Simulation Lab no-6 Assignment (Odd ID)
See Class Lecture of 11 August

Class Lecture Link:
https://drive.google.com/file/d/1MpYmUznL-d4LbGvURWhQNYb2816NYYvH/view?usp=sharing

Problem 1: **[15]**

Suppose you have a 5 * 5 array. Each cell of the array is either 0 (Dead) or 1 (Alive) . Now The value of a given cell at the next instant of time depends on the state of its neighbours at the previous time step. There are four rules:

1. If a cell is Alive and has fewer than two neighbours that are Alive, it dies on the next time step. (For Underpopulation)
2. If a cell is Alive and has either two or three neighbours that are alive, it remains Alive on the next time step.
3. If a cell is alive and has more than three neighbours that are Alive, it dies on the next time step. (For Overpopulation :3)
4. If a cell is Dead and has exactly three neighbours that are alive, it turns Alive on the Next Generation.

Example:

Time 0	Time -1	Time- 2	Time -3
0 1 0 0 0 0 0 1 0 0 0 1 1 0 1 0 1 0 0 1 0 0 0 0 0	0 0 0 0 0 0 0 1 1 0 0 1 1 0 0 0 1 1 1 0 0 0 0 0 0	0 0 0 0 0 0 1 1 1 0 0 0 0 0 0 0 1 0 1 0 0 0 1 0 0	0 0 1 0 0 0 0 1 0 0 0 1 0 1 0 0 0 1 0 0 0 0 1 0 0

So Use any programming language to solve this problem. Simulate your code up to 20-time steps and print the array at each time step. Use the above array at time = 0 for initialization.

Problem 2:

You have to simulate a chemical reaction involving three agents. At the beginning of the reaction two reagents A, B are present in the system with amounts of 50 units each and C is present with amounts of 25 units. A and B react together and forms C. Rate of the forward and backward reactions are .05 and .01 respectively. Now simulate the reaction using Python and report the time when the chemical reaction reaches equilibrium, the step size is 0.3 seconds. The equations for the rate of changes are given below:

$$\frac{dA(t)}{dt} = kb * C(t)^2 - kf * A(t) * B(t)$$

$$\frac{dB(t)}{dt} = kb * C(t)^2 - kf * A(t) * B(t)$$

$$\frac{dC(t)}{dt} = 3 * kf * A(t)\, B(t)^3 - kb * C(t)^2$$

where kf and kb are the rates of forward and backward reactions.