BIS LAB 07/11/2025

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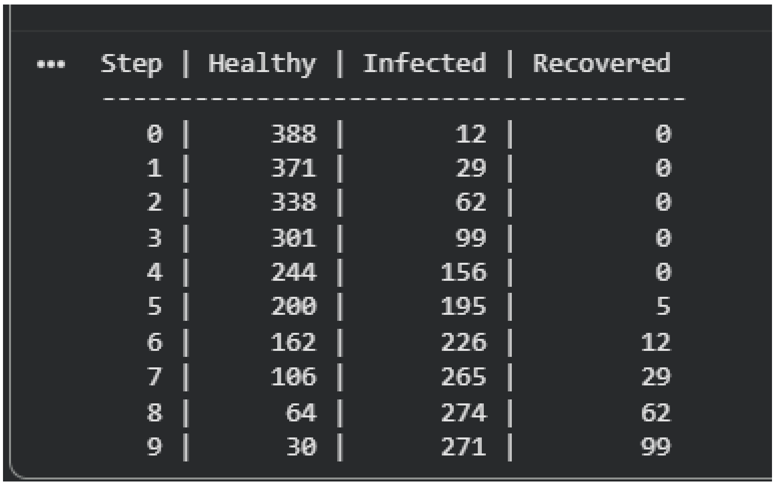
Code:

```
import numpy as np
N = 20
infection_prob = 0.25
infection_duration = 5
steps = 10

# States: 0 = healthy, 1 = infected, 2 = recovered
grid = np.zeros((N, N), dtype=int)
infection_time = np.zeros((N, N), dtype=int)

for _ in range(5):
    x, y = np.random.randint(0, N, 2)
    grid[x, y] = 1

print("Step | Healthy | Infected | Recovered")
print("--------------------------------------")

for step in range(steps):
    new_grid = grid.copy()

    for i in range(N):
        for j in range(N):
            if grid[i, j] == 0:  # Healthy
                for dx in [-1, 0, 1]:
                    for dy in [-1, 0, 1]:
                        if dx == 0 and dy == 0:
                            continue
                        ni, nj = (i + dx) % N, (j + dy) % N
                        if grid[ni, nj] == 1 and np.random.rand() < infection_prob:
                            new_grid[i, j] = 1
                            break
            elif grid[i, j] == 1:  # Infected
                infection_time[i, j] += 1
                if infection_time[i, j] > infection_duration:
                    new_grid[i, j] = 2  # Recover

    grid = new_grid

    healthy = np.count_nonzero(grid == 0)
    infected = np.count_nonzero(grid == 1)
    recovered = np.count_nonzero(grid == 2)

    print(f"{step:>4} | {healthy:>7} | {infected:>8} | {recovered:>9}")
```

OUTPUT:



```
Step | Healthy | Infected | Recovered
--------------------------------------
   0 |     388 |       12 |         0
   1 |     371 |       29 |         0
   2 |     338 |       62 |         0
   3 |     301 |       99 |         0
   4 |     244 |      156 |         0
   5 |     200 |      195 |         5
   6 |     162 |      226 |        12
   7 |     106 |      265 |        29
   8 |      64 |      274 |        62
   9 |      30 |      271 |        99
```