



## Atılım University

### CMPE 225 Object Oriented Programming

Fall, 2019-2020

#### Homework 2

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**Due Date: December 26th, 2019, 23:59**

The goal of this homework is to create a simple 2D predator-prey simulation. In this simulation, the prey are ants and the predators are doodlebugs. These critters live in a world composed of a 20x20 grid of cells. Only 1 critter may occupy a cell at a time. The grid is enclosed, so a critter is not allowed to move off the edges of the world. Time is simulated with a loop. Each critter performs some action every time step.

The ants behave according to the following model:

- **Move:** Every time step randomly try to move up, down, left, or right. If the neighboring cell in the selected direction is occupied or would move the ant off the grid, then the ant stays in the current cell.
- **Breed:** If an ant survives for three time steps, then at the end of the time step (that is; after moving) the ant will breed. This is simulated by creating a new ant in adjacent (up, down, left, or right) cell that is empty. If there is no empty cell available, then no breeding occurs. Once an offspring is produced, an ant cannot produce an offspring until three more time steps have elapsed.

The doodlebugs behave according to the following model:

- **Move:** Every time step, if there is an adjacent ant (up, down, left, or right), then the doodlebug will move to that cell and eat the ant. Otherwise, the doodlebug moves according to the same rules as the ant. Note that, a doodlebug cannot eat other doodlebugs.
- **Breed:** If a doodlebug survives for eight time steps, then at the end of the time step it will spawn off a new doodlebug in the same manner as an ant.
- **Starve:** If a doodlebug has not eaten an ant within the last three time steps, then at the end of the third time step it will starve and die. The doodlebug should then be removed from the grid of cells.

During one turn, all the doodlebugs should move before the ants do. Write a program to implement this simulation and draw the world using ASCII characters of “o” for an ant and “X” for a doodlebug. Create a class named *Organism* that encapsulates basic data common to both ants and doodlebugs. This class should have a virtual function named *move* that is defined in the derived classes of *Ant* and *Doodlebug*. You may need additional data structures to keep track of which critters have moved.

Initialize the world with 5 doodlebugs and 100 ants. Proceed 20 time steps. You should see a cyclical pattern between the population of predators and prey, although random perturbations may lead to the elimination of one or both species. First 2 time steps are provided for you as an example sample run:

The grading of the homework will be based on:

1. If you cheat, or high similarity percentage (above 90%), you will get 0.
2. In addition, if your code does not compile, your final grade will be over 50% of your total grade.
3. **Late submissions will not be graded.**

**Good luck**

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### SAMPLE RUN:

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