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 02 : B Specification Structure Diagram

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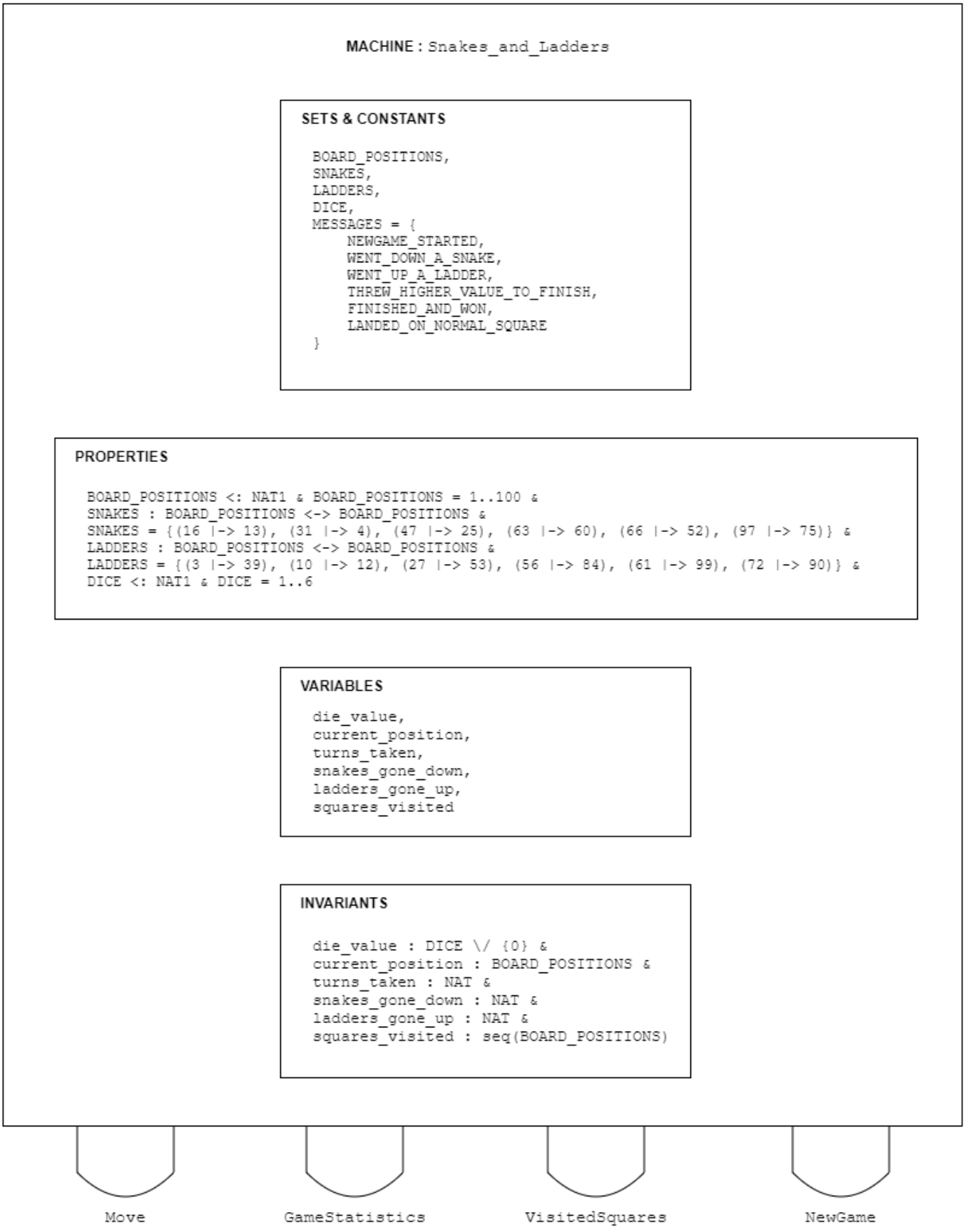
MACHINE : Snakes_and_Ladders
SETS & CONSTANTS
BOARD_POSITIONS,
SNAKES,
LADDERS,
DICE,
MESSAGES = {
NEWGAME_STARTED,
WENT_DOWN_A_SNAKE,
WENT_UP_A_LADDER,
THREW_HIGHER_VALUE_TO_FINISH,
FINISHED_AND_WON,
LANDED_ON_NORMAL_SQUARE
}
PROPERTIES
BOARD_POSITIONS <: NAT1 & BOARD_POSITIONS = 1..100 &
SNAKES : BOARD_POSITIONS <-> BOARD_POSITIONS &
SNAKES = {(16 |-> 13), (31 |-> 4), (47 |-> 25), (63 |-> 60), (66 |-> 52), (97 |-> 75)} &
LADDERS : BOARD_POSITIONS <-> BOARD_POSITIONS &
LADDERS = {(3 |-> 39), (10 |-> 12), (27 |-> 53), (56 |-> 84), (61 |-> 99), (72 |-> 90)} &
DICE <: NAT1 & DICE = 1..6
VARIABLES
die_value,
current_position,
turns_taken,
snakes_gone_down,
ladders_gone_up,
squares_visited
INVARIANTS
die_value : DICE \/ {0} &
current_position : BOARD_POSITIONS &
turns_taken : NAT &
snakes_gone_down : NAT &
ladders_gone_up : NAT &
squares_visited : seq(BOARD_POSITIONS)
Move
GameStatistics
VisitedSquares
NewGame

State invariants

There are 6 state invariants that I have used in the system. Namely,

1. die_value
2. current_position
3. turns_taken
4. snakes_gone_down
5. ladders_gone_up
6. squares_visited

The variable **die_value** holds the rolled dice value, which is an element of the set DICE, where the set DICE holds natural numbers(NAT1) from 1 to 6, and can hold a single value between 1 to 6 inclusively, or 0 at a given time. In the invariants we have unioned the DICE with {0} because at the instance of a new game, the die wont hold any value.

The variable **current_position** holds the current position of the player in the board, which is an element of the set BOARD_POSITIONS, and it can hold any value between 1 and 100 inclusively at any given time. Initially the variable will hold '1' since the player will be on the 1st square initially at the start of every new game.

The variable **turns_taken** holds the number of times the user has rolled the dice in the current game. It can be any value in the natural number set (NAT – because it holds 0 initially) and is incremented each time the user tries to makes a move, i.e. rolls the dice.

The variable **snakes_gone_down** holds the number of times the player has encountered snakes in the current game. It can hold any value in the natural number set(NAT – because it holds 0 initially) and is incremented by 1 each time the player lands on a snake's head.

The variable **ladders_gone_up** holds the number of times the player has encountered ladders in the current game. It can hold any value in the natural number set(NAT – because it holds 0 initially) and is incremented by 1 each time the player lands on a ladder's bottom.

The variable **squares_visited** is a sequence of BOARD_POSITION elements which holds the path taken by the player in terms of squares(i.e. board positions) in the order they have been visited in a single game. Once the player rolls the dice and moves to a new square, that new square(s) will be appended to the sequence. It initially holds the position 1 since the player is beginning from position 1 and is already on the 1st square.