

Mid Project
Due March 18, 11:00am
150 points
CS 4499/5531
Scientific Computing
Dr. Leslie Kerby

Write a program that creates a simulation of a population of bunnies, using a collection (ie vector) of Bunny objects. Use appropriate object-oriented programming, const where appropriate, and applicable reference and smart pointer standards.

Each Bunny object must have the following private member variables:

- gender: Male, Female, GenderX (random at creation 47/47/6)
- color: white, brown, black, spotted (random at creation, equal probability)
- age: 0-10 (years old)
- name: randomly chosen at creation from a list of at least 20 bunny names (your choice)
- radioactive_mutant_vampire_bunny: true/false (decided at time of bunny creation 3% chance of true)

Design and implement any Bunny methods that are sensible.

Create another object that contains the collection of Bunny-s and has methods necessary to run the simulation.

At program initialization 10 bunnies (no mutants) must be created and given randomly chosen characteristics of gender, color, and name.

- Each turn afterwards the bunnies age 1 year.
- For each male/female pair age 2-8 years: a new bunny is created each turn; genderX may pair with any other gender and has a 50% chance of creating a new bunny. Each bunny can pair at most once per turn.
- The color of new bunnies born should be randomly chosen between their mother and father; other characteristics (gender, name, and radioactive) are chosen randomly.
- If a bunny becomes older than 10 years old, it dies.

If a radioactive mutant vampire bunny is born then each turn it will change exactly one non-radioactive bunny into a radioactive vampire bunny. (If there are two radioactive mutant vampire bunnies two bunnies will be changed each turn and so on...)

- Radioactive vampire bunnies are excluded from regular breeding and do not count as adult bunnies.
- Radioactive vampire bunnies do not die until they reach age 50.

The program should also output each turns' events such as:

"Bunny Thumper was born!

Bunny Fufu was born!

Radioactive Mutant Vampire Bunny Voldemort was born!
Bunny Dumbledore died!”

- The program should print a list of summarized data on all the bunnies in the colony each turn (turn number, number of bunnies, how many M/F/X, how many mutant bunnies, how many bunnies born that turn, how many bunnies died that turn, and how many bunnies of each age).
- The program should also write all screen output to a file.
- When all the bunnies have died the program terminates.

Graduate Students also complete the following:

- 1) Modify the program to run in real time, with each turn lasting 2 seconds.
- 2) Study the population behavior relative to the mutant bunnies.
 - Try different random number seeds.
 - What is the average peak population?
 - Graph colony size and # mutants vs turn number.
 - Try different percentages for odds of being mutant (ie 25%, 10%, 5%, 1%) and repeat above analysis.
 - Etc...
- 3) Submit a written report (5 pages) highlighting your program structure and your analysis for item 2.