Assignment 11: Critters

HW11 Assignment Overview
Critters

- A simulation world with animal objects with behavior:
  - `fight` animal fighting
  - `getColor` color to display
  - `getMove` movement
  - `toString` letter to display
  - `eat` eat food?

- You must implement:
  - `Ant`
  - `Bird`
  - `Vulture`
  - `Hippo`
  - `Longhorn (Wins Overall and Creative)"
How the simulator works

- When you press "Go", the simulator enters a loop:
  - move each animal once (getMove), in random order
  - if the animal has moved onto an occupied square, fight!

- Key concept: The simulator is in control, NOT your animal.
  - Example: getMove can return only one move at a time. getMove can't use loops to return a sequence of moves.
    - It wouldn't be fair to let one animal make many moves in one turn!

- Your animal must keep state (as fields, instance variables) so that it can make a single move, and know what moves to make later.
Scoring

- Score for each species:
  - For all animals of that species
  - Number of animals alive
  - Number of fights won
  - Amount of food eaten
Food

• Simulator places food randomly around world
• Eating food increases score for species, but ...
• Critters sleep after eating
  • simulator (CritterMain) handles this
• A Critter that gets in a fight while sleeping always loses
  • simulator handles this
Mating

- Two Critters of same species next to each other mate and produce a baby Critter
- Simulator handles this
- Critters not asked if they want to mate
- Critters vulnerable while mating (heart graphic indicates mating)
  - automatically lose fight
- The Simulator handles all of this
  - You don't write any code to deal with mating
public abstract class Critter {
  public boolean eat() {
    return false;
  }
  public Attack fight(String opponent) {
    return Attack.FORFEIT;
  }
  public Color getColor() {
    return Color.BLACK;
  }
  public Direction getMove() {
    return Direction.CENTER;
  }
  public String toString() {
    return "?";
  }
}
Enums

- Critter class has two **nested** Enums for Direction of movement and how to fight

```java
// constants for directions
public static enum Direction { 
    NORTH, SOUTH, EAST, WEST, CENTER 
};

// constants for fighting
public static enum Attack { 
    ROAR, POUNCE, SCRATCH, FORFEIT 
};
```
Nested Enums

- To access a Direction or Attack a class external to Critter would use the following syntax:
  - Critter.Direction.NORTH
  - Critter.Attack.POUNCE
- Classes that are descendants of Critter (like the ones you implement) do not have to use the Critter.
  - it is implicit
- Direction.SOUTH, Attack.ROAR
A Critter class

public class name extends Critter {
    ...
}

• extends Critter tells the simulator your class is a critter

• override methods from Critter based on Critter spec
• Critter has a number of methods not required by the 4 simple Critter classes (Ant, Bird, Vulture, Hippo)
• ... but you should use them to create an interesting and successful Longhorn
**Critter exercise:** *Stone*

- Write a critter class `Stone` (the most stoic of all critters):

<table>
<thead>
<tr>
<th>Method</th>
<th>Behavior</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>constructor</code></td>
<td><code>public Stone()</code></td>
</tr>
<tr>
<td><code>fight</code></td>
<td><code>Always Attack.ROAR</code></td>
</tr>
<tr>
<td><code>getColor</code></td>
<td><code>Always Color.GRAY</code></td>
</tr>
<tr>
<td><code>getMove</code></td>
<td><code>Always Direction.CENTER</code></td>
</tr>
<tr>
<td><code>toString</code></td>
<td>&quot;S&quot;</td>
</tr>
<tr>
<td><code>eat</code></td>
<td><code>Always false</code></td>
</tr>
</tbody>
</table>
Ideas for state

- You must not only have the right state, but update that state properly when relevant actions occur.

- Counting is helpful:
  - How many total moves has this animal made?
  - How many times has it fought?

- Remembering recent actions in fields is helpful:
  - Which direction did the animal move last?
    - How many times has it moved that way?
Clicker 1

- We want to implement a Critter that moves West until it is in a fight. After the fight the Critter moves East until it is in another fight. Each time the Critter is in a fight it shifts its direction for the next move from West to East or East to West.

- Will the move method have a loop?
  A. No
  B. Yes
  C. Maybe
Keeping state

• How can a critter move west until it fights?

```java
public Direction getMove() {
    while (animal has not fought) {
        return Direction.EAST;
    }
    while (animal has not fought a second time) {
        return Direction.EAST;
    }
}
```

```java
private int fights; // total times Critter has fought
public Direction getMove() {
    if (fights % 2 == 0) {
        return Direction.WEST;
    } else {
        return Direction.EAST;
    }
}
```
Testing critters

- Use the MiniMain to create String based on actions and print those out

- Focus on one specific critter of one specific type
  - Only spawn 1 of each animal, for debugging

- Make sure your fields update properly
  - Use `println` statements to see field values

- Look at the behavior one step at a time
  - Use "Tick" rather than "Go"
Critter exercise: **Snake**

<table>
<thead>
<tr>
<th>Method</th>
<th>Behavior</th>
</tr>
</thead>
<tbody>
<tr>
<td>constructor</td>
<td><code>public Snake(boolean northSnake)</code></td>
</tr>
<tr>
<td>fight</td>
<td>alternates between SCRATCH and POUNCE</td>
</tr>
<tr>
<td>getColor</td>
<td>Yellow</td>
</tr>
<tr>
<td>getMove</td>
<td>north bound snakes: 5 steps north, pause 5 ticks, 5 steps north, pause 5 ticks, ...</td>
</tr>
<tr>
<td></td>
<td>otherwise: 5 steps west, pause 5 ticks, 5 steps west, pause 5 ticks, ...</td>
</tr>
<tr>
<td>eat</td>
<td>always eats</td>
</tr>
<tr>
<td>toString</td>
<td>&quot;K&quot;</td>
</tr>
</tbody>
</table>
Determining necessary fields

• Information required to decide what move to make?
  • Direction to go in
  • Length of current cycle
  • Number of moves made in current cycle

• Remembering things you've done in the past:
  • an int counter?
  • a boolean flag?