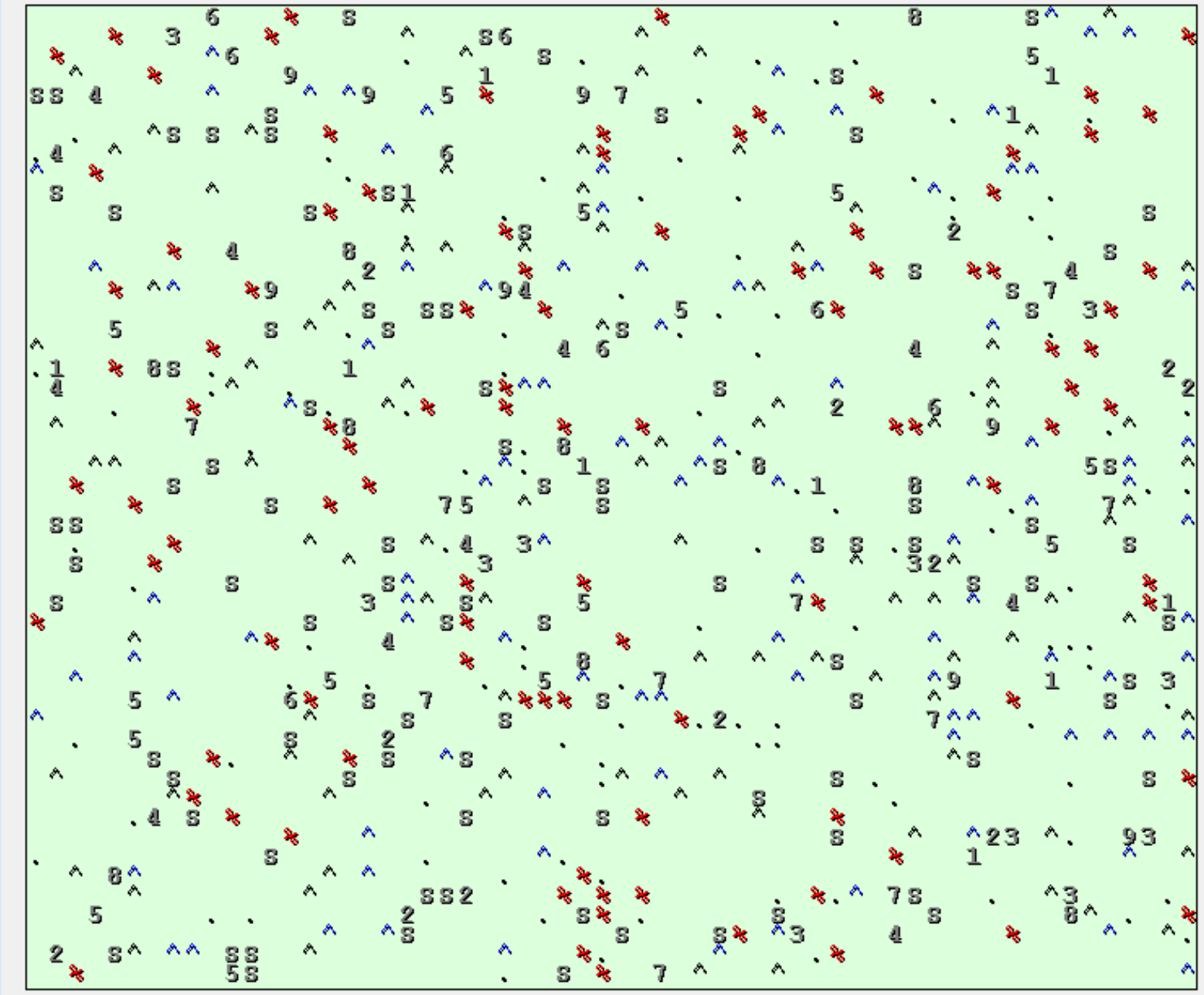
Assignment 11: Critters

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)`



Ant
100 alive (- 0)
+ 0 kills
+ 0 food
=100 TOTAL

Bird
100 alive (- 0)
+ 0 kills
+ 0 food
=100 TOTAL

Hippo
100 alive (- 0)
+ 0 kills
+ 0 food
=100 TOTAL

Stone
100 alive (- 0)
+ 0 kills
+ 0 food
=100 TOTAL

Vulture
100 alive (- 0)
+ 0 kills
+ 0 food
=100 TOTAL

Speed:

0 moves

Go | Stop | Tick | Reset

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

Critter Class

```
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

```
// 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):

Method	Behavior
constructor	`public Stone()`
`fight`	Always `Attack.ROAR`
`getColor`	Always `Color.GRAY`
`getMove`	Always `Direction.CENTER`
`toString`	`"S"`
`eat`	Always `false`

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?

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

```
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`

Method	Behavior
constructor	`public Snake(boolean northSnake)`
`fight`	alternates between SCRATCH and POUNCE
`getColor`	Yellow
`getMove`	north bound snakes: 5 steps north, pause 5 ticks, 5 steps north, pause 5 ticks, … otherwise: 5 steps west, pause 5 ticks, 5 steps west, pause 5 ticks, …
`eat`	always eats
`toString`	`"K"`

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?