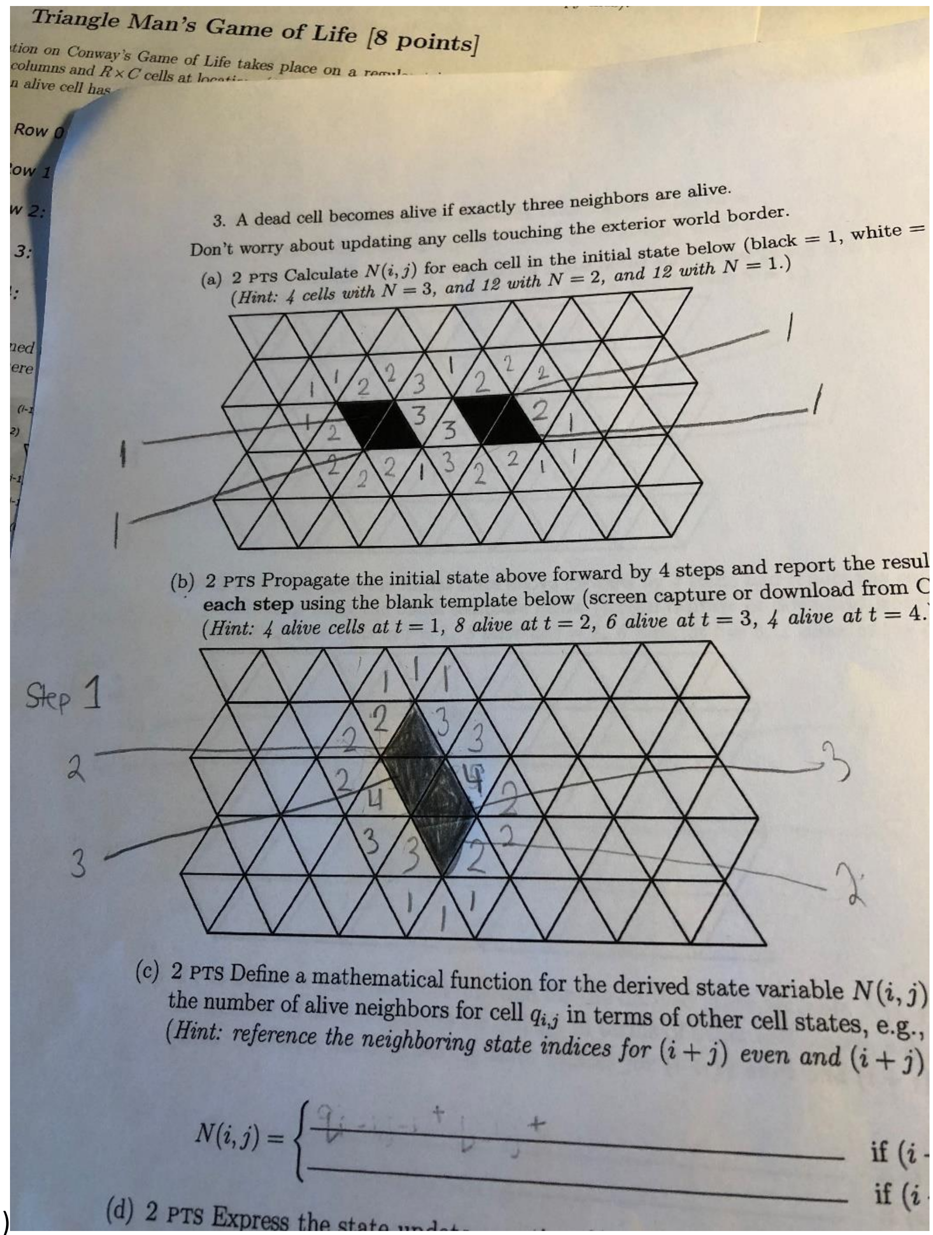
Grace Miguel

October 18, 2021

Homework 4

4.1



Triangle Man's Game of Life [8 points]

3. A dead cell becomes alive if exactly three neighbors are alive.

Don't worry about updating any cells touching the exterior world border.

(a) 2 PTS Calculate $N(i,j)$ for each cell in the initial state below (black = 1, white =
(*Hint: 4 cells with $N = 3$, and 12 with $N = 2$, and 12 with $N = 1$.*)

(b) 2 PTS Propagate the initial state above forward by 4 steps and report the resul
each step using the blank template below (screen capture or download from C
(*Hint: 4 alive cells at $t = 1$, 8 alive at $t = 2$, 6 alive at $t = 3$, 4 alive at $t = 4$.*

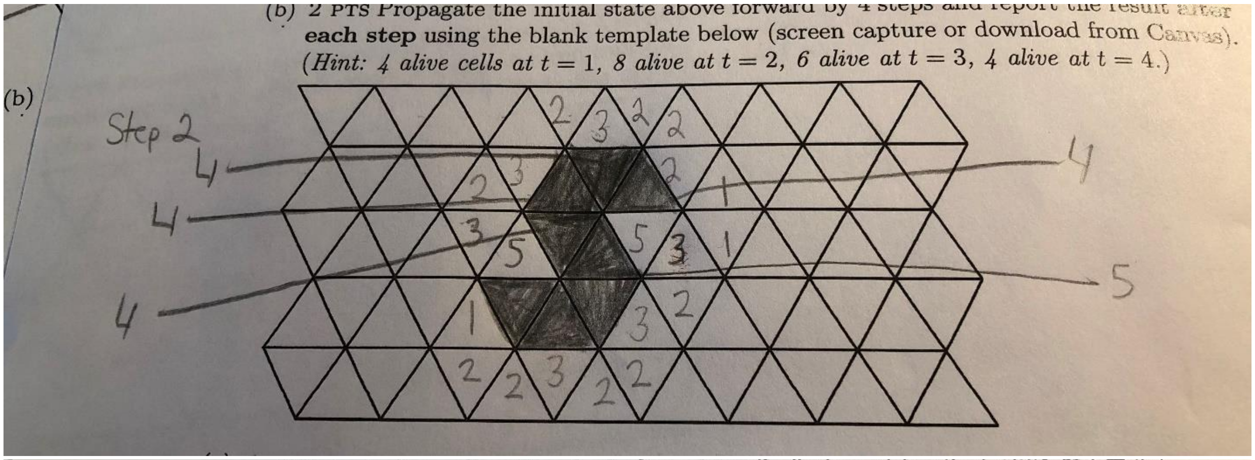
Step 1

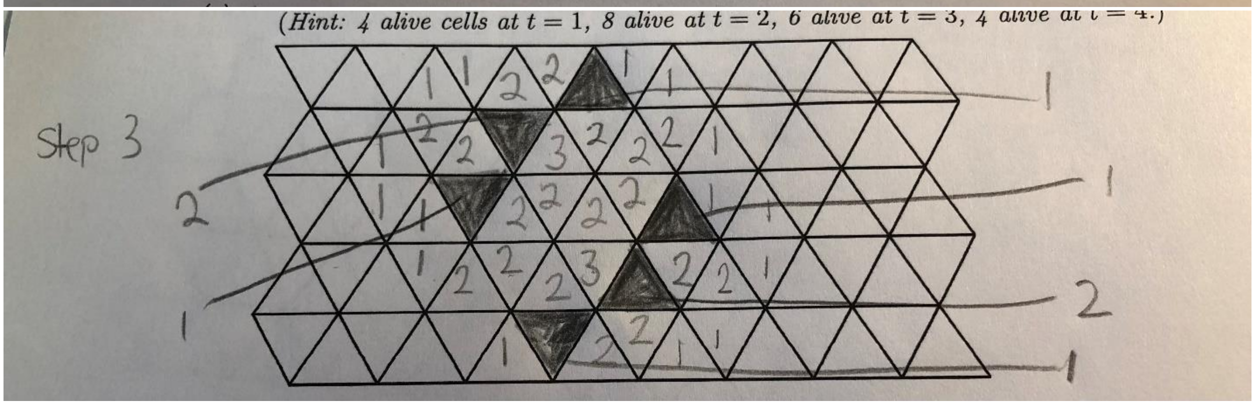
(c) 2 PTS Define a mathematical function for the derived state variable $N(i,j)$
the number of alive neighbors for cell $q_{i,j}$ in terms of other cell states, e.g.,
(*Hint: reference the neighboring state indices for $(i+j)$ even and $(i+j)$*

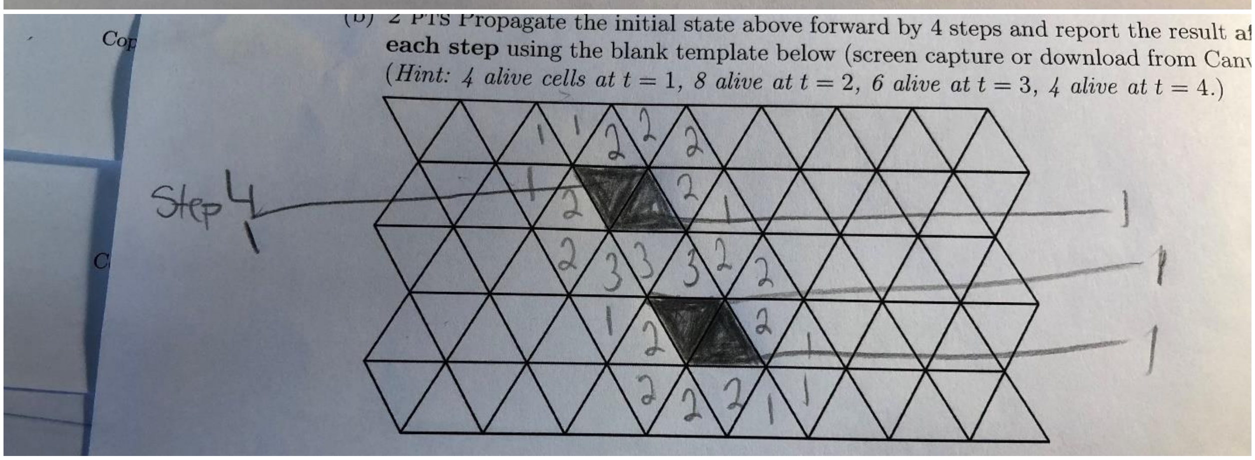
$N(i,j) = \begin{cases} \_\_\_\_\_\_ & \text{if } (i \\ \_\_\_\_\_\_ & \text{if } (i \end{cases}$

(d) 2 PTS Express the state upd

a)







c) $$N(i,j) = \begin{cases} q_{i-1,j-1} + q_{i-1,j+1} + q_{i-1,j-2} + q_{i-1,j} + q_{i-1,j+2} + q_{i,j-2} + q_{i-1,j+2} \\ \quad + q_{i,j-1} + q_{i-1,j+1} + q_{i+1,j-1} + q_{i+1,j+1} + q_{i+1,j} & \boldsymbol{if\ (i+j)\ even} \\ q_{i-1,j} + q_{i-1,j-1} + q_{i-1,j+1} + q_{i,j-1} + q_{i,j+1} + q_{i,j-2} + q_{i,j+2} \\ \quad + q_{i+1,j-2} + q_{i+1,j} + q_{i+1,j+2} + q_{i+1,j-1} + q_{i+1,j+1} & \boldsymbol{if\ (i+j) odd} \end{cases}$$

d) $$\delta(q_{i,j}) = \begin{cases} 1 \ if\ N(i,j) = 3\ or\ q_{i,j} = 1\ and\ N(i,j) = 2 \\ 0\ otherwise \end{cases}$$

4.2

(a) 2 pts Complete the output $\lambda(q)$ and state transition $\delta(q, x)$ values in the **transition/output table** below (*not a state trajectory table*) for a JK flip-flop.

$x(t)$		$q(t)$	$\lambda(q)$	$\delta(q, x)$
$j(t)$	$k(t)$			
0	0	0	0	0
0	0	1	1	1
0	1	0	0	0
0	1	1	1	O
1	0	0	0	1
1	0	1	1	1
1	1	0	0	1
1	1	1	1	O

(b) 3 pts Simulate the **state and output trajectories** $q(t)$ and $y(t)$ for the followinginput trajectory $x(t) = (j(t), k(t))$ for $0 \le t \le 9$ with initial state $q(0) = 0$.

t:	0	1	2	3	4	5	6	7	8	9
$j(t)$:	0	1	0	1	1	0	0	1	0	0
$k(t)$:	1	0	1	1	1	0	1	0	1	0
$q(t)$:	0 0	1	1	1	1	0	0	1	1	
$y(t)$:	0	0	1	1	1	1	0	0	1	1

4.3

a)

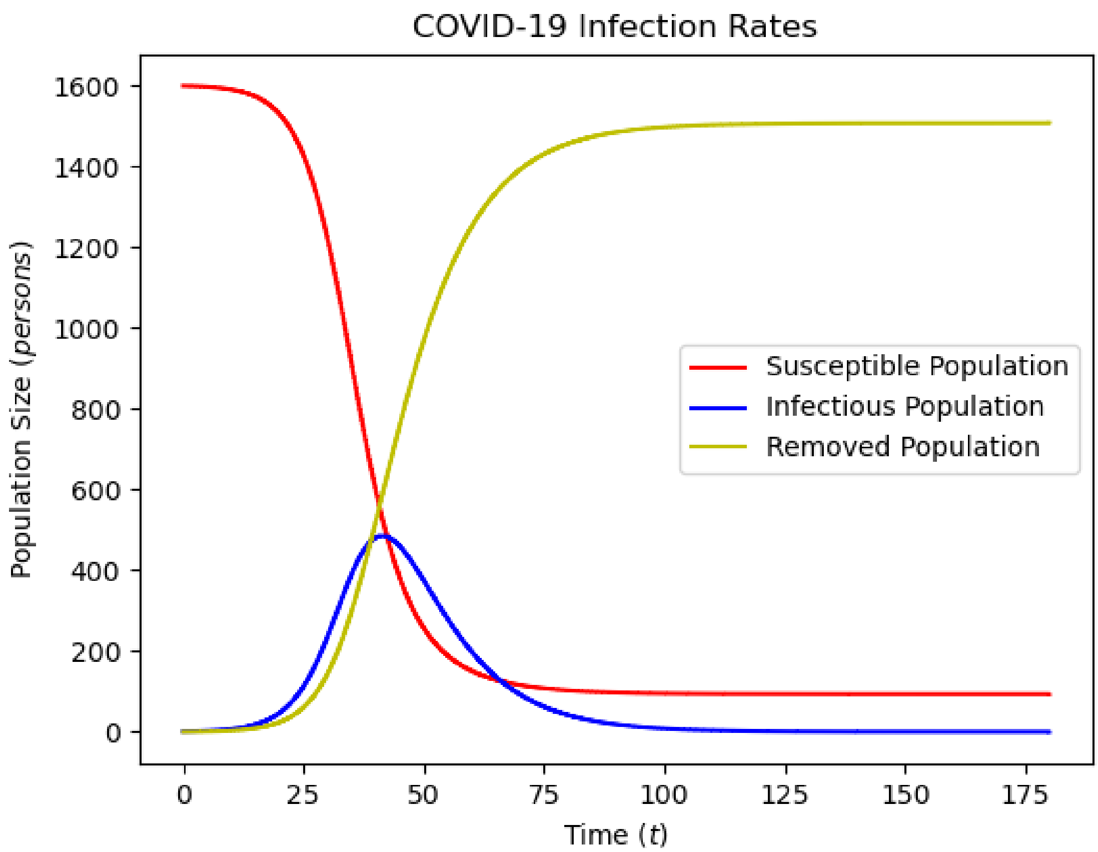
$\delta\left(S, \frac{dS}{dt}\ delta(t)\right)$= S(t) +Δt*dS/dt

$\delta\left(I, \frac{dI}{dt}\ delta(t)\right)$= I(t) + Δt*dI/dt

$\delta\left(R, \frac{dR}{dt}\ delta(t)\right)$= R(t) + Δt*dR/dt

b) $R = \frac{\beta}{\gamma}$ $\beta = R * \gamma = 3 * 10 = 30$

c)



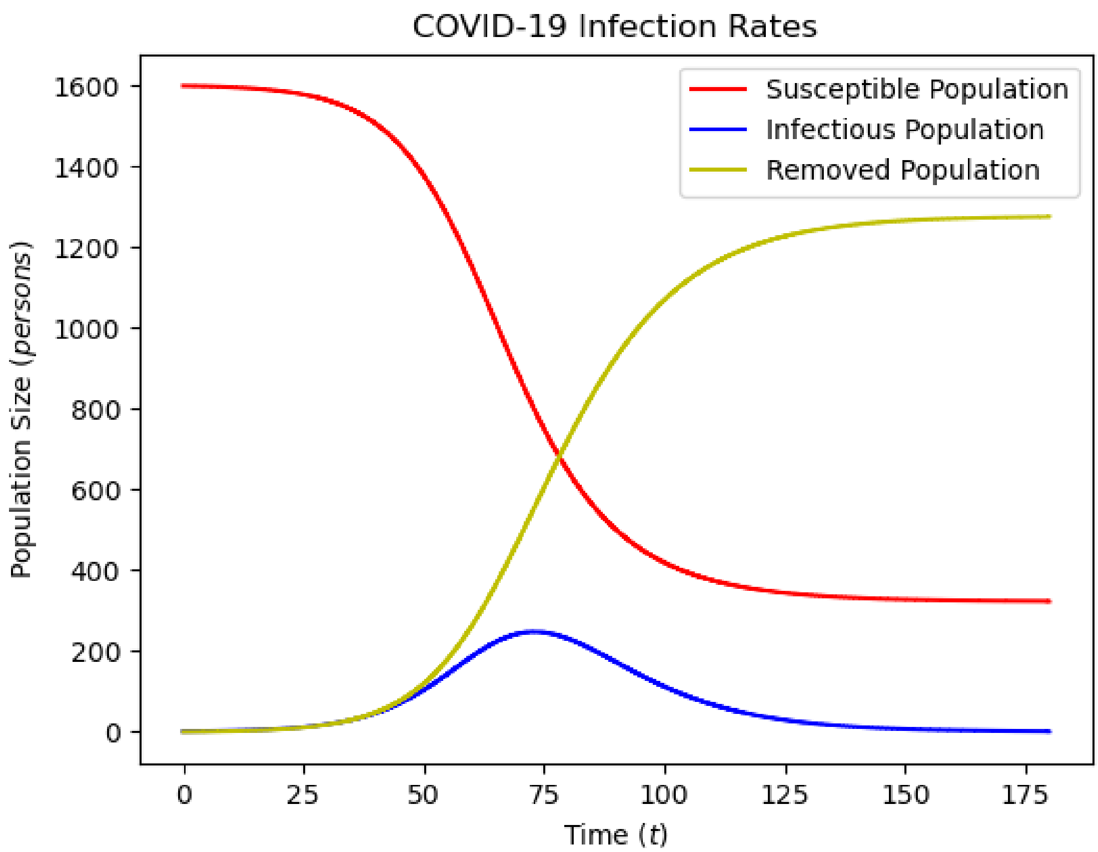
d) Maximum Infected People are: 484.783 at 41.2 days

e) Total Removed is approximately 1506 so 2% of that is **30.1 people dead**

f)

i)R = 2

ii)



iii) Day 73 was the peak day of infections and 247 people where infected.

iv) **25.5 people died**

I pledge my honor that I've abided by the Stevens Honor System.