Executive Summary
Problem C
Group 2

A common part of human interactions involve the formation of social groups. In settings like kindergarten classrooms, high schools, and college campuses, there are often times many different social groups or cliques. The goal of this project is to model the population dynamics that these social groups experience over time.

Most often, students tend to be part of a social group with people who have interests that are similar to their own. This phenomenon is called homophily. Due to this homophilic tendency of most individuals, our model assumes that an individual will only switch groups if the new group is a better fit for them than the old one.

The number of people switching from one group to another is a function of each group’s homophily index as well as the difference between each group’s identity. The homophily index is a number that represents how similar the members of the group are to one another. The group identity represents the collective interests of the group and is assumed constant over time. This identity is a 3 dimensional vector comprised of values ranging from 0 to 1 that represent GPA, Socioeconomic status, and extracurricular involvement.

The equation for the rate of change of a group’s population is defined as follows:

\[
\frac{dG_i}{dt} = \sum_{k=0}^{n} \left( m_{ki}G_k(1 - H_k) - m_{ik}G_i(1 - H_i) \right)
\]

Where:
- \(G_i\) is the population of group \(i\)
- \(H_i\) is the homophily index of group \(i\)
- \(M_{ik}\) is the fraction of group \(i\) that will move to group \(k\)
- \(n\) is the number of groups

If the identity vectors of 2 groups are very different, there is a lesser chance of people switching between the two groups. Similarly, if the homophily index of a group is high, the probability of people leaving it is lower since most people in the group are already very similar.

The choice of friend groups that are associated with high school and college become more diverse as the population of student groups increases. The higher the number of groups, the more choices a student has, which increases the likelihood of the student leaving their current group for a new one. This is likely explained by the increased options allowing a student more options, and thus does not require them to maintain relationships within their current group, as they are able to find another group they have a similar amount in common with, allowing them to easily move between groups, without risk of loneliness.
"clique" is a group of 2 to 12 (averaging 5 or 6) "who interact with each other more regularly and intensely than others in the same setting"

