COVID-19 Simulation

Data Structures, 2020 Spring, EECS, NTHU

Descriptions

- The simulation takes place in one matrix $r_1 \times c_1$ and an ICU list with capacity k
- Initially, people will be randomly placed in the matrix
  - Either healthy, masked, or tested positive for COVID-19
  - It will be very sparse at the beginning
- People will be inserted into the regular matrix from time to time
  - Example: 4 101 33 Alice Healthy
  - Example2: 5 101 34 Bob Masked
  - Example3: 8 53 21 Xeno Sick
  - Example4: 8 101 32 John Sick

Specification

- Healthy people with mask will remain healthy
- Healthy people without masks will be infected by ill people in the orthogonally adjacent cells.
  - For example, in the samples we give at previous slide, Alice will be infected by John at Time t=8 and become sick at Time t=9
- Initially, the recovery time for all sick people is 14 days.
  - Once the recovery time is 0, this person becomes healthy and all counters will be reset
- Every "new inserted" or "new infected" sick neighbor will increase recovery time by 7 days.
  - For example, at Time t=9, Alice recovery time is 14+7 (since John next to her).
  - Assume at Time t=10, Alice has another sick neighbor, her recover time will be: (21-1)+7
  - Assume at Time t=38, Alice becomes healthy but her neighbor still sick. She will be infected by even the same neighbor (since all counters are reset).

Specification (Contd.)

- A sick person should be moved to ICU, only if:
  - The recovery time is more than 28 days
    - For example, at time T=10, Alice recovery time is 27 days, she will not sent to ICU
    - For another example, at time T=11, Alice has another sick neighbor, her recovery time becomes (27-1)+7, she will be sent to ICU at t=11 (if none in the ICU yet)
  - There does have some rooms in ICU
  - Once the people are moved to ICU, he/she will be there till the end
    - For example, Alice will become the survivor till the end but will stay in ICU forever.
- When sick people successively surrounded by more than three other sick people for more than 7 days will die.
  - When a person die, the cell becomes empty and blocked.
- Your job is to print:
  - The survivor rate in the end
  - The names of survivors (who are not in ICU)

Illustration

- Assume we have the following matrix at time t=0:

	Bob, Sick	
	Alice, Healthy	

- Alice will become sick at time t=1, assume three sick neighbors are inserted at t=1, the recovery time of Alice will be 14+4*7=42

	Bob, Sick	
Steven, Sick	Alice, Sick	John, Sick
	Xeon, Sick	

If ICU capacity is 0, Alice will die at time t=8

Input Samples

r_1 c_1 **ICU capacity**   **Output at time t**

```
1000 800 20 48
30
0 200 60 Mary Masked
0 400 70 Kim Healthy
0 400 71 Bob Sick
0 600 61 Jev Sick
0 101 32 Fey Sick
0 101 35 Alan Healthy
0 121 36 Larry Healthy
4 101 33 Alice Healthy
5 101 34 Bob Masked
8 53 21 Xeno Sick
12 97 60 Jay Healthy
20 689 500 Joe Healthy
⋮
```

The number of people inserted during the simulation time

At Time 0 insert a patient named Mary wearing Masks at position (200,60)

30

Output Sample

```
80%
Mary Jev Fey Alan Larry Alice Bob Xeno Jay Joe Kay
Sim Alex Kobe Fan Bill Sandy Mickey
```

Sorted from Matrix row 0 col 0 -> row 0 col 1 -> …ro1 col 0 -> …

Restriction

- You should not use STL to write your homework assignments.