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Java Puzzle Ball

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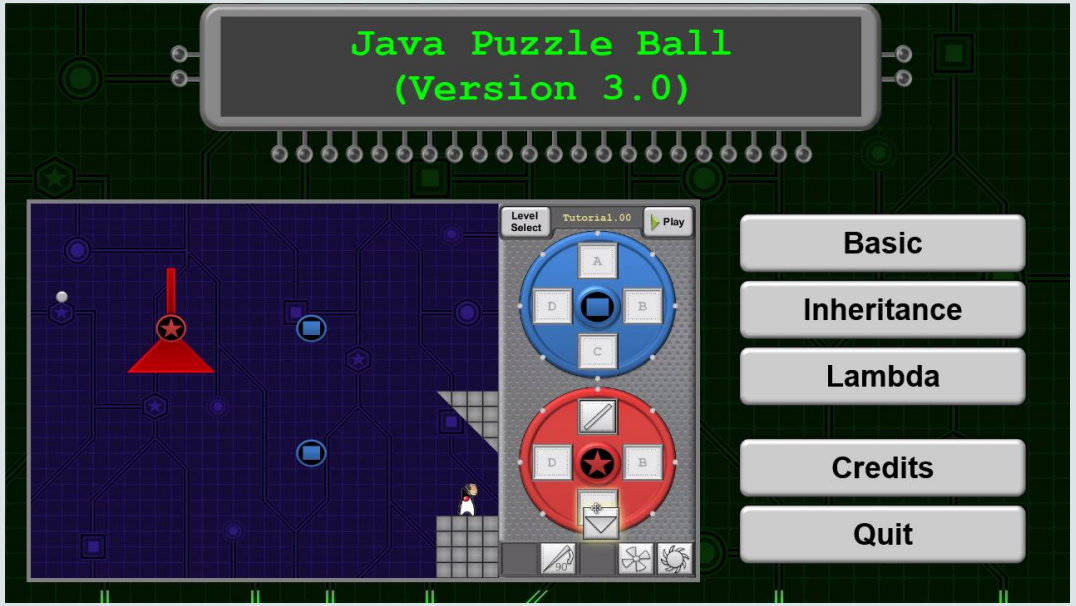
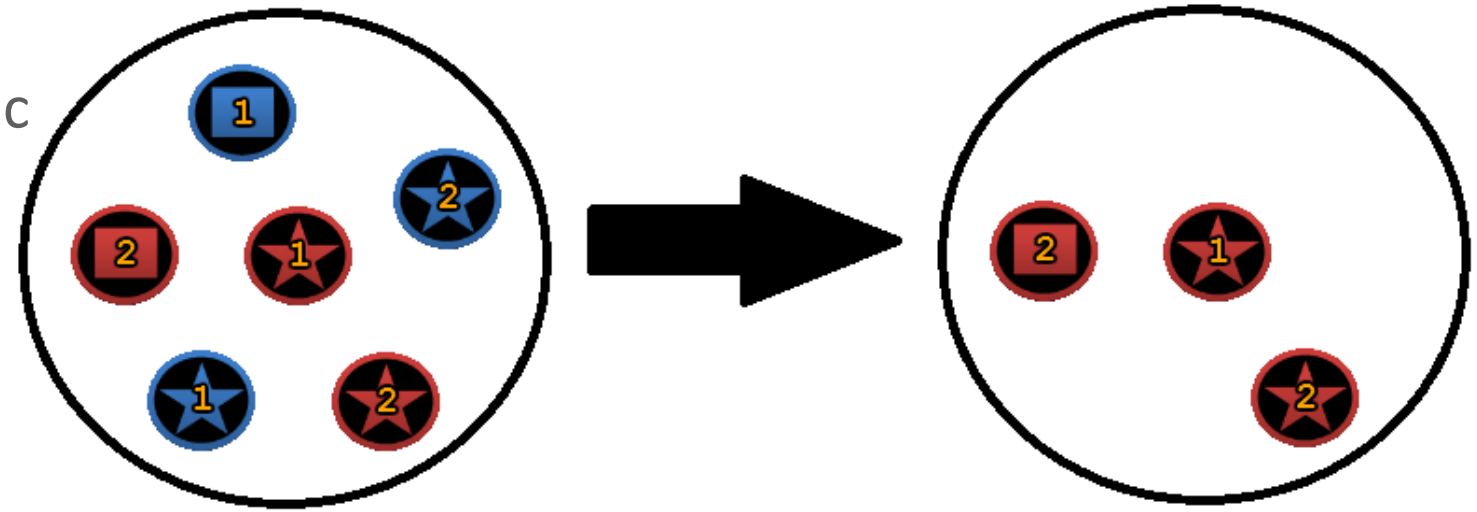
Lesson 4-2
Lambda Expressions



Exercise 4

You're welcome to play beyond puzzle 7

- Play **Lambda Puzzles 1 through 7.**
  - Destroy Blue Bumpers
  - Preserve Red Bumpers
- Consider the following:
  - Can you identify use-cases for lambda expressions?
  - Can you figure out how the logic operators work?



Lambda Use-Case 1

- Lambda expressions handle mouse and keyboard input.
- `blade` is a field in the Ball class. It's also a special object type.
  - Yes, an object can be used as a field.
- `.setOnMousePressed()` is a method this object type is capable of.
  - It tells the instance to listen in the Event the mouse is pressed.
- An Event is special class in Java. One is created by the action of clicking the mouse on `blade`. The Event is represented by `e`.

```
blade.setOnMousePressed
(e -> setDirection(Dir.NE));
```

Lambda Use-Case 1 continued

- `setDirection()` is a method defined in the Ball class.
  - Instead of accepting a numeric value, this method accepts a special `Dir` value.
- `Dir` is a direction **enumerator**. The 8 possible `Dir` values are defined elsewhere and were specially written for this game.
- Put this all together, and you get your observation: Clicking the blade changes the direction it's moving to the one you set in the lambda expression. This is presented as a single line of code.

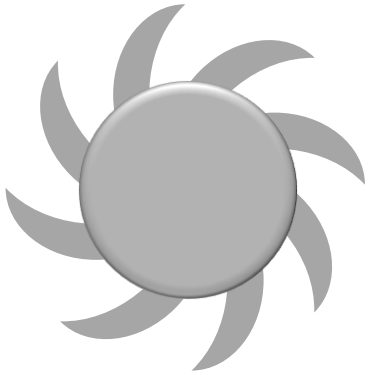
```
blade.setOnMousePressed
(e -> setDirection(Dir.NE));
```

Does this Sound Complicated?

- The previous slides are heavy on technical detail.
- The details may be more helpful later as reference material as you start playing with lambda expressions in NetBeans.
- The important thing for now is that you understand the use case conceptually.

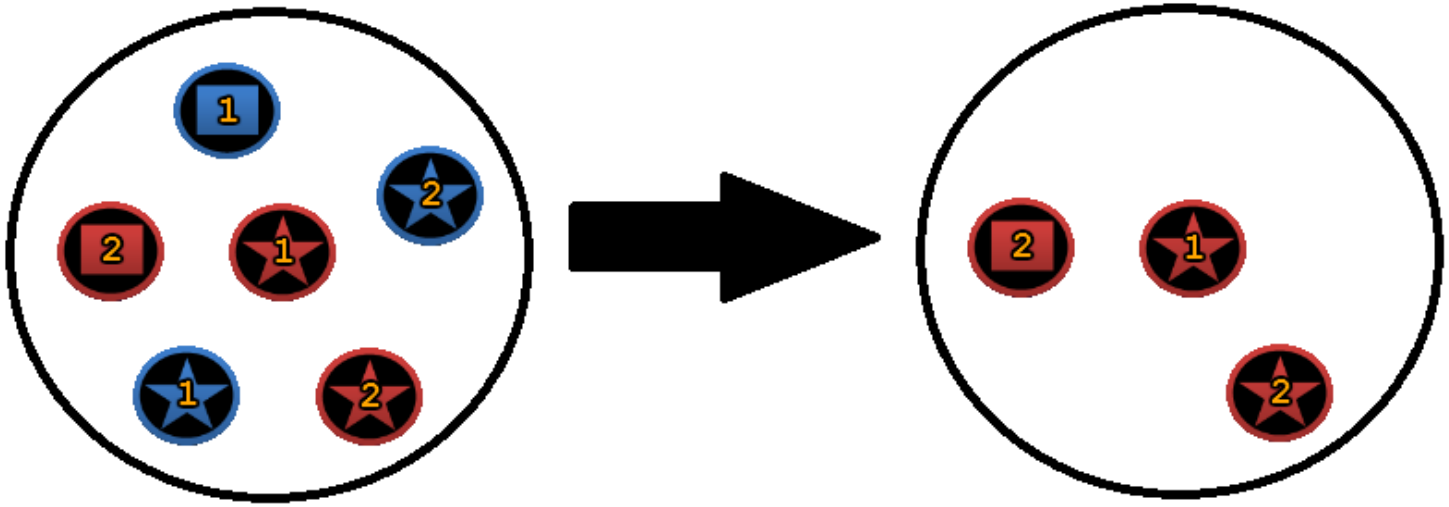
One Other Observation

- You can't change the `Dir` value while the ball is moving across the screen.
  - This rule was implemented for the sake of accuracy.
- Values that are explicitly written in code are considered **hard coded**.
  - You can't change hard coded values in NetBeans while your program is running.
  - You have to restart the program for your changes to take effect.
  - Give this a try in Lab 4.



Lambda Use Case 2

- Lambda expressions allow you to easily work with a collection of objects.
- As you play, you perform the same logic as the lambda code:
  - Take a collection of many bumpers.
  - Identify bumpers based on certain properties (color).
  - For each bumper matching that criteria, perform an action on it (Destroy/Preserve).



What is the Java Syntax?

- The collection is called `BumperList`.
- **Filter** through objects in the collection based on their properties:
  - Shape, color, number
  - If the criteria matches, the object passes through the filter.
- Call a method **for each** instance that matches the filter criteria.
  - `b` represents any given bumper instance in the collection.

```
BumperList.stream()
.filter
   (b -> b.getShape() == Shape.STAR )
.forEach
   (b -> b.setShape(Shape.RECT) );
```

Other Aspects You May Have Noticed, Part 1

- Lambda.05: A forEach statement can contain multiple methods.
- To do this…
  - Enclose all the methods in a set of curly braces { }
  - Put a semicolon ; at the end of each method call.

```
.forEach(b -> {
    b.shiftEast();
    b.setNum(3);  });
```

Other Aspects You May Have Noticed, Part 2

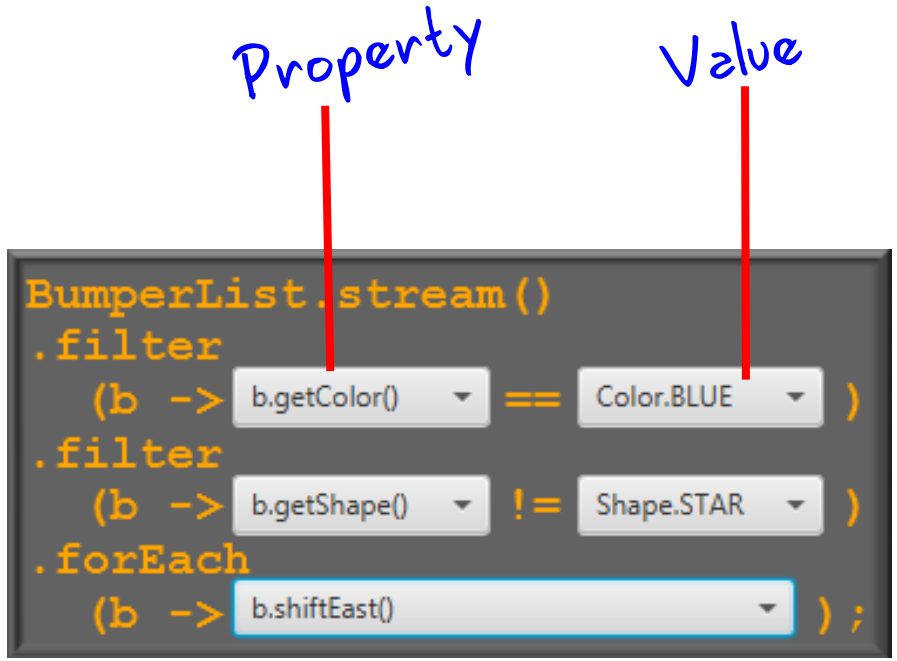
- Lambda.06: Compound logic (&&, ||) can be applied to filters.
  - When using an &&, both criteria must be true for an object to pass through the filter.
  - When using an ||, either criteria can be true for an object to pass through the filter.

```
.filter(b ->
        b.getNum()   ==  1
    ||  b.getColor()  ==  Color.RED  )
```

Other Aspects You May Have Noticed, Part 3

- Lambda.07: Multiple filters can be chained together.
  - This is the same as using &&

- == checks to see if a property is equal to a value.
- != checks to see if a property is not equal to the value.



Summary of Use Case 2

- Lambda.05: A forEach block can contain multiple methods.

```
.forEach(b -> {
    b.shiftEast();
    b.setNum(3);  });
```

- Lambda.06: Compound logic (&&, ||) can be applied to filters.

```
.filter(b ->
        b.getNum() == 1
    || b.getColor() == Color.RED )
```

- Lambda.07: Multiple filters can be chained together.

```
BumperList.stream()
.filter
    (b -> b.getColor() == Color.BLUE )
.filter
    (b -> b.getShape() != Shape.STAR )
.forEach
    (b -> b.shiftEast() );
```

How Useful is this?

- I pull up the game whenever I need to remember how to write lambdas.
- But the game could convey **functional programming** better:
  - Take a lambda expression.
  - Save it as a variable.
    - Reference the variable in methods like you would any field.
    - Pass the variable or logic between methods like you would any number.
  - Functional programming is about storing and passing around functionality and logic.

This logic is the lambda expression.

```
blade.setOnMousePressed
(e -> setDirection(Dir.NE));
```

Example Using Lambda Logic as a Field Variable

- The lambda expression is stored as the field variable `lambdaExample`.
  - This type of lambda expression is called a Consumer.
  - There are many more types.

```
public class SomeClass{
   Consumer<ImageView> lambdaExample = (e -> setDirection(Dir.NE));
   ImageView blade;
…


public void someMethod() {
    blade.setOnMousePressed(lambdaExample);
}

public void setDirection(Dir dir) {
    …
}
```

lambda

Example Passing Lambda Logic to a Method

Although using a field variable is probably better, you can pass logic directly.

```
public class SomeClass{
   ImageView blade;
…


public void someMethod() {
    someOtherMethod(e -> setDirection(Dir.NE));
}

public void someOtherMethod(Consumer x) {
    blade.setOnMousePressed(x);
}

public void setDirection(Dir dir) {
    …
}
```

How is Functional Programming Useful?

- It makes your programming more flexible.
- It makes your programming easier to maintain
- If you make a mistake and need to change your logic, you can change it in once place (the variable) instead of searching for each situation where the same logic is repeated.
  - You might miss one.
  - It's also tedious.

```
Consumer<ImageView> lambdaExample = (e -> setDirection(Dir.NE));
```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