CSE 6730-A/CX 4230 Checkpoint 1

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1 Checkpoint 1 Requirements

1.1 Detailed Description

Abstract - Ashley An abstract summarizing the system and the goals of the project

System Description - Seth Description of the system being studied

Conceptual Model and Platforms - everyone A conceptual model of the system, Platform(s) of development

Literature Review Paste in what you submitted before, possibly updated if you discovered new things in the interim — the literature review does not count against the 2-4 page guideline

1.2 Current Project State

Working Code and Initial Modeling - everyone A "show of progress" via some working code, analysis, or initial modeling attempts

Changes from Proposal - everyone If there have been any major changes in direction or "course corrections" since your original proposal, you can describe them here.

Division of Remaining Work - Ashley Contribution Table and Gantt Chart, Division of labor: How will you divide up the remaining work among your team? In particular, we will be looking to see that you've given thought to how to ensure your project justifies a multi-person effort.

1.3 Github Repo

Readme or Checkpoint Report - Nick This component of the checkpoint would ensure that you have set up a git repository on the Georgia Tech GitHub repository. This is where you will be sharing your final project implementation with the instructors.

2 Modeling Procedures

2.1 Platforms, Languages, Libraries

2.2 Mutation Rate

geneVector and Mutation of Genes

$$\text{Generation 1: geneVector1} = \begin{bmatrix} g_1 \\ g_2 \\ \dots \\ g_n \end{bmatrix}, \text{ offspring will be}$$

$$\downarrow$$

$$\text{Generation 2: geneVector2} \; \epsilon \; \{\text{case0, case1, case2, case3, ... caseN}\}, \text{ where}$$

$$\text{case0} = \begin{bmatrix} g_1 \\ g_2 \\ \dots \\ g_n \end{bmatrix} \quad \text{case1} = \begin{bmatrix} g'_1 \\ g_2 \\ \dots \\ g_n \end{bmatrix}, \; \text{case2} = \begin{bmatrix} g_1 \\ g'_2 \\ \dots \\ g_n \end{bmatrix}, \; \dots \; \text{caseN} = \begin{bmatrix} g'_1 \\ g'_2 \\ \dots \\ g'_n \end{bmatrix}$$

$$\text{Probability of } g_1 \rightarrow g'_1 \text{ from one generation to the next} = P(g'_1)$$

$$\therefore P(case1) = P(g'_1 \cap g_2 \cap g_3 \cap ... \cap g_n) = P(g'_1) \cdot P(g_2) \cdot P(g_3) \cdot ... \cdot P(g_n)$$

(Use Markov with probability of each case selection to choose the gene vector for offspring)

2.3 Strategies of Antibiotic Resistance

Uptake Prevention:

- Changing Membrane Composition between generation (Gram_Positive (extra layer), Gram_Negative (no extra layer), Acid_Fast (gram_positive and acid layer))
- Changing Porins in Membranes between generation

Eflux Pumps:

- types of pumps to pump different antibiotics out of bacteria changes between generations

Drug Modification/Inactivation:

- Molecules to bond to antibiotics
- Enzymes to destroy/modify drugs

Target Modification:

- Resistance to binding by antibiotic, changing the structure which the antibiotic binds to

2.4 Modeling Bacterial Death

Antibiotic Matrix

antibioticMatrix = [deathCase0, deathCase1, deathCase2, ..., deathCaseN], where each of the deathCase0...deathCaseN are possible gene vectors for bacteria that would result in their death

Implementing Logic

```
if(geneVector = col(antibioticMatrix)):
    //bacteria will die
else:
    if(environmental death):
        //bacteria will die
    else:
        //bacteria will live
```