CS 2401 HW Project 5 (100 Points) (No Late Submission) Summer

A Bug's Life

This is a game of survival between ants and wasps. In this simulation, ants and wasps live together on a grid. Each grid cell can only be occupied be one critter.
Ants can survive on their own and can breed. Wasps can only survive if they eat ants.

In this simulation, you are to create a two-dimension grid of 20x20. The simulation starts by creating 5 wasps and 100 ants (**use const declarations**). Only one bug occupies each cell. Bugs are not allowed to leave this world. They will either survive or die within this grid.
We are going to simulate time by taking time-steps.

The ant behaves as follows:

- **Move**: Every time-step, it **randomly** tries to move to an adjacent cell (up, down, left, or right). If the cell is occupied or the ant moves off the grid, then it stays in the current cell. An ant must not move more than once in each time-step.
- **Breed**: If an ant survives for three time-steps, the ant will spawn another ant. It will create a new ant in any of the adjacent cells (check if any are available). If none are available, then no breeding occurs. Once an offspring is produced, an ant cannot produce another ant until three more time-steps have elapsed.

The wasp behaves as follows:

- **Move**: Every time-step if there is an adjacent ant (randomly selected cell), the wasp will move to that cell and eat the ant. Otherwise, the wasp moves according to the same rules as the ant. A wasp cannot eat other wasps. A Wasp must not move more than once in each time-step.
- **Breed**: if the wasp survives eight time-steps, it will spawn another wasp in any of the adjacent cells (check all availabilities).
- If a wasp 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 wasp should be removed from the grid of cells.

During one turn, all the wasps should move before the ants. This involves going to every element of the grid and determine how the object inside the cell should move.

Write a program that simulates the above bug world. Draw the world using a character symbol for ant and one for a wasp (see sample run below).
You may add functions and member variables as you see fit. However, you may not change any of the move and breed functions' prototypes.

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Create a class called Bug that contains all the basic data common to both ants and wasps. This class should have two virtual functions:

- **move**: that takes a grid (two-dimensional array) and moves the bug(ant/wasp) into another cell
- **breed**: that takes a grid (two-dimension array) and spawns another ant/wasp if it's able to.

Initialize the world randomly with 5 wasps and 100 ants. After each time-step, prompt the user to move to the next time-step.
If you run the simulation many times, it may lead to the elimination of one of the species.

Initial Code:
The three classes and the main program are included in the starter code.

Hints:

- Start early. This is not a small project. It will take time
- Review the video I posted about the project
- Start by creating the grid and displaying it
- Create a time-step function to iterate through each of the objects in the array
- Implement one of the move functions (e.g. wasp)
- Call the wasp move function on all the elements of the grid that match a wasp
- Implement the breed function for the wasp
- Repeat the above for the ant

Grading:

Programs that contain syntax errors will earn zero points.
Programs that use global variables, other than constants, will earn zero points.

- 20 points for the Ant and the Wasp classes
- 20 points for the move functions
- 20 for the breed functions
- 30 points for the main program
- 10 points for coding style and documentations

A Bug's Life

Sample run:

Initial Grid (; = ant, W = wasp)

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 3|W|;|W|W|;| |W|;|;|;|;|;|;|;|;|;|;|;|;|;|
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