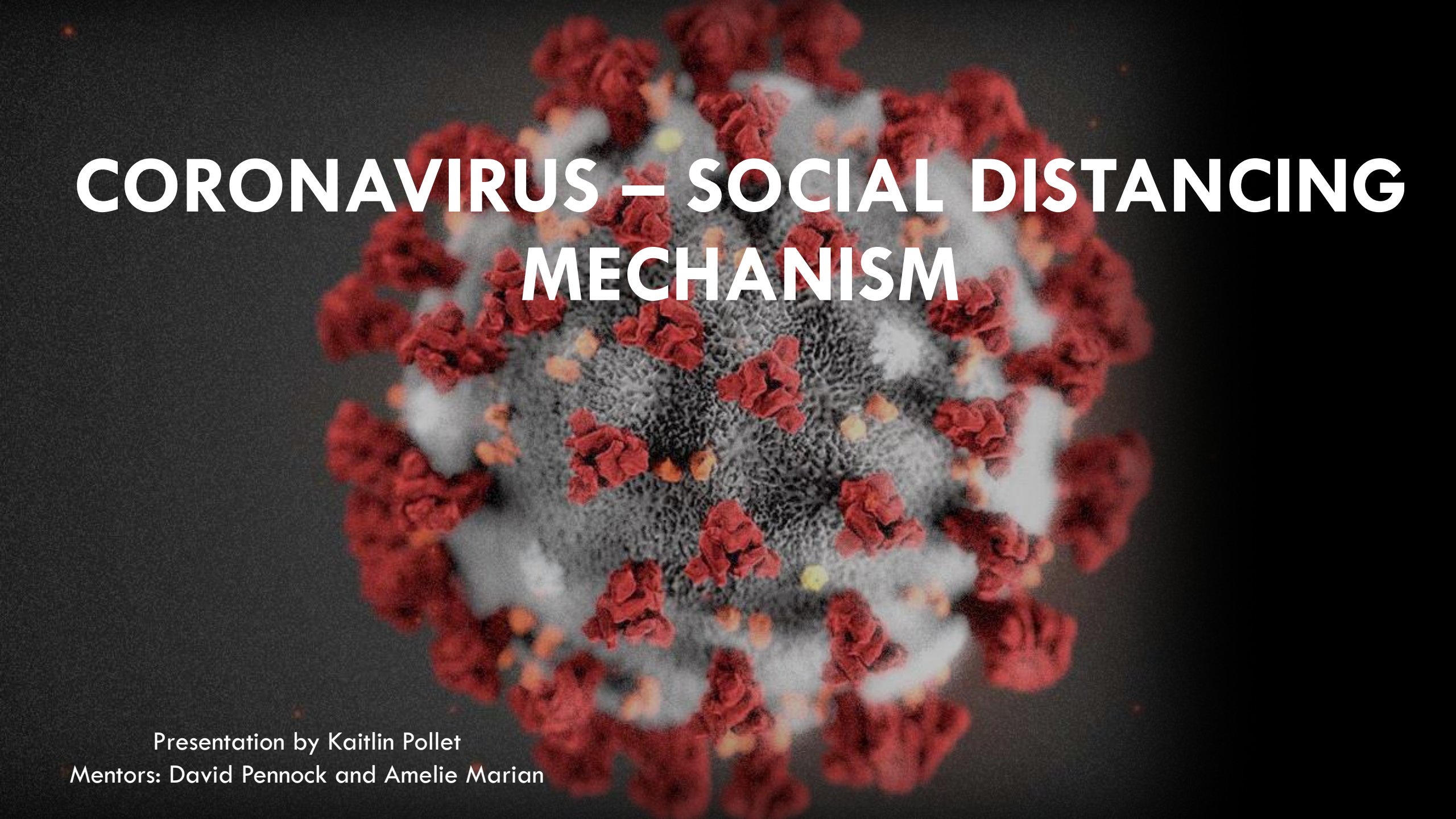
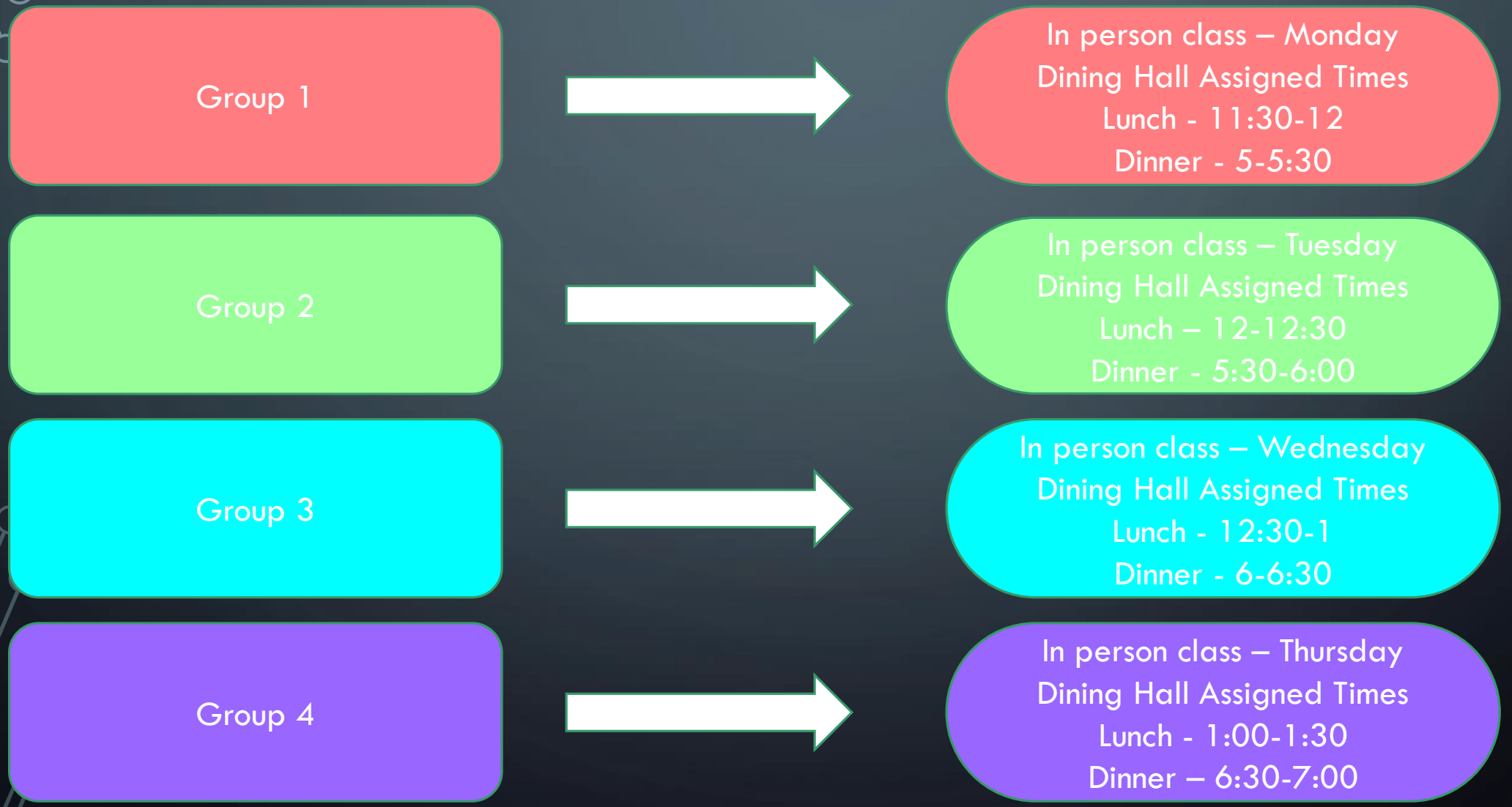
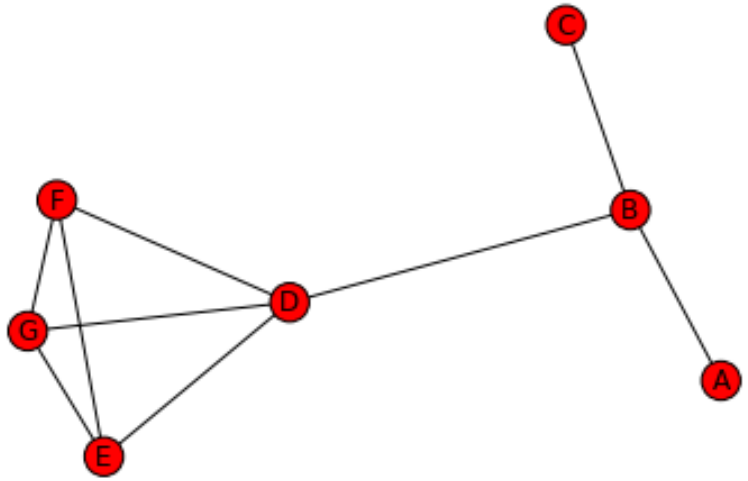


CORONAVIRUS – SOCIAL DISTANCING MECHANISM

Presentation by Kaitlin Pollet
Mentors: David Pennock and Amelie Marian

ORIGINAL IDEA: PARTITIONING INTO GROUPS – COLLEGE EXAMPLE



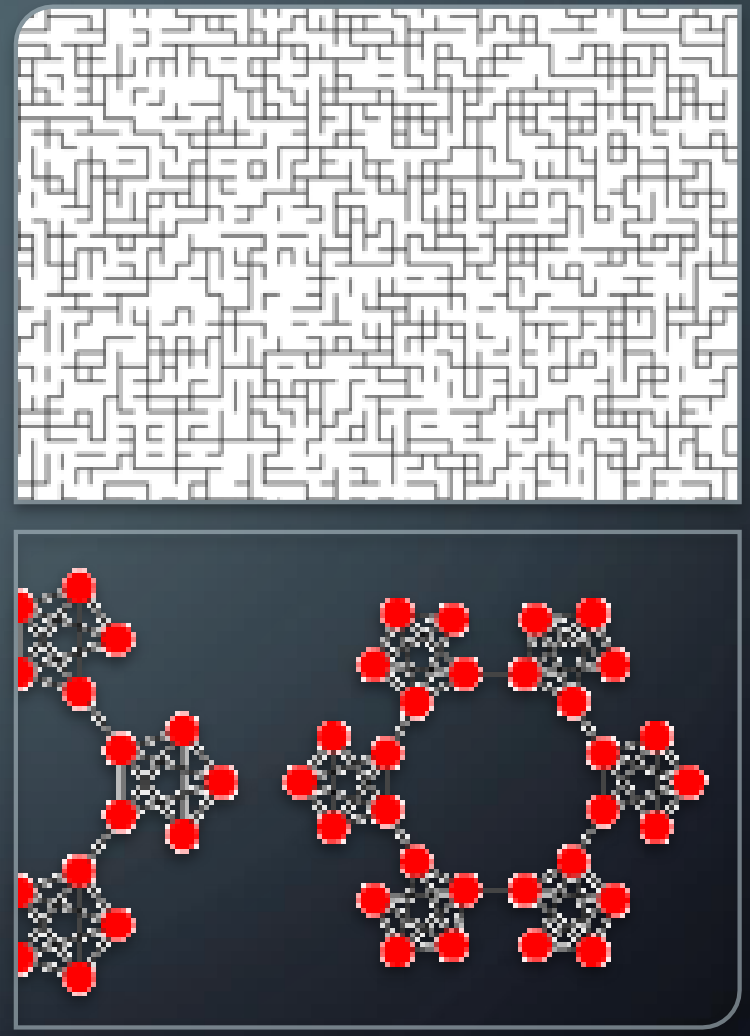


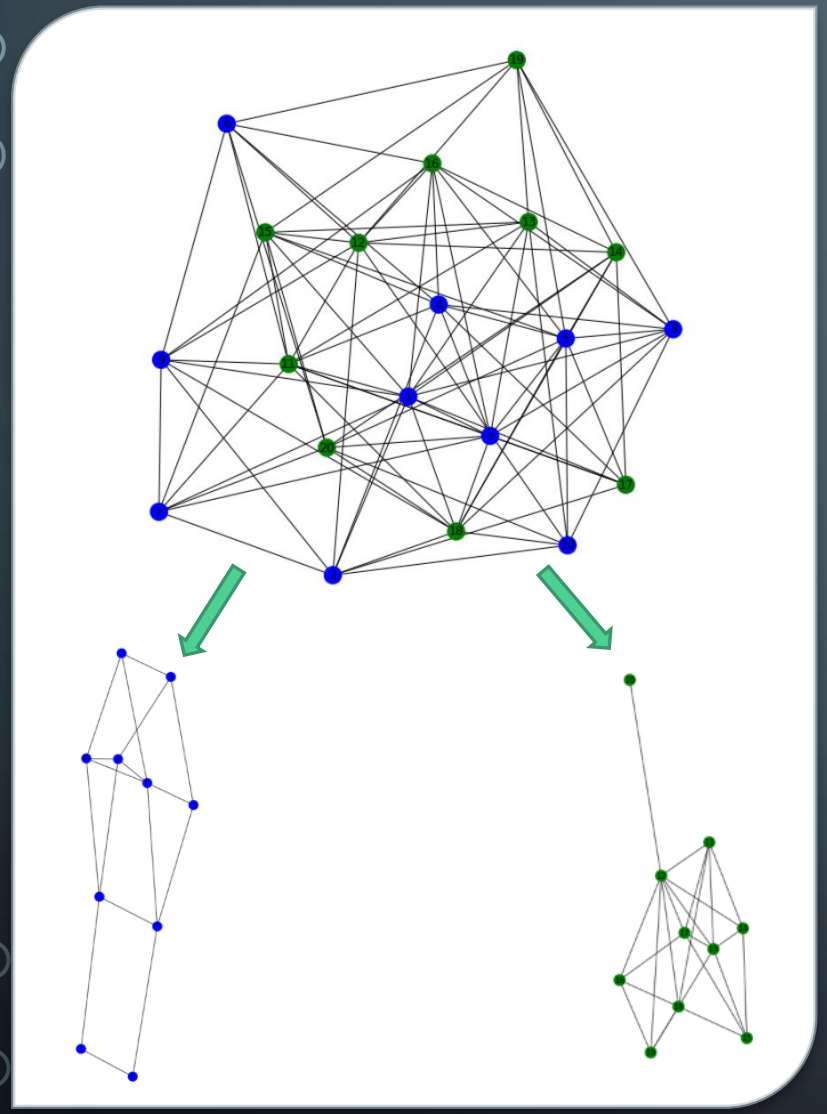
REPRESENTING VIRUS SPREAD ON A GRAPH

- Node – person
- Edge – connection/social interaction

RELATED CONCEPTS

- Percolation Theory
- Graphical Congestion Game
- Correlated Equilibrium



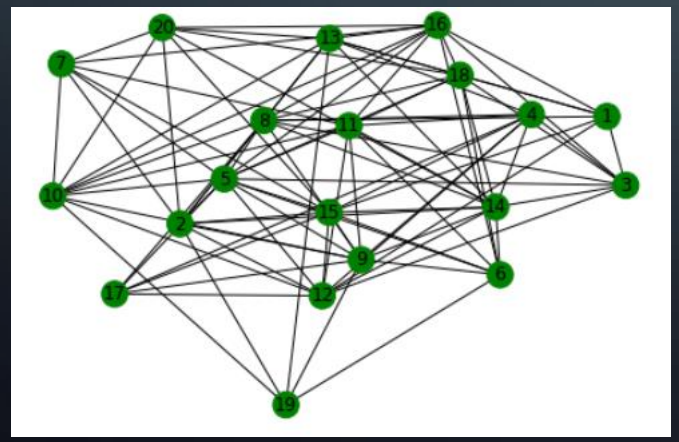


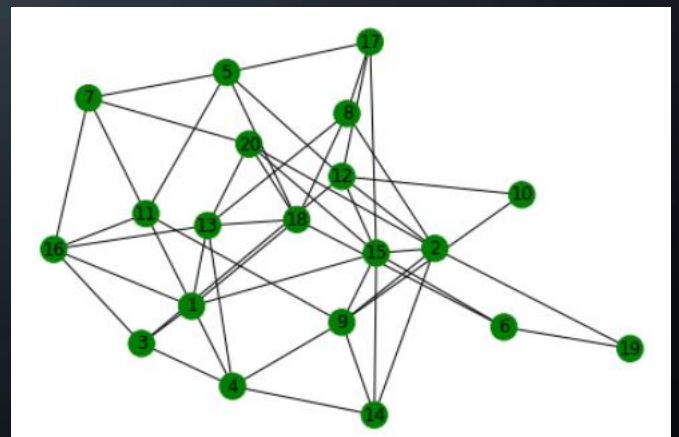
GRAPH 1 - RANDOM

- Random Grouping & Graph
- Fairness
- But different relationships have different weights

GRAPH 2 – RANDOM WITH WEIGHTS

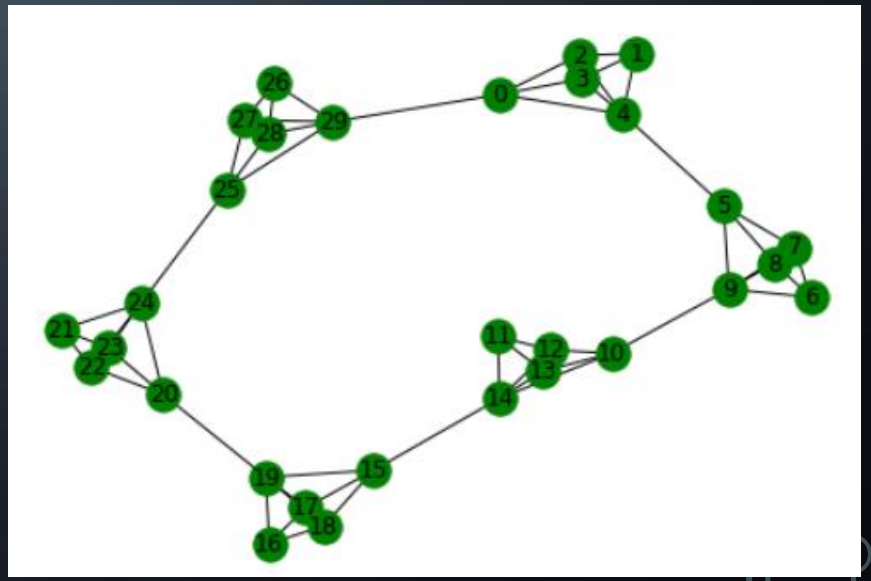
- Assigning random weights to edges (define by number of times a person sees another in a given period of time)
- Remove edges of weight less than a given value
- Partition into groups from here (randomly or keeping removing higher weight level)

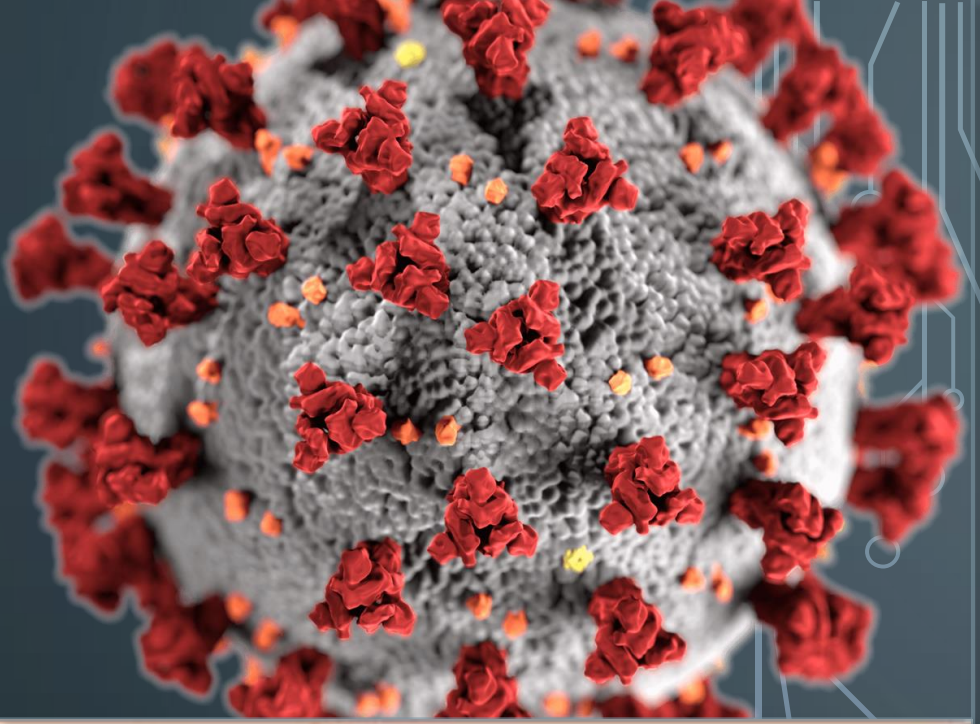


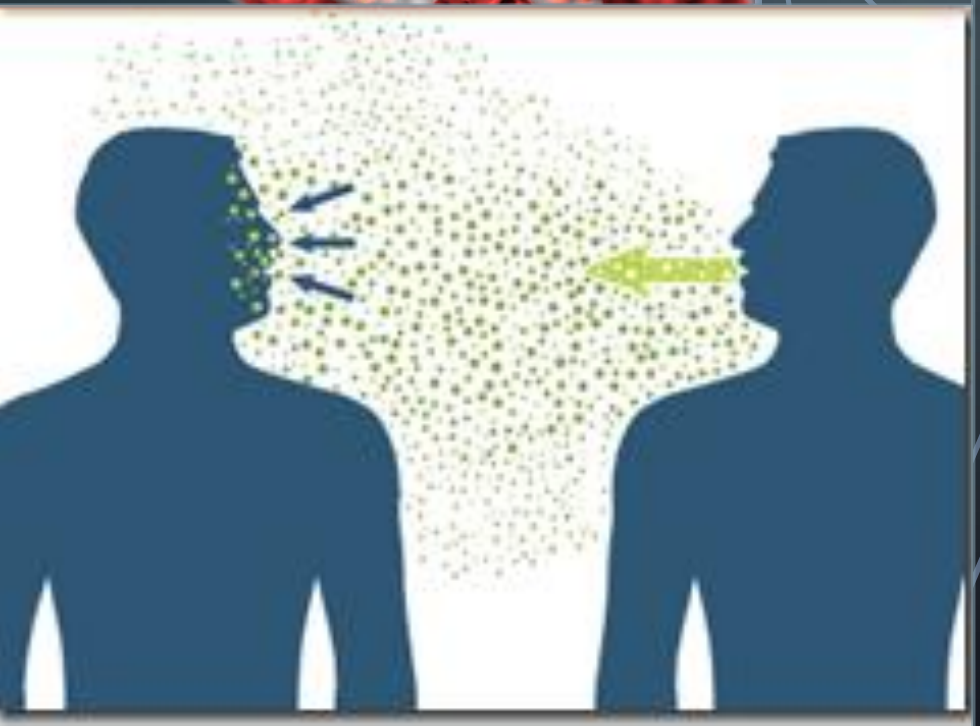


CONNECTED CAVEMAN GRAPH

Idea: fits with partitioning people into groups but has realistic quality that cheating would be involved



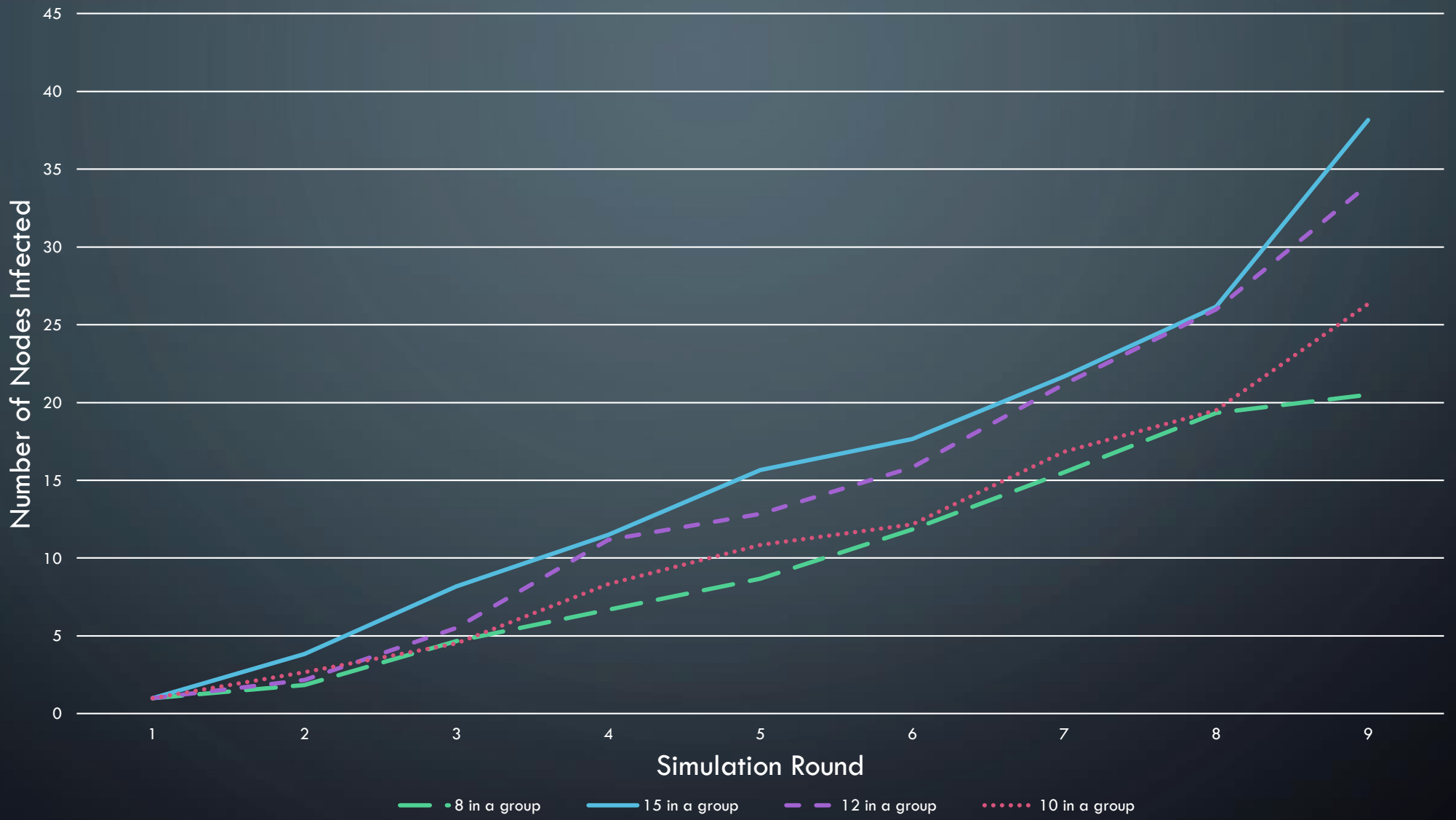


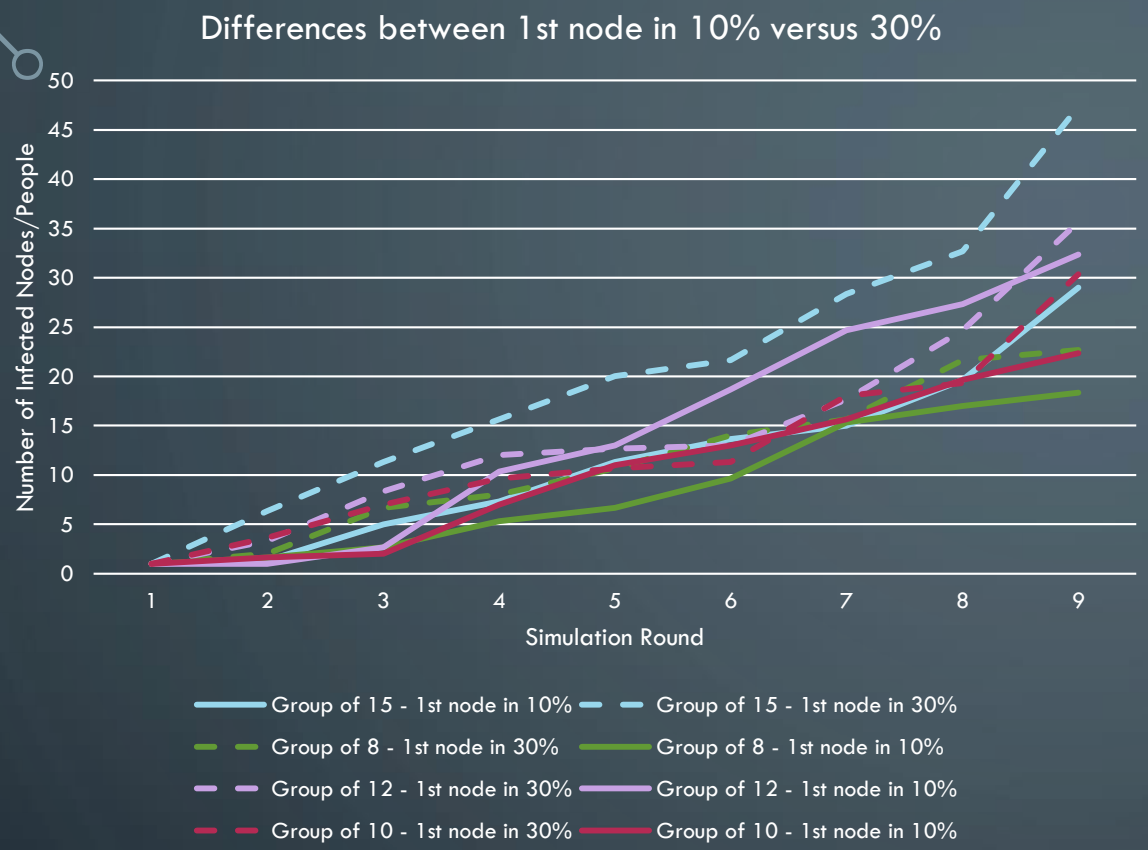


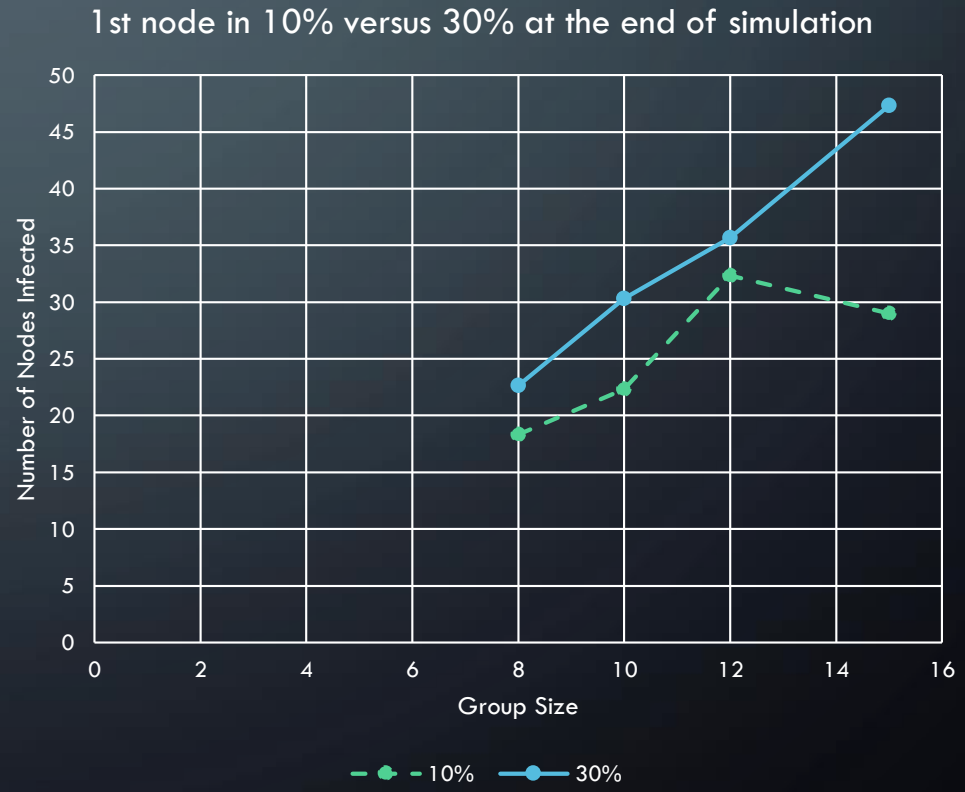
SIMULATION - TESTING

- 120 nodes
  - 10 groups of 12 versus 12 groups of 10
  - 8 groups of 15 versus 15 groups of 8
  - 10% group & 30% group

Different Group Sizes




Differences between 1st node in 10% versus 30%
Number of Infected Nodes/People
0
5
10
15
20
25
30
35
40
45
50
1
2
3
4
5
6
7
8
9
Simulation Round
Group of 15 - 1st node in 10%
Group of 15 - 1st node in 30%
Group of 8 - 1st node in 30%
Group of 8 - 1st node in 10%
Group of 12 - 1st node in 30%
Group of 12 - 1st node in 10%
Group of 10 - 1st node in 30%
Group of 10 - 1st node in 10%

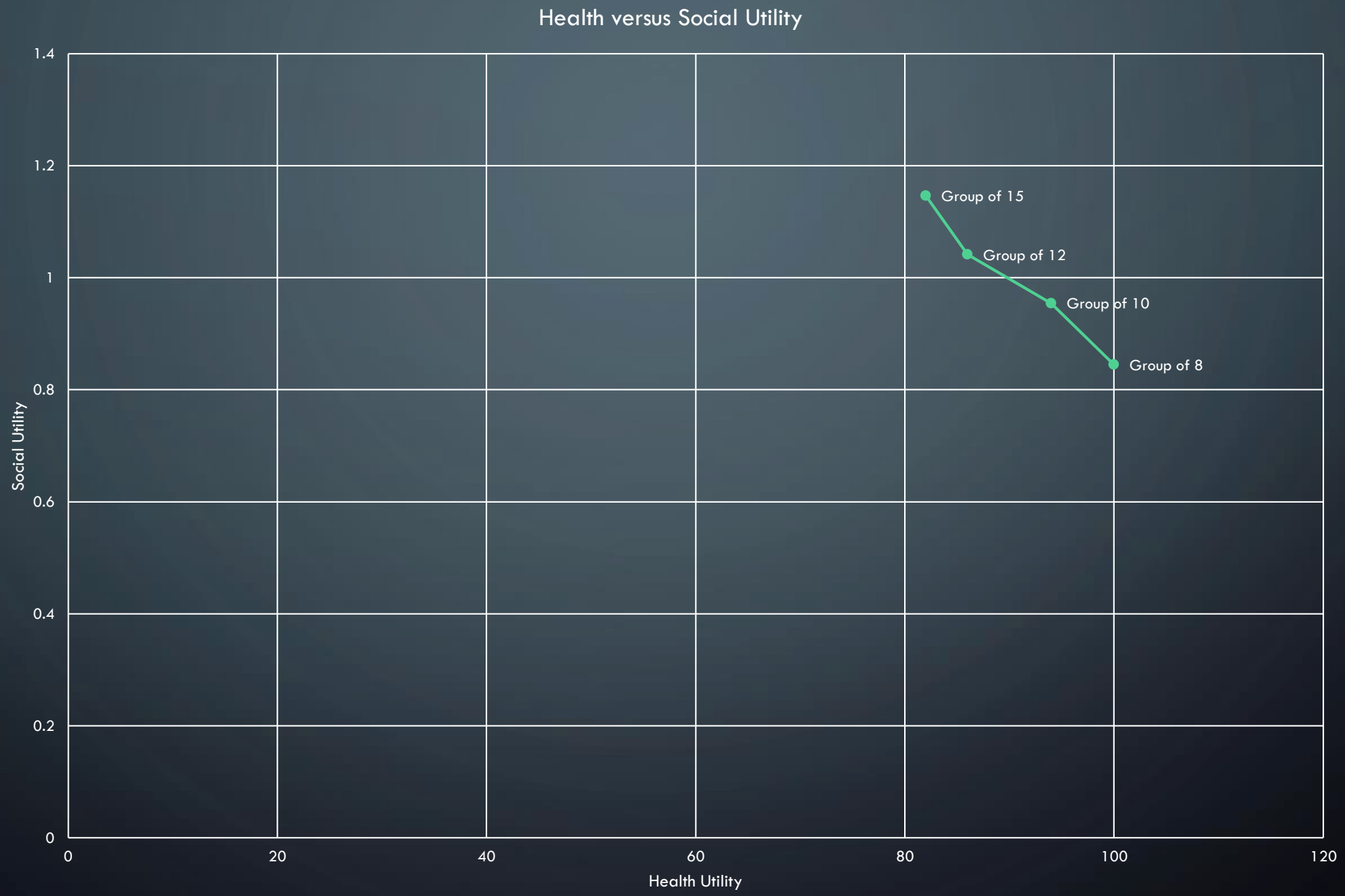

1st node in 10% versus 30% at the end of simulation
Number of Nodes Infected
0
5
10
15
20
25
30
35
40
45
50
0
2
4
6
8
10
12
14
16
Group Size
10%
30%

BALANCING GAME - UTILITY

Is it worth seeing my friend to possibly get sick?

Is it worth seeing my aunt to possibly spread the virus?

Is it worth going to the store if I am immunocompromised?


Health versus Social Utility
1.4
1.2
1
0.8
0.6
0.4
0.2
0
Social Utility
0
20
40
60
80
100
120
Health Utility
Group of 15
Group of 12
Group of 10
Group of 8

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- Mentors: David Pennock and Amelie Marian

REFERENCES

connected_caveman_graph — NetworkX 1.10 documentation. Networkx.github.io. (2015). Retrieved 16 July 2020, from https://networkx.github.io/documentation/networkx-1.10/reference/generated/networkx.generators.community.connected_caveman_graph.html.

Duminil-Copin, H. (2017). *Sixty Years of Percolation* [Ebook]. Retrieved 16 July 2020, from https://arxiv.org/pdf/1712.04651.pdf.

Game Theory Online. (2012). *GTO-3-05: Correlated Equilibrium: Intuition* [Video]. Retrieved 16 July 2020, from https://www.youtube.com/watch?v=sQOrIpARr5E.

Southwell, R. (2012). *Graphical Congestion Games* [Video]. Retrieved 16 July 2020, from https://www.youtube.com/watch?v=NtwtNawqzN4.