Specification

COMPSCI 2ME3

April 9, 2020

This Module Interface Specification (MIS) document contains three main modules, DotT, Model, and View. And, a DotType module that provides the different-colored dot types required by both DotT and Model modules. The Model is constructed using a customizable row, column, and target size. The methods of the Model module allow the user to delete a matching line of dots from the Model. The deleted dots are replaced by dots located above.

The game over condition will satisfy one of the following conditions.

- The user deletes a selection of same-colored dots that matches or exceeds a given target size.
- The user reaches the allowed number of delete moves per a game. Which is 18.

In other words, the game is set to finish either when the user accomplishes a same-colored dots deletion of target size or when the number of delete moves reaches 18.

EarthquakeBag Module

Template Module

EarthquakeBag is seq of EarthquakeT

Generic Queue Module

Generic Template Module inherits Iterable(T)

Queue(T)

Uses

None

Syntax

Exported Constants

None

Exported Types

Queue = ?

Exported Access Programs

Routine name	In	Out	Exceptions
Queue		Queue	
isEmpty		$\mathbb{B}$	
start			
next		T	NoSuchElementException

Semantics

State Variables

s: sequence of T
$n : \mathbb{N}$

State Invariant

None

Assumptions

None

Access Routine Semantics

Queue():

- transition: $s, i := x, 0$
- output: $out :=$ self
- exception: none

isEmpty():

- output: $out := i \geq |s|$
- exception: None

enqueue(item):

- output: $out := i \geq |s|$
- exception: None

toString():

- output: $out := i \geq |s|$
- exception: None

Iterator Methods:

$i : \mathbb{N}$

start():

- transition: $i := 0$
- exception: none

next():

- transition-output: $i, out := i + 1, s[i]$
- exception: $(i > n) \Rightarrow$ NoSuchElementException

Generic RedBlackBST Module

Generic Template Module

RedBlackBST(T with Comparable(T), V)

Uses

None

Syntax

Exported Types

RedBlackBST = ?

Internal Types

Node = ?
State Variables of Node:
key: Key, lst: seq of V, left: Node, right: Node, color: B, size: N

 # Internal Node type was modified to store a seq of V.

Exported Access Programs

Routine name	In	Out	Exceptions
RedBlackBST		RedBlackBST	
size		$\mathbb{N}$	
isEmpty		$\mathbb{N}$	
get		$\mathbb{N}$	
put		$\mathbb{N}$	
min		$\mathbb{N}$	
max		$\mathbb{N}$	
keys		$\mathbb{N}$	
keys		$\mathbb{N}$	

Semantics

State Variables

root: Node

State Invariant

None

Assumptions

None

Access Routine Semantics

RedBlackBST():

- transition: None
- output: $out := self$
- exception: None

size():

- output: $out := root.size$
- exception: None

isEmpty():

- output: $out := r$
- exception: None

get():

- output: $out := cl$
- exception: None

put():

- output: $out := cl$

- exception: None

min():

- output: $out := cl$
- exception: None

max():

- output: $out := cl$
- exception: None

keys():

- output: $out := cl$
- exception: None

keys():

- output: $out := cl$
- exception: None

EarthquakeT Module

Template Module

EarthquakeT

Uses

LocalDateTime, PointT

Syntax

Exported Types

EarthquakeT = ?

ColorRating = { NOCOLOR, ZERO, PURPLE, BLUE, GREEN, YELLOW, ORANGE, RED }

MagType = { M5, mb, MB, Mb, MC, Mc, mc, ML, MLSn, MN, MS, MW, Ms, Mw, BLANK }

 # EarthquakeT implements Comparable(EarthquakeT)

Exported Constants

None

Exported Access Programs

Routine name	In	Out	Exceptions
EarthquakeT	String, String, LocalDateTime, $\mathbb{R}, \mathbb{R}, \mathbb{R}, \mathbb{R}$, MagType, ColorRating	EarthquakeT	
getNameOfProv		String	
getPlace		String	
getPointT		PointT	
getMag		$\mathbb{R}$	
getDph		$\mathbb{R}$	
getMagitudeType		MagType	
getDate		LocalDateTime	
getColor		ColorRating	
compareTo	EarthquakeT	$\mathbb{Z}$	
equals	EarthquakeT	$\mathbb{B}$	

Semantics

State Variables

place: String
nameOfProv: String
date: LocalDateTime
lat: $\mathbb{R}$
lng: $\mathbb{R}$
dph: $\mathbb{R}$
mag: $\mathbb{R}$
magnitudeType: MagType
color: ColorRating

State Invariant

None

Assumptions

- The 0th row is at the top of the grid and the 0th column is at the leftmost side of the grid.
- Once a Dot is removed, above Dots move down to replace the Dot that was removed.

Access Routine Semantics

EarthquakeT(place, prov, date, lat, lng, dph, mag, mgT, color):

- transition:
  lat, lng, place, nameOfProv, date, dph, mag, magnitudeType, color :=
  lat, lng, place, prov, date, dph, mag, mgT, color
- output: *out* := *self*
- exception: None

getNameOfProv():

- output: *out* := nameOfProv
- exception: None

getPlace():

- output: *out* := place
- exception: None

getPointT():

- output: *out* := PointT(lat, lng)
- exception: None

getMag():

- output: *out* := mag
- exception: None

getDph():

- output: *out* := dph
- exception: None

getMagitudeType():

- output: *out* := magnitudeType
- exception: None

getDate():

- output: *out* := date
- exception: None

getColor():

- output: *out* := color
- exception: None

compareTo(eq):

- output: *out* := selectedDots || DotT(d.row, d.col)
- exception: *exc* := (¬validPoint(d) ⇒ IndexOutOfBoundsException)

equals(that):

- output: *out* := selectedDots || DotT(d.row, d.col)
- exception: *exc* := (¬validPoint(d) ⇒ IndexOutOfBoundsException)∧(¬sameColor(d)∨ ¬validSelect(d) ⇒ InvalidObjectException)

Local Functions

removeDot: DotT $\rightarrow \mathbb{B}$
removeDot(d) $\equiv d =$ Null
[Remove the Dot from the grid by setting it to null —SS]

sameColor: DotT $\rightarrow \mathbb{B}$
sameColor(d) $\equiv d.cl =$ selectedDots[0].cl
[returns true if the next selection is the same color as the first dot on selectedDots list. —SS]

validSelect: DotT $\rightarrow \mathbb{B}$
validSelect(d) $\equiv (d.row =$ selectedDots[|selectedDots| $- 1].row) \vee$
$(d.col =$ selectedDots[|selectedDots| $- 1].col)$
[returns true if the next selection is the same row or column of the grid. —SS]

validRow: $\mathbb{N} \rightarrow \mathbb{B}$
validRow(i) $\equiv 0 \leq i \leq$ (ROWS $- 1$)
[returns true if the given natural number is a valid row number. —SS]

validCol: $\mathbb{N} \rightarrow \mathbb{B}$
validCol(j) $\equiv 0 \leq j \leq$ (COLS $- 1$)
[returns true if the given natural number is a valid column number. —SS]

validDot: DotT $\rightarrow \mathbb{B}$
validPoint(d) $\equiv$ validRow(d.row) $\wedge$ validCol(d.col)
[Returns true if the given point lies within the boundaries of the grid. —SS]

CSVreader Module

Module

CSVreader

Uses

CityPostT, CityT, EarthquakeT,
EarthquakeT.ColorRating, EarthquakeT.MagType,
EarthquakeBag, GeoCollection, RedBlackBST

Syntax

Exported Constants

None

Exported Access Programs

Routine name	In	Out	Exceptions
readEarthquakes	String, EarthquakeBag		
readEarthquakesBST	String, RedBlackBST		
readPopulation	String, GeoCollection		
readCityPosition	String, seq of CityPostT		
rmFirstLastQuote	String	String	
generateColorRating	$\mathbb{R}$	ColorRating	
fullProvName	String	String	

Semantics

Environment Variables

None

State Variables

None

State Invariant

None

Assumptions

None

Access Routine Semantics

readEarthquakes(filename, bag):

- transition: currentM := cM.toString()
- exception: None

readEarthquakesBST(filename, bst):

- transition:
  currentM := “”
  currentM := cM.toString()
- exception: None

readPopulation(filename, geoCollec):

- transition: currentM := “”
- exception: None

readCityPosition(filename, cityPostList):

- transition: currentM := “”
- exception: None

rmFirstLastQuote(cell):

- transition: currentM := “”
- exception: None

generateColorRating(cell4):

- transition: currentM := “”
- exception: None

fullProvName(nameP):

- output: a new provice name similar to the following table.

	nameP =	*out* :=
|nameP| = 2	ON	Ontario
	QC, PQ	Quebec
	NS	Nova Scotia
	NB	New Brunswick
	MB	Manitoba
	BC	British Columbia
	PE	Prince Edward Island
	SK	Saskatchewan
	AB	Alberta
	NL	Newfoundland and Labrador
	NU	Nunavut
	NT	Northwest Territories
	YT	Yukon
	AK	Alaska
	WA	Washington
	default	UNLOCATED
|nameP| $\neq$ 2	VANCOUVER ISLAND	British Columbia
	SOUTHERN QUEBEC	Quebec
	default	UNLOCATED

- exception: None

Considerations

There are a number of different variations of geolocation names in the earthquake csv file, for these an appropriate province name should be assigned. For any that could not be matched to a province name, UNLOCATED should be assigned.