGER & yy:INTEGER | RANDOM (xx, yy))
SEES
MACHINE Dice
SETS & CONSTANTS
dice
PROPERTIES
dice <: NAT1 & dice = 1..6
VARIABLES
diceValue
INVARIANT
diceValue : NAT1 & diceValue : dice
RollDice

Explanation of State Variants

1. diceValue : NAT1

   The value of the dice rolled should be a natural number greater than 0.

2. diceValue : dice

   The value of the dice rolled should be an element of dice. Therefore, the value of the dice will be within the range of 1 to 6 inclusive.

3. currentPosition : NAT1

   The current position of the player should be a natural number greater than 0.

4. currentPosition : board

   The current position on the game should be an element of the board. Therefore, the current position will be within the range of 1 to 100 inclusive.

5. noOfSnakesEncountered : NAT

   The number of snakes encountered should be a natural number greater than or equal to 0. Therefore, the value will be within the range of 0 to positive infinity.

6. noOfLaddersEncountered : NAT

   The number of ladders encountered should be a natural number greater than or equal to 0. Therefore, the value will be within the range of 0 to positive infinity.

7. noOfTurnsTaken : NAT

   The number of turns taken in the game should be a natural number greater than or equal to 0. Therefore, the value will be within the range of 0 to positive infinity.

8. visitedSquares : seq (board)

   The squares visited in the game should be a set of sequences over the set board.