MATH 190 - Mathematical Models of Population Growth
An Infection Simulation

Purpose:
The intent of this activity is to simulate the spread of an infectious disease, as well as the recovery from that disease. All players but one will start off healthy (susceptible), and one player will be infected. Players will interact with each other, not knowing who has the disease at any given time, and spread the disease through "risky interactions". Infected individuals are able to recover, but it is not immediate, and they may take a while to recover. During the simulation, play will be stopped from time to time to keep track of the size of the populations (susceptible, infected, and recovered).

Set Up:
First of all, you'll need materials:

- Dixie cups (or plastic cups that aren't clear), one per person
- Dice: one white, one red and one blue (or other color) per person

Put one die of each color in each cup. Mark the bottom of one of the cups with an "I" (for infected). Pass the cups out, one per person. Have the people look at the bottom of their cups. Tell them, if they have an "I" at the bottom they are to keep the red die in the cup, other wise they are to keep the white die in the cup. Discretely remove the other two die and hold them in their hand.

How to Play:
The simulation will consist of several timed rounds. The number of rounds may vary. Each round will last 45 seconds (feel free to adjust this number, though you want all rounds to last the same amount of time). One person is the time keeper/data collector. Everyone else is considered a player in the population. During each round the players will

1. Mover around the room with the intent to interact with another player,
2. Upon meeting another player, both players shake their cups with the die in them (hands over the cup), then show their die to the other player.
    - If a susceptible person (white die) meets an infected person (red die) and the sum of the roll is greater than 9 (a risky interaction), the susceptible person becomes infected (swaps out their white die for a red die immediately, but discretely).
    - If an infected person (red die) rolls a 6, they become cured (swaps out their red die for a blue die immediately, but discretely).
    - For all other pairings, rolls, nothing happens and the pair move on to more interactions.

At the end of each round, the players are to close their eyes. The time keeper will call out a population name (or die color) and players with that criteria are to raise their hand while the time keeper takes count. Do this for two of the populations types (or colors) and determine the third population by the remaining number of players in the game. For example, after the first round it is probably easiest to ask for the number of people with red die and the number of people with blue die, as these will be smaller numbers. The simulation should continue until most of the population has recovered.

What to do with the Data:
Having completed the simulation, the time keeper should have a set of data in the format:

Time	Susceptible	Infected	Recovered
0	$N-1$	1	0
1	⋮	⋮	⋮
2	⋮	⋮	⋮
3	⋮	⋮	⋮
⋮	⋮	⋮	⋮

These can be entered into Excel and graphed.

Discussion Possibilities:
Here are some ideas to reflect upon after completing the simulation and looking at the data:

- Do the curves/data make sense? What's going on (put some explanation into the meaning of the curves in terms of what's going on with the disease)? Interpret the graphs.
- What kinds of "diseases" could this be modeling? (Be careful on this one in terms of your audience, make sure to keep the discussion appropriate for the age group.)
- How should we change the game if we wanted to speed up/slow down recovery?
- How should we change the game if we wanted to increase/decrease the chance of infection?
- Do you feel that this simulation is very realistic? What attributes of the simulation reflect how things work in real life?
- What would happen if, once you've recovered, you become susceptible again? How would you have to change the game? Are there sicknesses like that? Is there a time period after you recover that you can't re-catch the illness?