edu.vt.cs5044

**Interface DotsAndBoxes**

public interface **DotsAndBoxes**

This interface defines the methods needed to manage a two-player game of Dots And Boxes. The game is played on a matrix pattern of dots, with each dot representing one vertex of a grid of neighboring, non-overlapping boxes. Each turn involves the current player drawing a single line to connect any two unconnected adjacent dots, either horizontally or vertically. Except on the outer-most grid boundaries, each line is shared between two neighboring boxes.

Players generally take alternating turns. However, if a player completes the fourth edge of any box, the box becomes owned by that player, and the same player gets another turn immediately. Otherwise, if no box is completed by the turn, it becomes the other player's turn.

Play continues until all the boxes are owned, at which point the winner is the player who owns the most boxes.

Each instance of an implementation of this interface must be entirely independent from any other instances. Thun static fields and static methods are prohibited.

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**Author:**

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* + ***Method Summary***

|  |  |
| --- | --- |
| **All Methods**[**Instance Methods**](javascript:show(2);)[**Abstract Methods**](javascript:show(4);) | |
| **Modifier and Type** | **Method and Description** |
| boolean | [**drawEdge**](http://127.0.0.1:49757/help/nftopic/jar:file:/C:/Users/zfore/Desktop/dab5044-api.jar!/edu/vt/cs5044/DotsAndBoxes.html#drawEdge-edu.vt.cs5044.Coordinate-edu.vt.cs5044.Direction-)([**Coordinate**](http://127.0.0.1:49757/help/nftopic/jar:file:/C:/Users/zfore/Desktop/dab5044-api.jar!/edu/vt/cs5044/Coordinate.html) coord, [**Direction**](http://127.0.0.1:49757/help/nftopic/jar:file:/C:/Users/zfore/Desktop/dab5044-api.jar!/edu/vt/cs5044/Direction.html) dir)  Draw an edge of the box at a specified location by the current player. |
| [**Player**](http://127.0.0.1:49757/help/nftopic/jar:file:/C:/Users/zfore/Desktop/dab5044-api.jar!/edu/vt/cs5044/Player.html) | [**getCurrentPlayer**](http://127.0.0.1:49757/help/nftopic/jar:file:/C:/Users/zfore/Desktop/dab5044-api.jar!/edu/vt/cs5044/DotsAndBoxes.html#getCurrentPlayer--)()  Get the player for the current turn, or null if the game is over. |
| Collection<[**Direction**](http://127.0.0.1:49757/help/nftopic/jar:file:/C:/Users/zfore/Desktop/dab5044-api.jar!/edu/vt/cs5044/Direction.html)> | [**getDrawnEdgesAt**](http://127.0.0.1:49757/help/nftopic/jar:file:/C:/Users/zfore/Desktop/dab5044-api.jar!/edu/vt/cs5044/DotsAndBoxes.html#getDrawnEdgesAt-edu.vt.cs5044.Coordinate-)([**Coordinate**](http://127.0.0.1:49757/help/nftopic/jar:file:/C:/Users/zfore/Desktop/dab5044-api.jar!/edu/vt/cs5044/Coordinate.html) coord)  Get a collection of edges currently drawn of the box at the specified location. |
| [**Player**](http://127.0.0.1:49757/help/nftopic/jar:file:/C:/Users/zfore/Desktop/dab5044-api.jar!/edu/vt/cs5044/Player.html) | [**getOwnerAt**](http://127.0.0.1:49757/help/nftopic/jar:file:/C:/Users/zfore/Desktop/dab5044-api.jar!/edu/vt/cs5044/DotsAndBoxes.html#getOwnerAt-edu.vt.cs5044.Coordinate-)([**Coordinate**](http://127.0.0.1:49757/help/nftopic/jar:file:/C:/Users/zfore/Desktop/dab5044-api.jar!/edu/vt/cs5044/Coordinate.html) coord)  Get the owner of the fully-drawn box at a specified location. |
| Map<**[Player](http://127.0.0.1:49757/help/nftopic/jar:file:/C:/Users/zfore/Desktop/dab5044-api.jar!/edu/vt/cs5044/Player.html" \o "enum in edu.vt.cs5044)**,Integer> | [**getScores**](http://127.0.0.1:49757/help/nftopic/jar:file:/C:/Users/zfore/Desktop/dab5044-api.jar!/edu/vt/cs5044/DotsAndBoxes.html#getScores--)()  Get a collection of the scores of the players. |
| int | [**getSize**](http://127.0.0.1:49757/help/nftopic/jar:file:/C:/Users/zfore/Desktop/dab5044-api.jar!/edu/vt/cs5044/DotsAndBoxes.html#getSize--)()  Get the current size of the game grid. |
| void | [**init**](http://127.0.0.1:49757/help/nftopic/jar:file:/C:/Users/zfore/Desktop/dab5044-api.jar!/edu/vt/cs5044/DotsAndBoxes.html#init-int-)(int size)  Initialize the grid for a new game. |

* + ***Method Detail***
    - **init**

void init(int size)

Initialize the grid for a new game. Applications must initialize the grid before calling any other methods. This method creates a grid with no drawn edges, resets all scores to zero, and sets the current player to Player.ONE.

A game grid is always square, with equal height and width; the smallest grid size allowed is 2 (meaning 2 boxes by 2 boxes).

**Parameters:**

size - the width (and thus the height) of the game grid, in boxes.

**Throws:**

[GameException](http://127.0.0.1:49757/help/nftopic/jar:file:/C:/Users/zfore/Desktop/dab5044-api.jar!/edu/vt/cs5044/GameException.html) - if the specified size is less than 2.

* + - **getSize**

int getSize()

Get the current size of the game grid. This will always be the same as the size used to invoke the most recent successful initialization.

**Returns:**

the width (and height) of the game grid, in boxes.

**Throws:**

[GameException](http://127.0.0.1:49757/help/nftopic/jar:file:/C:/Users/zfore/Desktop/dab5044-api.jar!/edu/vt/cs5044/GameException.html) - if the grid was never initialized.

* + - **getDrawnEdgesAt**

Collection<[Direction](http://127.0.0.1:49757/help/nftopic/jar:file:/C:/Users/zfore/Desktop/dab5044-api.jar!/edu/vt/cs5044/Direction.html)> getDrawnEdgesAt([Coordinate](http://127.0.0.1:49757/help/nftopic/jar:file:/C:/Users/zfore/Desktop/dab5044-api.jar!/edu/vt/cs5044/Coordinate.html" \o "class in edu.vt.cs5044) coord)

Get a collection of edges currently drawn of the box at the specified location. If there are no edges currently drawn, the returned collection is empty (zero elements). The sequence of elements within the collection is unspecified, and may vary.

The returned collection reflects the edges drawn at the time this method is called. Edges of the same box that are drawn later must not appear in the returned collection.

**Parameters:**

coord - the location of a box within the grid.

**Returns:**

a Collection containing zero or more Direction objects, representing drawn lines.

**Throws:**

[GameException](http://127.0.0.1:49757/help/nftopic/jar:file:/C:/Users/zfore/Desktop/dab5044-api.jar!/edu/vt/cs5044/GameException.html) - if the location is invalid, or the grid was never initialized.

**See Also:**

[Direction](http://127.0.0.1:49757/help/nftopic/jar:file:/C:/Users/zfore/Desktop/dab5044-api.jar!/edu/vt/cs5044/Direction.html)

* + - **getOwnerAt**

[Player](http://127.0.0.1:49757/help/nftopic/jar:file:/C:/Users/zfore/Desktop/dab5044-api.jar!/edu/vt/cs5044/Player.html) getOwnerAt([Coordinate](http://127.0.0.1:49757/help/nftopic/jar:file:/C:/Users/zfore/Desktop/dab5044-api.jar!/edu/vt/cs5044/Coordinate.html" \o "class in edu.vt.cs5044) coord)

Get the owner of the fully-drawn box at a specified location. The owner of a box is the Player who drew the final (fourth) edge of that box. If the specified box has fewer than four edges, this method returns null, to indicate that neither player owns the box.

**Parameters:**

coord - the location of a box within the grid.

**Returns:**

the Player who owns this box, or null if this box has fewer than four edges.

**Throws:**

[GameException](http://127.0.0.1:49757/help/nftopic/jar:file:/C:/Users/zfore/Desktop/dab5044-api.jar!/edu/vt/cs5044/GameException.html) - if the location is invalid, or the grid was never initialized.

**See Also:**

[Player](http://127.0.0.1:49757/help/nftopic/jar:file:/C:/Users/zfore/Desktop/dab5044-api.jar!/edu/vt/cs5044/Player.html)

* + - **drawEdge**
    - boolean drawEdge([Coordinate](http://127.0.0.1:49757/help/nftopic/jar:file:/C:/Users/zfore/Desktop/dab5044-api.jar!/edu/vt/cs5044/Coordinate.html) coord,

[Direction](http://127.0.0.1:49757/help/nftopic/jar:file:/C:/Users/zfore/Desktop/dab5044-api.jar!/edu/vt/cs5044/Direction.html) dir)

Draw an edge of the box at a specified location by the current player. This method returns false, and takes no other action, if the specified edge has already been drawn. Otherwise, this method draws the edge, performs the actions noted below, then returns true.

If this edge completed (as the fourth edge) one or two boxes, the current player becomes the owner of each newly-completed box, and it is still the current player's turn (unless the game is now over).

If this is the last edge to be drawn of the entire grid, then the game is now over.

If the game is not over, and no box was completed this turn, then the current player's turn is over and it is now the other player's turn.

**Parameters:**

coord - the location of a box within the grid.

dir - which edge of the box to draw.

**Returns:**

true if the edge was drawn successfully; false otherwise (if the edge has already been drawn)

**Throws:**

[GameException](http://127.0.0.1:49757/help/nftopic/jar:file:/C:/Users/zfore/Desktop/dab5044-api.jar!/edu/vt/cs5044/GameException.html) - if the location is invalid, the direction is null, or the grid was never initialized.

**See Also:**

[Direction](http://127.0.0.1:49757/help/nftopic/jar:file:/C:/Users/zfore/Desktop/dab5044-api.jar!/edu/vt/cs5044/Direction.html)

* + - **getScores**

Map<[Player](http://127.0.0.1:49757/help/nftopic/jar:file:/C:/Users/zfore/Desktop/dab5044-api.jar!/edu/vt/cs5044/Player.html" \o "enum in edu.vt.cs5044),Integer> getScores()

Get a collection of the scores of the players. The score of each player is the number of boxes currently owned by that player.

The returned map reflects the scores at the time this method is called. Later score updates must not appear in the returned collection.

**Returns:**

a map of current scores, where the Player is the key, and their score is the value.

**Throws:**

[GameException](http://127.0.0.1:49757/help/nftopic/jar:file:/C:/Users/zfore/Desktop/dab5044-api.jar!/edu/vt/cs5044/GameException.html) - if the grid was never initialized.

* + - **getCurrentPlayer**

[Player](http://127.0.0.1:49757/help/nftopic/jar:file:/C:/Users/zfore/Desktop/dab5044-api.jar!/edu/vt/cs5044/Player.html) getCurrentPlayer()

Get the player for the current turn, or null if the game is over. Each game always begins with player ONE. In each turn, a player draws a single line, which is an edge of one or two boxes. If no box was completed, the turn is over and play continues with the other player.

If any box was completed, then the turn is not over and the same player goes again. A player can continue in this manner, until a turn does not result in a completed box (thus ending this player's turn), or until all possible edges have been drawn in the entire grid (thus ending the game).

**Returns:**

the current player, or null if the game is over.

**Throws:**

[GameException](http://127.0.0.1:49757/help/nftopic/jar:file:/C:/Users/zfore/Desktop/dab5044-api.jar!/edu/vt/cs5044/GameException.html) - if the grid was never initialized.

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## Class Coordinate

* Object
  + Coordinate

public class Coordinate

extends Object

Holds a single grid location. The location is based on simple Cartesian coordinates.  
The X component values increase going east/right, and decrease going west/left.  
The Y component values increase going south/down, and decrease going north/up.

* + ***Constructor Summary***

|  |
| --- |
| **Constructors** |
| **Constructor and Description** |
| [Coordinate](http://127.0.0.1:49757/help/nftopic/jar:file:/C:/Users/zfore/Desktop/dab5044-api.jar!/edu/vt/cs5044/Coordinate.html#Coordinate-int-int-)(int x, int y)  Construct a new immutable Coordinate representing a specific location. |

* + ***Method Summary***

|  |  |
| --- | --- |
| **All Methods**[**Instance Methods**](javascript:show(2);)[**Concrete Methods**](javascript:show(8);) | |
| **Modifier and Type** | **Method and Description** |
| boolean | [equals](http://127.0.0.1:49757/help/nftopic/jar:file:/C:/Users/zfore/Desktop/dab5044-api.jar!/edu/vt/cs5044/Coordinate.html#equals-java.lang.Object-)(Object obj)  Returns true if this Coordinate is equivalent to the specified Coordinate. |
| [**Coordinate**](http://127.0.0.1:49757/help/nftopic/jar:file:/C:/Users/zfore/Desktop/dab5044-api.jar!/edu/vt/cs5044/Coordinate.html) | [getNeighbor](http://127.0.0.1:49757/help/nftopic/jar:file:/C:/Users/zfore/Desktop/dab5044-api.jar!/edu/vt/cs5044/Coordinate.html#getNeighbor-edu.vt.cs5044.Direction-)([**Direction**](http://127.0.0.1:49757/help/nftopic/jar:file:/C:/Users/zfore/Desktop/dab5044-api.jar!/edu/vt/cs5044/Direction.html) dir)  Get the location of an adjacent (neighbor) location. |
| int | [getX](http://127.0.0.1:49757/help/nftopic/jar:file:/C:/Users/zfore/Desktop/dab5044-api.jar!/edu/vt/cs5044/Coordinate.html#getX--)()  Get the X value of this Coordinate |
| int | [getY](http://127.0.0.1:49757/help/nftopic/jar:file:/C:/Users/zfore/Desktop/dab5044-api.jar!/edu/vt/cs5044/Coordinate.html#getY--)()  Get the Y value of this Coordinate. |
| int | [hashCode](http://127.0.0.1:49757/help/nftopic/jar:file:/C:/Users/zfore/Desktop/dab5044-api.jar!/edu/vt/cs5044/Coordinate.html#hashCode--)() |

* + - **Methods inherited from class Object**

clone, finalize, getClass, notify, notifyAll, toString, wait, wait, wait

* + ***Constructor Detail***
    - **Coordinate**
    - public Coordinate(int x,

int y)

Construct a new immutable Coordinate representing a specific location.

Parameters:

x - horizontal component of the location

y - vertical component of the location.

* + ***Method Detail***
    - **getX**

public int getX()

Get the X value of this Coordinate

Returns:

horizontal component of this location

* + - **getY**

public int getY()

Get the Y value of this Coordinate.

Returns:

vertical component of this location

* + - **getNeighbor**

public [Coordinate](http://127.0.0.1:49757/help/nftopic/jar:file:/C:/Users/zfore/Desktop/dab5044-api.jar!/edu/vt/cs5044/Coordinate.html) getNeighbor([Direction](http://127.0.0.1:49757/help/nftopic/jar:file:/C:/Users/zfore/Desktop/dab5044-api.jar!/edu/vt/cs5044/Direction.html) dir)

Get the location of an adjacent (neighbor) location.

Parameters:

dir - direction of the neighbor

Returns:

a new Coordinate object representing the neighboring location

* + - **equals**

public boolean equals(Object obj)

Returns true if this Coordinate is equivalent to the specified Coordinate. Coordinates are equivalent the X and Y components both match.

Overrides:

equals in class Object

Parameters:

obj - a Coordinate to compare.

Returns:

true if the Coordinates are equivalent; false otherwise.

* + - **hashCode**

public int hashCode()

Overrides:

hashCode in class Object

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## Enum Direction

* Object
  + Enum<[Direction](http://127.0.0.1:49757/help/nftopic/jar:file:/C:/Users/zfore/Desktop/dab5044-api.jar!/edu/vt/cs5044/Direction.html)>
    - Direction
* **All Implemented Interfaces:**

Serializable, Comparable<[Direction](http://127.0.0.1:49757/help/nftopic/jar:file:/C:/Users/zfore/Desktop/dab5044-api.jar!/edu/vt/cs5044/Direction.html)>

public enum Direction

extends Enum<[Direction](http://127.0.0.1:49757/help/nftopic/jar:file:/C:/Users/zfore/Desktop/dab5044-api.jar!/edu/vt/cs5044/Direction.html)>

Each value of this enum represents a single cardinal direction. NORTH, SOUTH, EAST, and WEST indicate their traditional meanings in the northern hemisphere, corresponding respectively to up, down, right, and left.

* + ***Enum Constant Summary***

|  |
| --- |
| **Enum Constants** |
| **Enum Constant and Description** |
| [EAST](http://127.0.0.1:49757/help/nftopic/jar:file:/C:/Users/zfore/Desktop/dab5044-api.jar!/edu/vt/cs5044/Direction.html#EAST)  East (right). |
| [NORTH](http://127.0.0.1:49757/help/nftopic/jar:file:/C:/Users/zfore/Desktop/dab5044-api.jar!/edu/vt/cs5044/Direction.html#NORTH)  North (up). |
| [SOUTH](http://127.0.0.1:49757/help/nftopic/jar:file:/C:/Users/zfore/Desktop/dab5044-api.jar!/edu/vt/cs5044/Direction.html#SOUTH)  South (down). |
| [WEST](http://127.0.0.1:49757/help/nftopic/jar:file:/C:/Users/zfore/Desktop/dab5044-api.jar!/edu/vt/cs5044/Direction.html#WEST)  West (left). |

* + ***Method Summary***

|  |  |
| --- | --- |
| **All Methods**[**Static Methods**](javascript:show(1);)[**Instance Methods**](javascript:show(2);)[**Concrete Methods**](javascript:show(8);) | |
| **Modifier and Type** | **Method and Description** |
| [**Direction**](http://127.0.0.1:49757/help/nftopic/jar:file:/C:/Users/zfore/Desktop/dab5044-api.jar!/edu/vt/cs5044/Direction.html) | [getOpposite](http://127.0.0.1:49757/help/nftopic/jar:file:/C:/Users/zfore/Desktop/dab5044-api.jar!/edu/vt/cs5044/Direction.html#getOpposite--)()  Get the opposite direction. |
| static [**Direction**](http://127.0.0.1:49757/help/nftopic/jar:file:/C:/Users/zfore/Desktop/dab5044-api.jar!/edu/vt/cs5044/Direction.html) | [valueOf](http://127.0.0.1:49757/help/nftopic/jar:file:/C:/Users/zfore/Desktop/dab5044-api.jar!/edu/vt/cs5044/Direction.html#valueOf-java.lang.String-)(String name)  Returns the enum constant of this type with the specified name. |
| static [**Direction**](http://127.0.0.1:49757/help/nftopic/jar:file:/C:/Users/zfore/Desktop/dab5044-api.jar!/edu/vt/cs5044/Direction.html)[] | [values](http://127.0.0.1:49757/help/nftopic/jar:file:/C:/Users/zfore/Desktop/dab5044-api.jar!/edu/vt/cs5044/Direction.html#values--)()  Returns an array containing the constants of this enum type, in the order they are declared. |

* + - **Methods inherited from class Enum**

clone, compareTo, equals, finalize, getDeclaringClass, hashCode, name, ordinal, toString, valueOf

* + - **Methods inherited from class Object**

getClass, notify, notifyAll, wait, wait, wait

* + ***Enum Constant Detail***
    - **NORTH**

public static final [Direction](http://127.0.0.1:49757/help/nftopic/jar:file:/C:/Users/zfore/Desktop/dab5044-api.jar!/edu/vt/cs5044/Direction.html) NORTH

North (up).

* + - **SOUTH**

public static final [Direction](http://127.0.0.1:49757/help/nftopic/jar:file:/C:/Users/zfore/Desktop/dab5044-api.jar!/edu/vt/cs5044/Direction.html) SOUTH

South (down).

* + - **EAST**

public static final [Direction](http://127.0.0.1:49757/help/nftopic/jar:file:/C:/Users/zfore/Desktop/dab5044-api.jar!/edu/vt/cs5044/Direction.html) EAST

East (right).

* + - **WEST**

public static final [Direction](http://127.0.0.1:49757/help/nftopic/jar:file:/C:/Users/zfore/Desktop/dab5044-api.jar!/edu/vt/cs5044/Direction.html) WEST

West (left).

* + ***Method Detail***
    - **values**

public static [Direction](http://127.0.0.1:49757/help/nftopic/jar:file:/C:/Users/zfore/Desktop/dab5044-api.jar!/edu/vt/cs5044/Direction.html)[] values()

Returns an array containing the constants of this enum type, in the order they are declared. This method may be used to iterate over the constants as follows:

for (Direction c : Direction.values())

  System.out.println(c);

Returns:

an array containing the constants of this enum type, in the order they are declared

* + - **valueOf**

public static [Direction](http://127.0.0.1:49757/help/nftopic/jar:file:/C:/Users/zfore/Desktop/dab5044-api.jar!/edu/vt/cs5044/Direction.html) valueOf(String name)

Returns the enum constant of this type with the specified name. The string must match *exactly* an identifier used to declare an enum constant in this type. (Extraneous whitespace characters are not permitted.)

Parameters:

name - the name of the enum constant to be returned.

Returns:

the enum constant with the specified name

Throws:

IllegalArgumentException - if this enum type has no constant with the specified name

NullPointerException - if the argument is null

* + - **getOpposite**

public [Direction](http://127.0.0.1:49757/help/nftopic/jar:file:/C:/Users/zfore/Desktop/dab5044-api.jar!/edu/vt/cs5044/Direction.html) getOpposite()

Get the opposite direction. This is a convenience method that returns the opposite of any Direction.

Returns:

the Direction directly opposite of this direction

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## Class GameException

* Object
  + Throwable
    - Exception
      * RuntimeException
        + GameException
* **All Implemented Interfaces:**

Serializable

public class GameException

extends RuntimeException

This unchecked exception is thrown in cases specified by the DotsAndBoxes API.

See Also:

[Serialized Form](http://127.0.0.1:49757/help/nftopic/jar:file:/C:/Users/zfore/Desktop/dab5044-api.jar!/serialized-form.html#edu.vt.cs5044.GameException)

* + ***Constructor Summary***

|  |
| --- |
| **Constructors** |
| **Constructor and Description** |
| [GameException](http://127.0.0.1:49757/help/nftopic/jar:file:/C:/Users/zfore/Desktop/dab5044-api.jar!/edu/vt/cs5044/GameException.html#GameException--)()  Construct a new instance with no message. |
| [GameException](http://127.0.0.1:49757/help/nftopic/jar:file:/C:/Users/zfore/Desktop/dab5044-api.jar!/edu/vt/cs5044/GameException.html#GameException-java.lang.String-)(String message)  Construct a new instance with a custom message. |

* + ***Method Summary***
    - **Methods inherited from class Throwable**

addSuppressed, fillInStackTrace, getCause, getLocalizedMessage, getMessage, getStackTrace, getSuppressed, initCause, printStackTrace, printStackTrace, printStackTrace, setStackTrace, toString

* + - **Methods inherited from class Object**

clone, equals, finalize, getClass, hashCode, notify, notifyAll, wait, wait, wait

* + ***Constructor Detail***
    - **GameException**

public GameException()

Construct a new instance with no message.

* + - **GameException**

public GameException(String message)

Construct a new instance with a custom message.

Parameters:

message - a custom message