Maze

A maze consists of rooms and doors:

- An door is either
  - a door into a room
  - an escape to a particular place
- A room has two doors, left and right

Door Data Definition

```
interface IDoor {
}

class Into implements IDoor {
  Room next;
  Into(Room next) {
    this.next = next;
  }
}

class Escape implements IDoor {
  String name;
  Escape(String name) {
    this.name = name;
  }
}
```

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Room Data Definition

```
class Room {
  IDoor left;
  IDoor right;
  Room(IDoor left, IDoor right) {
   this.left = left;
   this.right = right;
  }
}
```

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Examples

```
class Examples {
  IDoor meadow = new Escape("meadow");
  IDoor street = new Escape("street");
  Room ms = new Room(meadow, street);
  Room planets = new Room(new Escape("mars"),
                          new Escape("venus"));
  Room maze = new Room(new Into(ms),
                       new Into(planets));
}
```

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Finding Paths

Implement the **`IDoor`** method **`canEscape`** that takes a string and returns a boolean indicating whether an escape with the given name is available

Replace the **`canEscape`** method with a **`escapePath`** method that takes a string and returns either a path of "left" and "right" leading to the escape, or a failure value

```
Path escapePath(String dest)
```

Paths

A path result is either

- failure
- immediate success
- left followed by a (succesful) path
- right followed by a (successful) path

We'll need a **`Path`** interface with an **`isOk`** method

Paths

```
interface IPath {
  boolean isOk();
}

class Fail implements IPath {
  Fail() { }
  public boolean isOk() { return false; }
}

class Success implements IPath {
  Success() { }
  public boolean isOk() { return true; }
}

class Right implements IPath {
  IPath rest;
  Right(IPath rest) { this.rest = rest; }
  public boolean isOk() { return true; }
}

class Left implements IPath {
  IPath rest;
  Left(IPath rest) { this.rest = rest; }
  public boolean isOk() { return true; }
}
```

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Door Variations and Person Attributes

Eventually, we want locked doors, short doors, magic doors, and other kinds of doors

Finding an escape will depend on having keys, being a certain height, etc.

Instead of adding more and more arguments to **`escapePath`**, let's introduce a **`Person`** to carry attributes

Replace the destination-string argument of **`escapePath`** with a **`Person`** argument, where a **`Person`** has a destination and height

Short Doors

Add a new kind of door, a short door, where a person must be less that the door's height to pass

Adding a short door requires only the declaration of a `Short` class — no other code changes!

Locked Doors

Add a new kind of door, a locked door, where a person must have a key to pass

Besides adding **`Locked`**, we change **`Person`** to add the notion of keys to the person

In contrast to adding new variants, adding new operations requires changing the class

Racket versus Java

Racket:

- New variant ⇒ change old functions
- New function ⇒ no changes to old code

Java:

- New variant ⇒ no changes to old code
- New method ⇒ change old classes

This is the essential difference between ***functional*** programming and ***object-oriented*** programming