4CCS1PPA Coursework 3: Game of Life

Background pattern

Description automatically generatedCoursework completed by: Caleb Chan [caleb.chan@kcl.ac.uk](mailto:caleb.chan@kcl.ac.uk) and Alexander Wickman [alexander.wickman@kcl.ac.uk](mailto:alexander.wickman@kcl.ac.uk)

# Life Forms

**Mycoplasma**

* Follows rules outlined in base task. If cell has fewer than two neighbours, it will die. If the cell has two or three live neighbours, it will live on the next generation. If the cell has more than three neighbours, it will die. Any dead cell that is dead and has exactly three neighbours, will come alive.

**Influenza**

* Becomes alive after a random number of generation cycles after initial creation. Once alive, it will remain alive only if it has three or more living neighbours. If it has two or less neighbours, it will die. It will also die if at least one neighbour is a white blood cell. If it is dead, it will come back to life if it has at least one neighbour and none of its neighbours are white blood cells.

**Flavobacterium**

* Changes colour depending on the number of neighbours. If it has no neighbours, it dies. If it has 1 or more neighbours, it continues to live. If it has 1 neighbour it changes colour to red, if it has 2 or more it changes to pink. If it is currently dead and there are exactly three neighbours, it comes back to life.

**White Blood Cell**

* Under the assumption that white blood cell only recognises and targets the influenza cell. White blood cell only remains alive if it has 2 or three neighbours. For any other amount, it will die. If it is currently dead, two or more of its neighbours must be influenza in order to come alive.

**Melanocyte**

* Nondeterministic cell that executes a rule from a set of rules with a given probability. Contains one ruleset for whilst it is alive and one ruleset whilst it is dead. Each rule has an assigned probability to which it will occur in a given generation.

# Challenge Tasks:

1. **Non-Deterministic Cell**

In our project we chose a random cell to use for a nondeterministic cell. This is the melanocyte cell. Within the act() method, a random generator generates a double, between 0 and 1 representing a percentage. Using this random double, we can proportion probabilities to a set of rules, which simulate a non-deterministic cell. For the rules, we decided to use a mix of colour changes, rules that cause the cell to die and rules that cause the cell to live on. We have also included a separate set of rules for when the cell is dead and may come back to life.

Ruleset whilst alive:

Assumed to always die unless rule says otherwise.

10% - Changes colour to blue.

10% - Changes colour to black (default colour).

20% - If two or more of its neighbours is mycoplasma it will die.

30% - If it has exactly 1 neighbour it will live on.

30% - If it has exactly 3 neighbours it will live on.

Ruleset whilst dead:

40% - Comes back to alive in presence of white blood cell.

60% - Comes back to alive with 3 or more neighbours.

1. **Symbiosis**

Symbiosis achieved by white blood cells and influenza cells. The nature of a white blood cell is that it will only target cells that are recognised by it. Hence, we are under the assumption that the white blood cell only targets the influenza cell (parasitic relationship), the influenza’s rules set ensure that in the presence of a white blood cell, it will die. Likewise, in the white blood cell, it will come back to life to kill living influenza cells. Whilst the white blood cell is living, at any point if one of its neighbours is an influenza cell, it kills that cell one by one. These rules were implemented in both the act() methods of the Whiteblood class and the Influenza class.

1. **Disease**