

# COMP1111 Project 3 / FALL 2022

**Desing Phase Deadline: 10 January 2022 (23:59 PM)**

**Implementation Phase Deadline: 18 January 2022 (23:59 PM)**

IF YOU HAVE ANY QUESTION ABOUT THE PROJECT, PLEASE TALK WITH YOUR INSTRUCTOR OR LAB TUTOR.

1. This is a **strictly individual** assignment. That means, you **are not allowed** to take a peek at any solutions, including online resources, and you **are not allowed** to share your answers with anyone, including your classmates. **Never show or share your code to your friends. Do not write your program together with your friend or relative.**
2. In case of any form of copying and cheating on programs, all parties will get no project contribution to their grading.
3. Failure to follow these rules may result in an F for the course grade, in the best case.
4. You can use if/if-else, switch, arrays, and loops (while/for) in your design and implementation.
5. Use [Blackboard](#) **system** to submit your design and implementation parts of your project.
6. For **Design Phase** of the project, you **must submit your design on a pdf, png, or jpeg file.** To **draw flowchart**, you can use any free software (e.g. <https://www.draw.io>) or any word processor (e.g. Microsoft Word).
7. After you finish your design, you should **immediately start to implement** it.
8. For **Implementation Phase** of the project, you **must submit your project as .java file(s).**
9. In order to validate your grade, you must present your work to your lab tutor on a given date/hour that is determined for the project presentations. Projects without presentations will not be graded.
10. The neatness, indentation of your code does matter. It should be clear and easy to read. You may loose points for non-commented code.

# compAlien: Genetics Simulation

Consider an alien species (life form) called **compAlien**, whose genetic material is coded by three characters: 'C', 'S', 'E'. An individual of this species has a code length of 128 and made up of these three characters.

A **compAlien** may have the following example genetic code having length of 128 characters:

C	E	S	C	C	...	S	S	E
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There are certain properties of this species, which can be identified by analyzing the genetic code:

- **Health:** An individual's health is proportional to the number of distinct "CSE" sequences in its code. Health affects the individual's chance of producing offsprings.
- **Gender:** gender is determined by the last (128th) character: males have 'S'; females have 'E' or 'C' on their code as the last character.
- **Reproduction:** When two individuals of opposite gender mate, they can produce an offspring with a probability proportional to the sum of their healths. The probability of having an offspring for two opposite gender individuals **X** and **Y** is formulated as follows:

$$p\_reproduce = (Health\_X + Health\_Y) / N$$

Experiment on **N** to find an appropriate value for reproduction probability. (**Hint:** Remember value of probability  $p\_reproduce$  can be between 0 and 1. A value of  $p\_reproduce = 0.5$ , for example, represent 50% change. If the health of an individual is related with number of "CSE" sequences in his/her genetic code, what can be the value of **N**?)

Your task in this project is to write a main program and related methods to simulate the above described **compAlien** species and its lifecycle. Your program must have at least 6 methods (main, calculateHealth, findGender, and reproductionResult,... etc.)

In your program

- Ask user to enter the size of the population of **compAlien** species
- Generate given number of individuals of **compAlien** species
- Calculate their healths and find their genders
- Assign ID to each pair starting from 1
- Show the following options to the user:
  - Mate two **compAliens**: user can enter the IDs of two **compAliens** to mate them. Show the result of reproduction.
  - Randomly enlarge population: ask user to enter number of randomly chosen **compAlien** pairs and simulate their reproduction.
  - Calculate statistics: find number of females and males, find number of **compAliens** having health of **H** (a user given number) or higher, and add other interesting statistics that you can imagine. Do not share your ideas with the others!!!
  - You are free to add other properties (at least two more operations) in order to make your program more interesting. Do not share your ideas with the others!!!

**Debugging and Testing:** During the development you can choose a smaller size for genetic code, e.g. 12, to trace and debug the program easier. Then, you can modify your code accordingly.

### Example output:

Enter the size of compAlien population: 71  
Simulating compAlien species...

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ID:1, Female, Health: 4  
ID:2, Female, Health: 1  
ID:3, Male, Health: 3  
...  
ID:71, Male, Health: 8

---

compAlien population is generated!

Choose an options:

- (1)Mate two compAliens
- (2)Randomly mate a set of compAliens
- (3)Show statistics
- (4)Your other option-1
- (5)Your other option-2

Enter an option: 1

Mating two compAliens

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Enter ID of first compAlien: 13  
Enter ID of second compAlien: 28  
compAlien 13(M) and 28(M) Mate: no mate

Choose an options:

- (1)Mate two compAliens
- (2)Randomly mate a set of compAliens
- (3)Show statistics
- (4)Your other option-1
- (5)Your other option-2

Enter an option: 1

Mating two compAliens

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Enter ID of first compAlien: 13  
Enter ID of second compAlien: 32  
compAlien 13(M) and 32(F) Mate: Offspring chance 67%. They have 1 offspring :)

Choose an options:

- (1)Mate two compAliens
- (2)Randomly mate a set of compAliens
- (3)Show statistics
- (4)Your other option-1
- (5)Your other option-2

Enter an option: 2

Simulating Random compAlien Reproduction

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Enter number of compAlien pairs to reproduce: 4  
Alien 1(F) and 5(M) mate: Offspring chance 67%. Result: 1 OffSpring  
Alien 2(M) and 5(F) mate: Offspring chance 5%. Result: no OffSpring  
Alien 1(F) and 7(F) mate: no mate  
Alien 3(M) and 9(M) mate: no mate.

Choose an options:  
(1)Mate two compAliens  
(2)Randomly mate a set of compAliens  
(3)Show statistics  
(4)Your other option-1  
(5)Your other option-2  
Enter an option: 3

#### compAlien Population Statistics

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FEMALE population = 55%  
MALE population = 45%  
Enter an health threshold [between ... and ...]: 12  
38% of compAlien population have a health of 12 or higher  
//Add other intersting statistics

Choose an options:  
(1)Mate two compAliens  
(2)Randomly mate a set of compAliens  
(3)Show statistics  
(4)Your other option-1  
(5)Your other option-2  
Enter an option: 4

...  
...  
...