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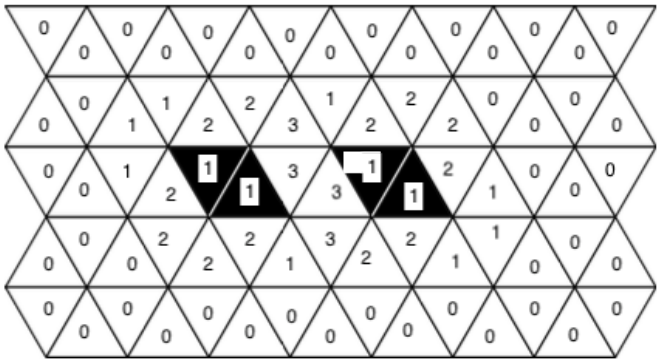
SYS 611

Homework #4

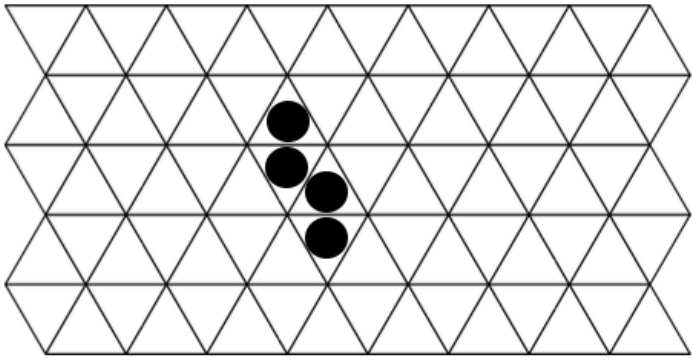
4.1 Triangle Man's Game of Life

a.

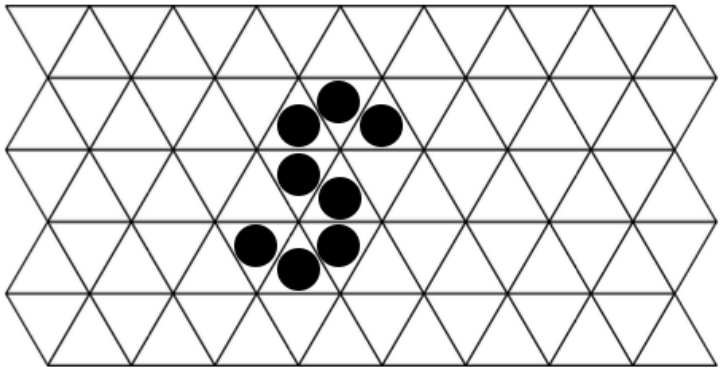


b.

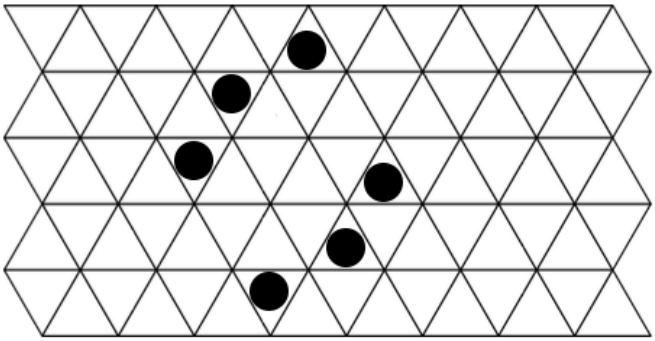
T=1:



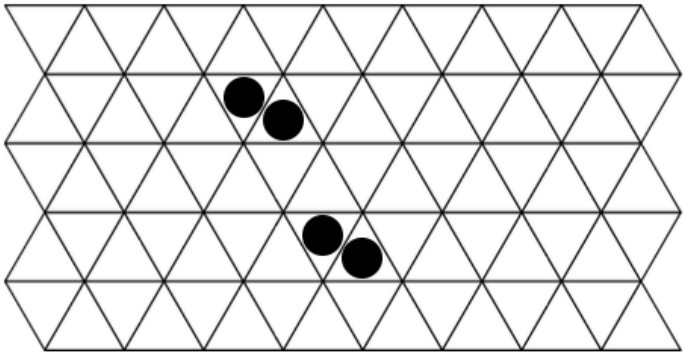
T=2:



T=3:



T=4:



c.

If (i+j) even

$$N(i,j) = q_{(i-1,j-2)} + q_{(i-1,j-1)} + q_{(i-1,j)} + q_{(i-1,j+1)} + q_{(i,j+2)} + q_{(i,j-2)} + q_{(i,j-1)} + q_{(i,j+1)} + q_{(i,j+2)} + q_{(i+1,j-1)} + q_{(i+1,j)} + a_{(i+1,j+1)}$$

If (i+j) odd

$$N(i,j) = q_{(i-1,j-1)} + q_{(i-1,j)} + q_{(i-1,j+1)} + q_{(i,j-2)} + q_{(i,j-1)} + q_{(i,j+1)} + q_{(i,j+2)} + q_{(i+1,j-2)} + q_{(i+1,j-1)} + q_{(i+1,j)} + q_{(i+1,j+1)} + a_{(i+1,j+2)}$$

d.

$$\delta(q_{i,j}) = 1 \qquad if\ N(i,j) = 3\ or\ (q_{i,j} = 1\ and\ N(i,j) = 2)$$

$$\delta(q_{i,j}) = 0 \qquad otherwise$$

4.2 Simulating a JK Flip-Flop

a.

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	0
1	0	0	0	1
1	0	1	1	1
1	1	0	0	1
1	1	1	1	0

b.

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	0	1	0	0	0	1	0
y(t)	0	0	1	0	1	0	0	0	1	0

4.3 Modeling Covid 19

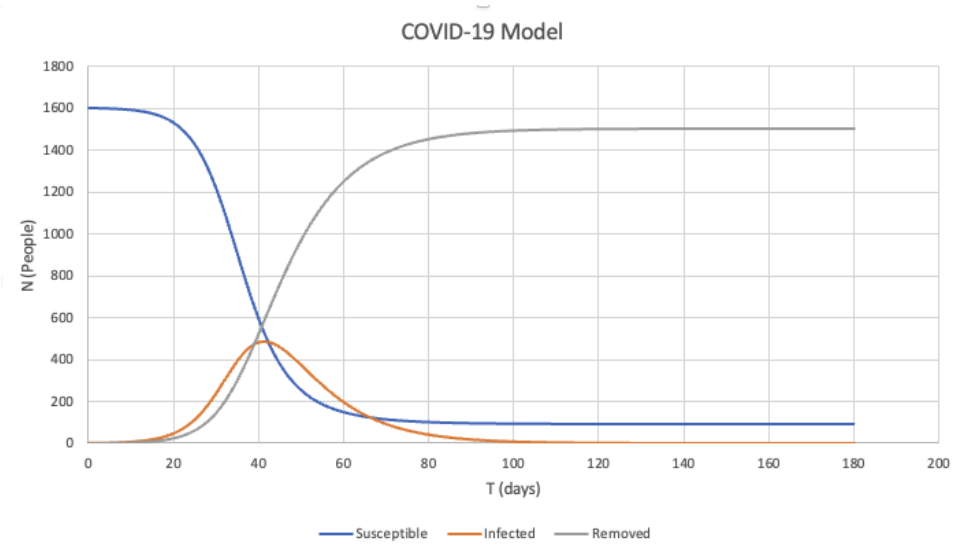
a.

$\delta(S, dS/dt, \Delta t) = S(t) + \Delta t * dS/dt$
$\delta(I, dI/dt, \Delta t) = I(t) + \Delta t * dI/dt$
$\delta(R, dR/dt, \Delta t) = R(t) + \Delta t * dR/dt$

b.

$\beta/\gamma = R_0 = 3$
$1/\gamma = 10 \dashrightarrow \gamma = 1/10$
$\beta/(1/10) = 3 \dashrightarrow \beta = 3/10$

c.



d.

Peak infected: 484.78 at t = 41.2 days

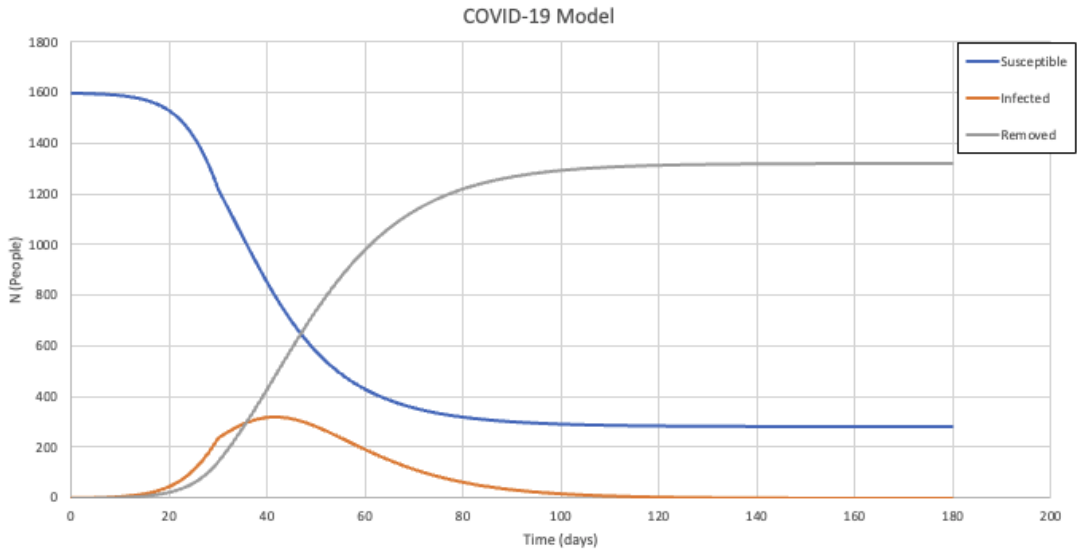
e.

$0.2 * 1506.77 = 30.135$ deaths

f.

i. $R_0 = \beta/\gamma = 0.2/0.1 = 2$

ii.



iii.

Peak infections: 320.743 at t = 41.6 days

iv.

$0.2 * 1321.49 = 26.43$ deaths