

Actividad M1: Modelando un sistema de robots limpiadores

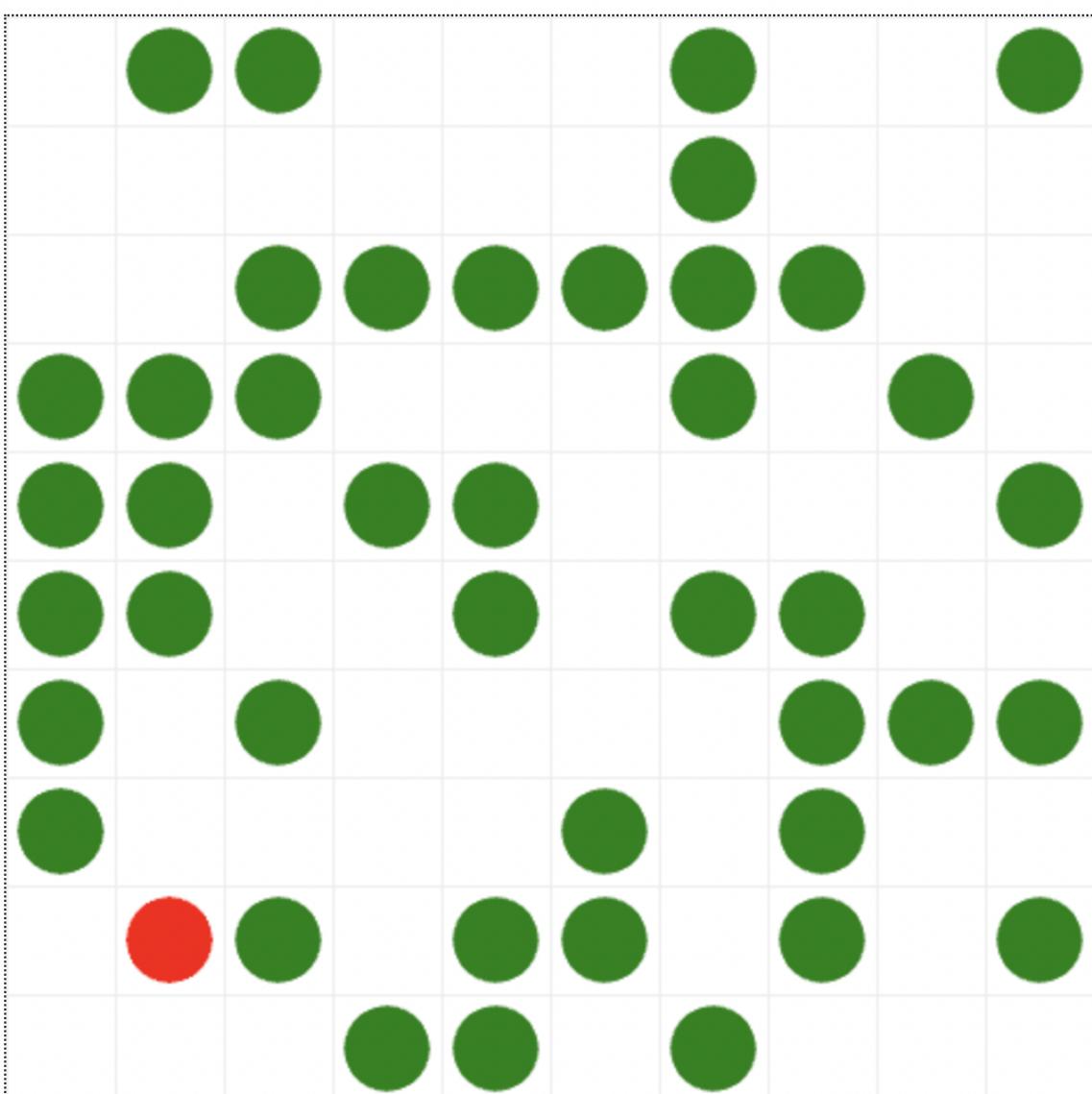
Datos iniciales del programa:

- Se utilizan 20 agentes, y 50% del tablero está sucio
- Correrá por un total de 25 pasos cada vez
- Todos los agentes comienzan en la celda [1, 1]

Estado inicial del tablero

Frames Per Second

Current Step: 0

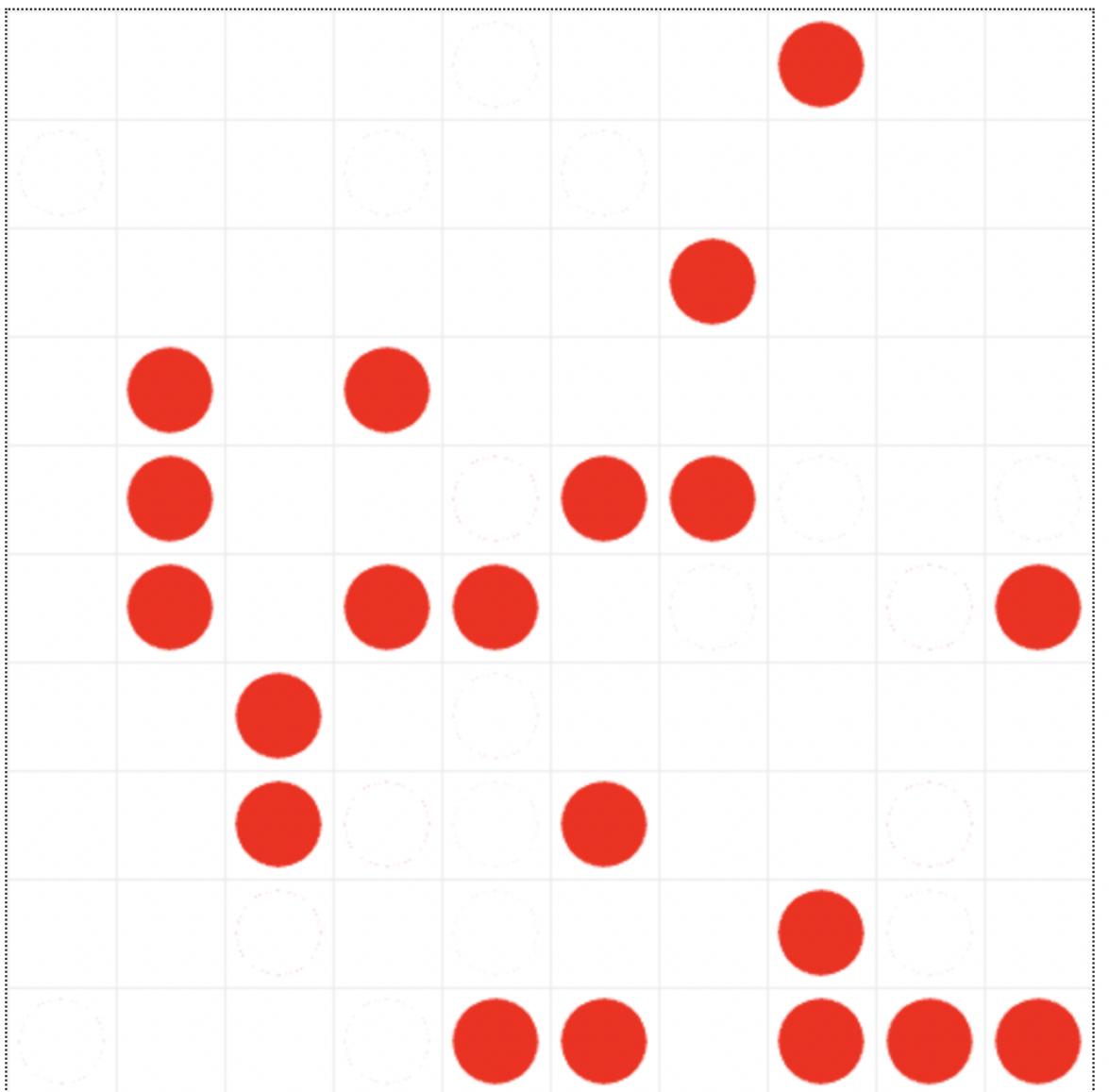


Se realizaron un total de 8 iteraciones del modelo con las condiciones establecidas anteriormente. A continuación se muestran los estados finales de cada iteración del modelo, el máximo permitido es de 26. Si se alcanza esta cifra y el tablero aún está sucio, se considera que el modelo no fue exitoso.

Estado final 1

Tablero limpio en 15 movimientos

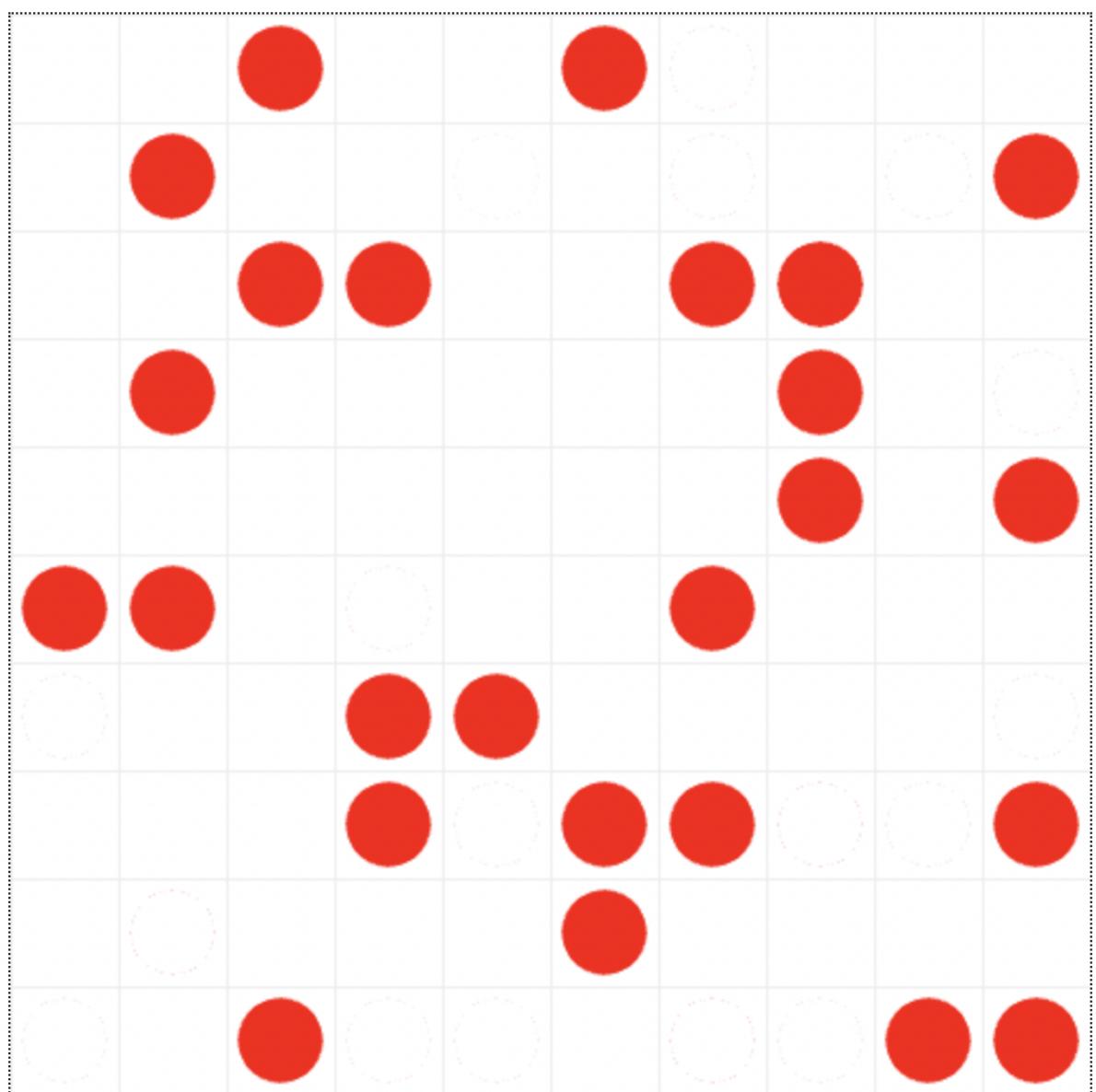
Current Step: 15



Estado final 2

Tablero Limpio en 14 movimientos

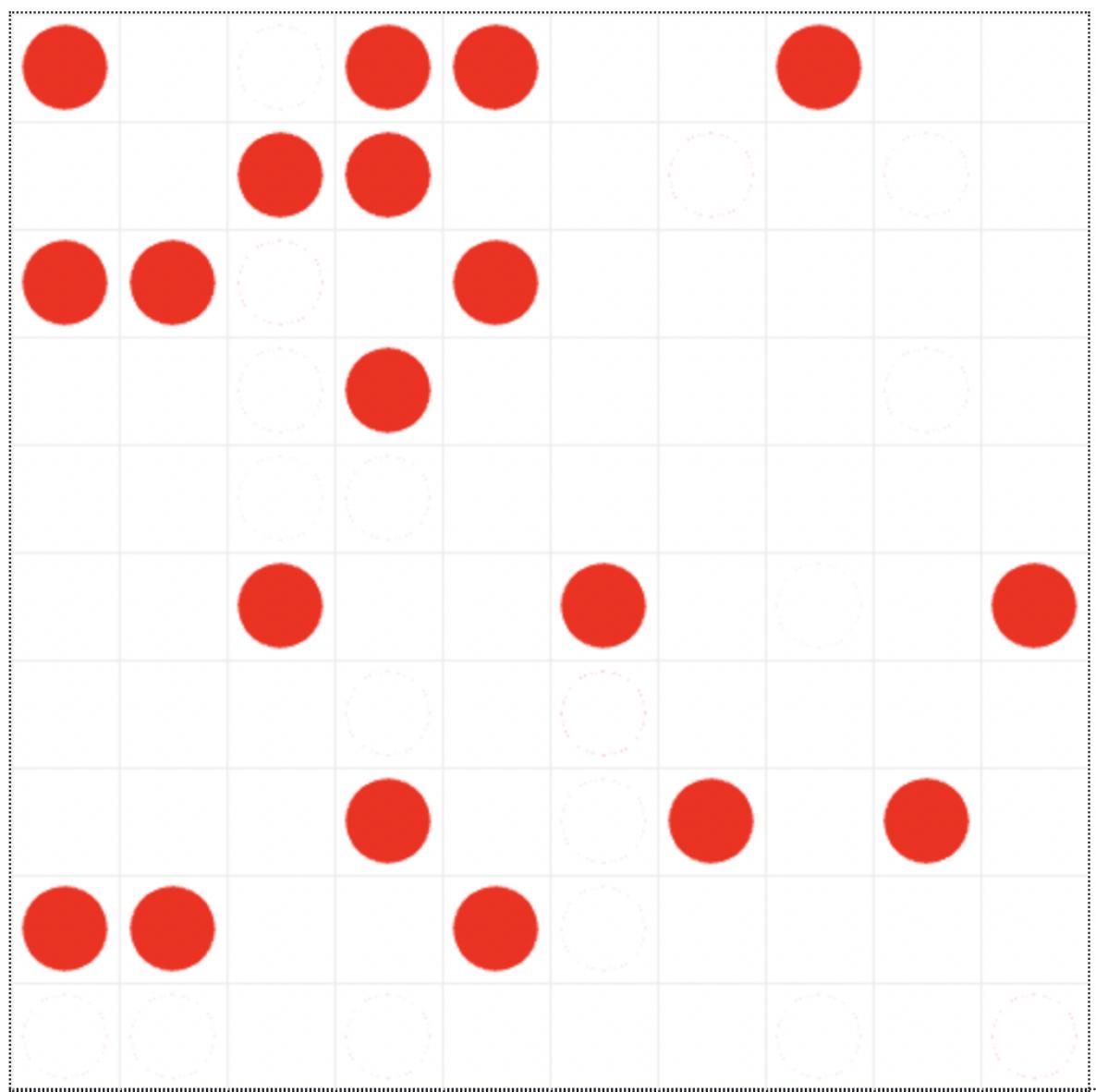
Current Step: 14



Estado final 3

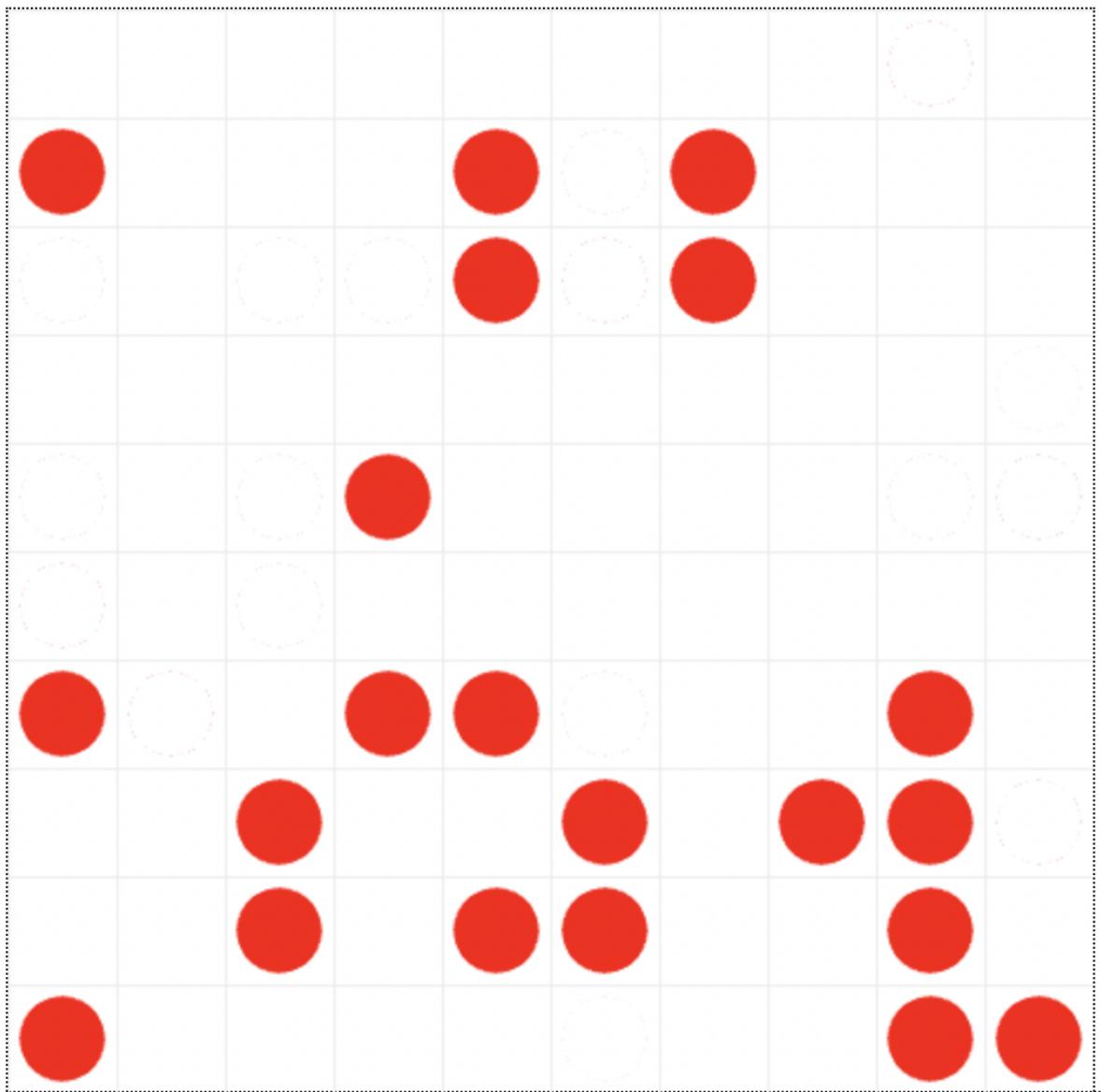
Tablero Limpio en 22 movimientos

Current Step: 22



Estado final 4
Tablero Limpio en 16 movimientos

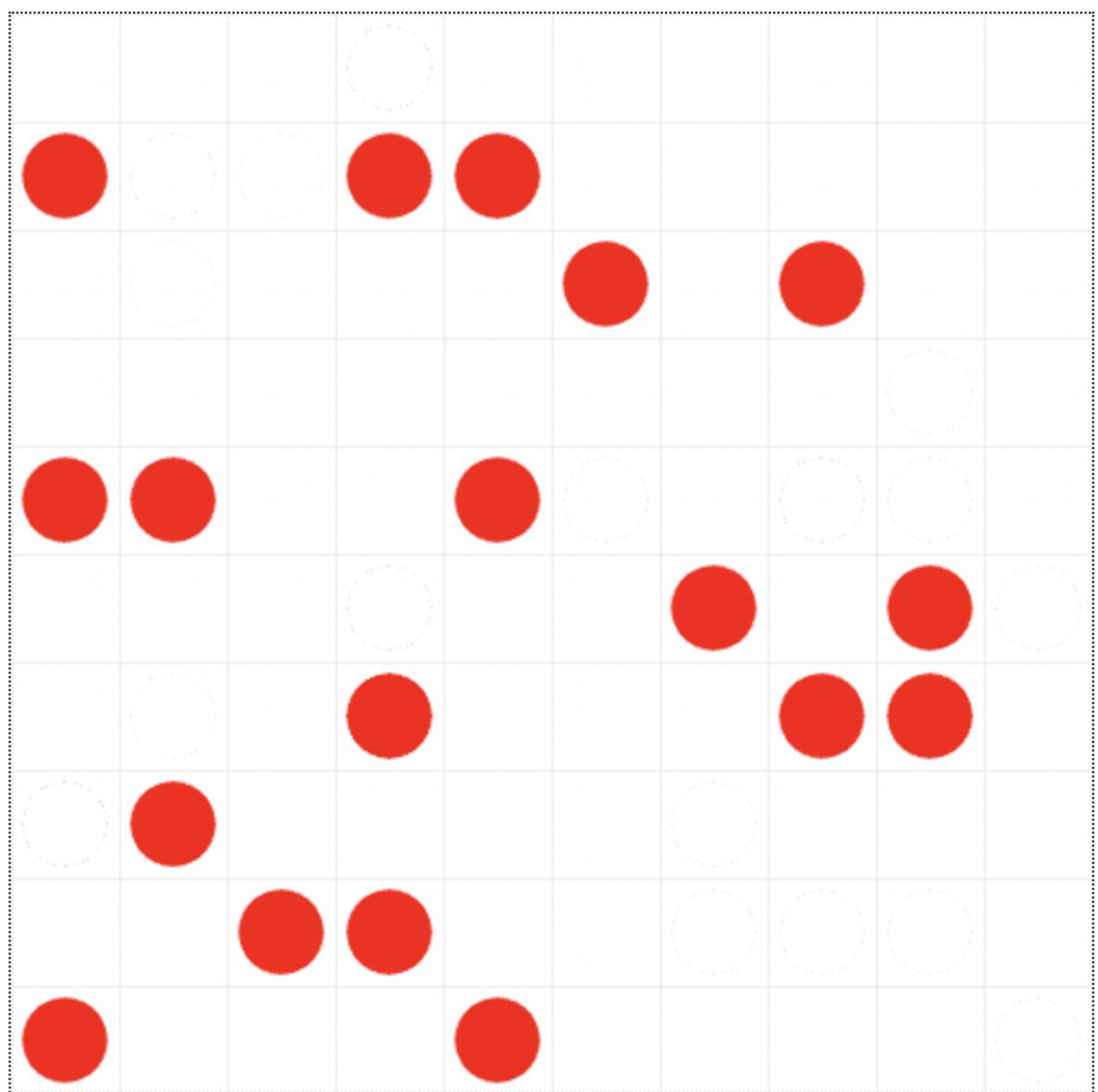
Current Step: 16



Estado final 5

Tablero limpio en 15 movimientos

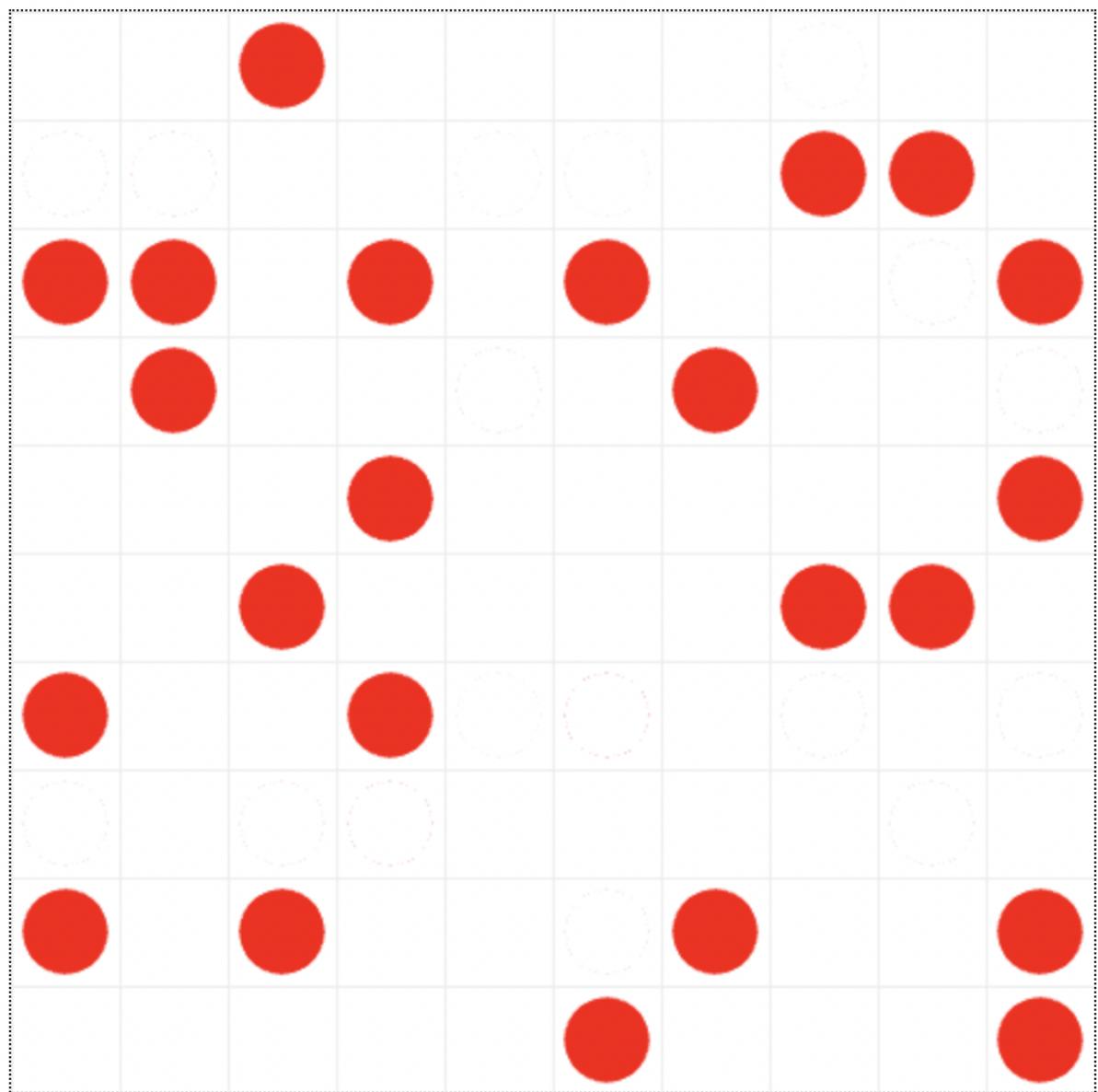
Current Step: 15



Estado final 6

Tablero limpio en 25 movimientos

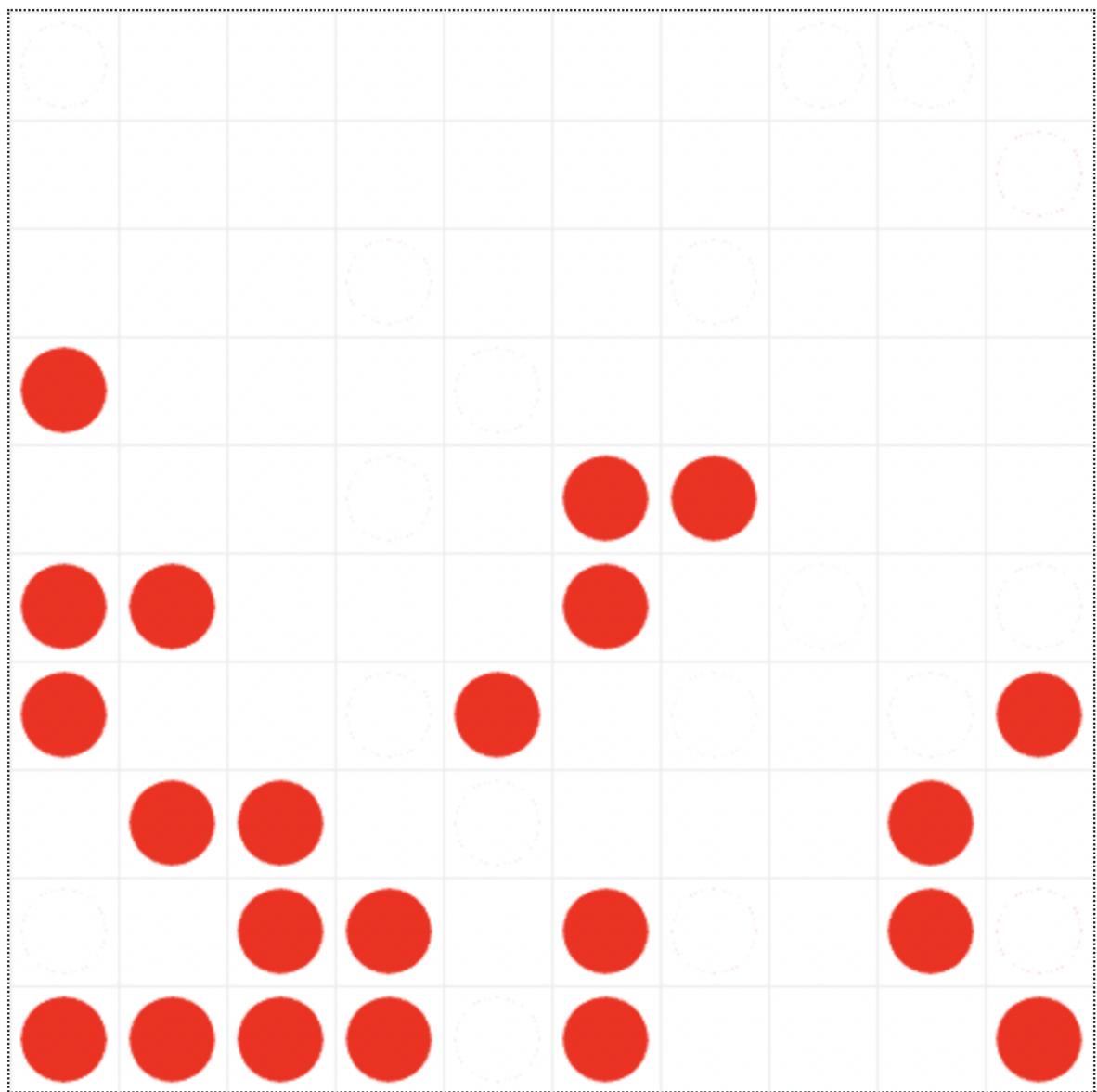
Current Step: 25



Estado final 7

Tablero Limpio en 23 movimientos

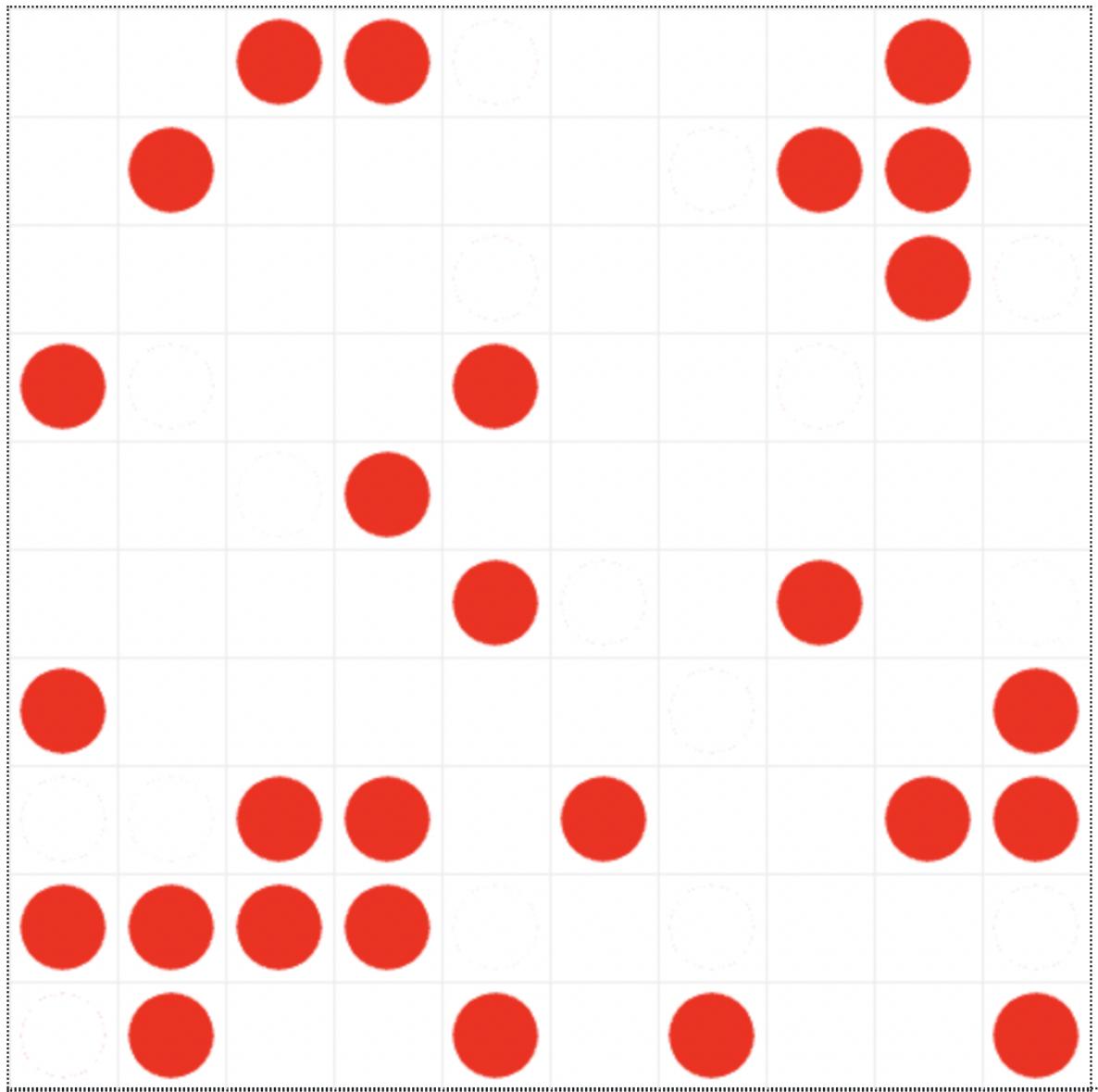
Current Step: 23



Estado final 8

Tablero Limpio en 15 movimientos

Current Step: 15



Para las iteraciones realizadas en el visualizador web, fue posible observar que en todas ellas los agentes fueron capaces de limpiar el tablero en una cantidad promedio de movimientos de 18.125 movimientos, con el tiempo más bajo siendo de 14 movimientos, y el más alto de exactamente 25.

La tasa de éxito tan alta que experimenta el modelo a pesar de ser completamente aleatorio se debe tanto a la cantidad de agentes que existen relativo a la cantidad de suciedad, como al tiempo que se le da al modelo de funcionar.

De la misma manera, es por esta variabilidad que es esencial realizar tantas ejecuciones del modelo, pues esto nos da una mejor idea de su efectividad y minimiza la probabilidad de que nuestra interpretación de los resultados que provee se vea afectada por una sola ejecución que pudiese no cumplir con los estándares establecidos.

A continuación, el modelo se ejecutó otras 8 veces bajo las mismas condiciones para observar cuántas celdas había limpiado cada agente al final de la ejecución.

```
Hi, I am agent 21 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 40 and i have moved 25 times, i have cleaned 1 cells.  
Hi, I am agent 41 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 25 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 42 and i have moved 25 times, i have cleaned 1 cells.  
Hi, I am agent 15 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 4 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 13 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 12 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 10 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 38 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 39 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 44 and i have moved 25 times, i have cleaned 3 cells.  
Hi, I am agent 31 and i have moved 25 times, i have cleaned 2 cells.  
Hi, I am agent 35 and i have moved 25 times, i have cleaned 1 cells.  
Hi, I am agent 2 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 17 and i have moved 25 times, i have cleaned 5 cells.  
Hi, I am agent 45 and i have moved 25 times, i have cleaned 1 cells.  
Hi, I am agent 9 and i have moved 25 times, i have cleaned 4 cells.  
Hi, I am agent 47 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 46 and i have moved 25 times, i have cleaned 2 cells.  
Hi, I am agent 11 and i have moved 25 times, i have cleaned 5 cells.  
Hi, I am agent 43 and i have moved 25 times, i have cleaned 2 cells.  
Hi, I am agent 8 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 1 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 30 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 37 and i have moved 25 times, i have cleaned 3 cells.  
Hi, I am agent 32 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 5 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 49 and i have moved 25 times, i have cleaned 1 cells.  
Hi, I am agent 3 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 33 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 18 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 0 and i have moved 25 times, i have cleaned 4 cells.  
Hi, I am agent 16 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 34 and i have moved 25 times, i have cleaned 1 cells.  
Hi, I am agent 29 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 23 and i have moved 25 times, i have cleaned 1 cells.  
Hi, I am agent 26 and i have moved 25 times, i have cleaned 1 cells.  
Hi, I am agent 24 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 48 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 28 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 36 and i have moved 25 times, i have cleaned 4 cells.  
Hi, I am agent 7 and i have moved 25 times, i have cleaned 4 cells.  
Hi, I am agent 19 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 20 and i have moved 25 times, i have cleaned 3 cells.  
Hi, I am agent 22 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 27 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 14 and i have moved 25 times, i have cleaned 1 cells.  
Interface starting at http://127.0.0.1:8521  
Socket opened!  
{"type":"reset"}  
[]
```



```
Hi, I am agent 49 and i have moved 25 times, i have cleaned 1 cells.  
Hi, I am agent 46 and i have moved 25 times, i have cleaned 1 cells.  
Hi, I am agent 48 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 40 and i have moved 25 times, i have cleaned 4 cells.  
Hi, I am agent 26 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 28 and i have moved 25 times, i have cleaned 1 cells.  
Hi, I am agent 42 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 17 and i have moved 25 times, i have cleaned 3 cells.  
Hi, I am agent 21 and i have moved 25 times, i have cleaned 1 cells.  
Hi, I am agent 4 and i have moved 25 times, i have cleaned 3 cells.  
Hi, I am agent 6 and i have moved 25 times, i have cleaned 1 cells.  
Hi, I am agent 39 and i have moved 25 times, i have cleaned 2 cells.  
Hi, I am agent 33 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 18 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 7 and i have moved 25 times, i have cleaned 2 cells.  
Hi, I am agent 37 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 3 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 1 and i have moved 25 times, i have cleaned 3 cells.  
Hi, I am agent 31 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 29 and i have moved 25 times, i have cleaned 1 cells.  
Hi, I am agent 35 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 5 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 2 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 11 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 14 and i have moved 25 times, i have cleaned 2 cells.  
Hi, I am agent 45 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 19 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 20 and i have moved 25 times, i have cleaned 1 cells.  
Hi, I am agent 8 and i have moved 25 times, i have cleaned 3 cells.  
Hi, I am agent 32 and i have moved 25 times, i have cleaned 1 cells.  
Hi, I am agent 13 and i have moved 25 times, i have cleaned 2 cells.  
Hi, I am agent 36 and i have moved 25 times, i have cleaned 2 cells.  
Hi, I am agent 43 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 38 and i have moved 25 times, i have cleaned 2 cells.  
Hi, I am agent 30 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 0 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 41 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 47 and i have moved 25 times, i have cleaned 4 cells.  
Hi, I am agent 9 and i have moved 25 times, i have cleaned 1 cells.  
Hi, I am agent 10 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 23 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 12 and i have moved 25 times, i have cleaned 1 cells.  
Hi, I am agent 24 and i have moved 25 times, i have cleaned 3 cells.  
Hi, I am agent 44 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 22 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 27 and i have moved 25 times, i have cleaned 1 cells.  
Hi, I am agent 15 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 25 and i have moved 25 times, i have cleaned 1 cells.  
Hi, I am agent 34 and i have moved 25 times, i have cleaned 1 cells.  
Hi, I am agent 16 and i have moved 25 times, i have cleaned 2 cells.  
Interface starting at http://127.0.0.1:8521  
Socket opened!
```

```
Hi, I am agent 39 and i have moved 25 times, i have cleaned 2 cells.  
Hi, I am agent 17 and i have moved 25 times, i have cleaned 4 cells.  
Hi, I am agent 14 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 40 and i have moved 25 times, i have cleaned 1 cells.  
Hi, I am agent 27 and i have moved 25 times, i have cleaned 1 cells.  
Hi, I am agent 31 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 9 and i have moved 25 times, i have cleaned 1 cells.  
Hi, I am agent 28 and i have moved 25 times, i have cleaned 2 cells.  
Hi, I am agent 16 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 34 and i have moved 25 times, i have cleaned 3 cells.  
Hi, I am agent 11 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 49 and i have moved 25 times, i have cleaned 1 cells.  
Hi, I am agent 45 and i have moved 25 times, i have cleaned 1 cells.  
Hi, I am agent 10 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 37 and i have moved 25 times, i have cleaned 1 cells.  
Hi, I am agent 12 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 1 and i have moved 25 times, i have cleaned 1 cells.  
Hi, I am agent 41 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 22 and i have moved 25 times, i have cleaned 2 cells.  
Hi, I am agent 20 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 46 and i have moved 25 times, i have cleaned 3 cells.  
Hi, I am agent 5 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 26 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 30 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 35 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 15 and i have moved 25 times, i have cleaned 2 cells.  
Hi, I am agent 6 and i have moved 25 times, i have cleaned 5 cells.  
Hi, I am agent 42 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 47 and i have moved 25 times, i have cleaned 3 cells.  
Hi, I am agent 3 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 36 and i have moved 25 times, i have cleaned 1 cells.  
Hi, I am agent 29 and i have moved 25 times, i have cleaned 3 cells.  
Hi, I am agent 44 and i have moved 25 times, i have cleaned 1 cells.  
Hi, I am agent 8 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 33 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 21 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 32 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 43 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 25 and i have moved 25 times, i have cleaned 1 cells.  
Hi, I am agent 0 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 23 and i have moved 25 times, i have cleaned 2 cells.  
Hi, I am agent 19 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 2 and i have moved 25 times, i have cleaned 1 cells.  
Hi, I am agent 4 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 38 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 7 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 24 and i have moved 25 times, i have cleaned 5 cells.  
Hi, I am agent 13 and i have moved 25 times, i have cleaned 1 cells.  
Hi, I am agent 18 and i have moved 25 times, i have cleaned 2 cells.  
Hi, I am agent 48 and i have moved 25 times, i have cleaned 0 cells.  
Interface starting at http://127.0.0.1:8521  
Socket opened!  
{"type":"reset"}  
██████████
```

```
Hi, I am agent 3 and i have moved 25 times, i have cleaned 1 cells.  
Hi, I am agent 9 and i have moved 25 times, i have cleaned 1 cells.  
Hi, I am agent 10 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 19 and i have moved 25 times, i have cleaned 2 cells.  
Hi, I am agent 43 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 8 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 4 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 11 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 26 and i have moved 25 times, i have cleaned 1 cells.  
Hi, I am agent 40 and i have moved 25 times, i have cleaned 1 cells.  
Hi, I am agent 42 and i have moved 25 times, i have cleaned 2 cells.  
Hi, I am agent 33 and i have moved 25 times, i have cleaned 6 cells.  
Hi, I am agent 28 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 7 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 18 and i have moved 25 times, i have cleaned 1 cells.  
Hi, I am agent 35 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 6 and i have moved 25 times, i have cleaned 1 cells.  
Hi, I am agent 41 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 5 and i have moved 25 times, i have cleaned 3 cells.  
Hi, I am agent 23 and i have moved 25 times, i have cleaned 2 cells.  
Hi, I am agent 48 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 20 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 30 and i have moved 25 times, i have cleaned 2 cells.  
Hi, I am agent 0 and i have moved 25 times, i have cleaned 2 cells.  
Hi, I am agent 45 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 29 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 39 and i have moved 25 times, i have cleaned 2 cells.  
Hi, I am agent 36 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 13 and i have moved 25 times, i have cleaned 2 cells.  
Hi, I am agent 24 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 21 and i have moved 25 times, i have cleaned 2 cells.  
Hi, I am agent 22 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 12 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 2 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 44 and i have moved 25 times, i have cleaned 2 cells.  
Hi, I am agent 47 and i have moved 25 times, i have cleaned 3 cells.  
Hi, I am agent 37 and i have moved 25 times, i have cleaned 4 cells.  
Hi, I am agent 46 and i have moved 25 times, i have cleaned 3 cells.  
Hi, I am agent 25 and i have moved 25 times, i have cleaned 2 cells.  
Hi, I am agent 38 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 16 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 31 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 34 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 15 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 1 and i have moved 25 times, i have cleaned 3 cells.  
Hi, I am agent 27 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 49 and i have moved 25 times, i have cleaned 1 cells.  
Hi, I am agent 32 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 17 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 14 and i have moved 25 times, i have cleaned 1 cells.  
Interface starting at http://127.0.0.1:8521  
Socket opened!  
{"type":"reset"}
```

```
Hi, I am agent 36 and i have moved 25 times, i have cleaned 1 cells.  
Hi, I am agent 47 and i have moved 25 times, i have cleaned 1 cells.  
Hi, I am agent 10 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 19 and i have moved 25 times, i have cleaned 2 cells.  
Hi, I am agent 24 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 28 and i have moved 25 times, i have cleaned 2 cells.  
Hi, I am agent 42 and i have moved 25 times, i have cleaned 4 cells.  
Hi, I am agent 45 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 20 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 30 and i have moved 25 times, i have cleaned 2 cells.  
Hi, I am agent 41 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 40 and i have moved 25 times, i have cleaned 1 cells.  
Hi, I am agent 38 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 0 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 32 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 1 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 15 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 48 and i have moved 25 times, i have cleaned 1 cells.  
Hi, I am agent 27 and i have moved 25 times, i have cleaned 1 cells.  
Hi, I am agent 49 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 23 and i have moved 25 times, i have cleaned 2 cells.  
Hi, I am agent 2 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 3 and i have moved 25 times, i have cleaned 1 cells.  
Hi, I am agent 12 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 4 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 22 and i have moved 25 times, i have cleaned 2 cells.  
Hi, I am agent 17 and i have moved 25 times, i have cleaned 1 cells.  
Hi, I am agent 37 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 35 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 25 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 34 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 39 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 8 and i have moved 25 times, i have cleaned 1 cells.  
Hi, I am agent 6 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 9 and i have moved 25 times, i have cleaned 1 cells.  
Hi, I am agent 5 and i have moved 25 times, i have cleaned 6 cells.  
Hi, I am agent 43 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 13 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 18 and i have moved 25 times, i have cleaned 1 cells.  
Hi, I am agent 26 and i have moved 25 times, i have cleaned 2 cells.  
Hi, I am agent 21 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 31 and i have moved 25 times, i have cleaned 2 cells.  
Hi, I am agent 33 and i have moved 25 times, i have cleaned 1 cells.  
Hi, I am agent 7 and i have moved 25 times, i have cleaned 2 cells.  
Hi, I am agent 16 and i have moved 25 times, i have cleaned 2 cells.  
Hi, I am agent 11 and i have moved 25 times, i have cleaned 3 cells.  
Hi, I am agent 29 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 44 and i have moved 25 times, i have cleaned 5 cells.  
Hi, I am agent 14 and i have moved 25 times, i have cleaned 1 cells.  
Hi, I am agent 46 and i have moved 25 times, i have cleaned 2 cells.  
Interface starting at http://127.0.0.1:8521  
Socket opened!  
{"type":"reset"}
```

```
Hi, I am agent 28 and i have moved 25 times, i have cleaned 1 cells.  
Hi, I am agent 14 and i have moved 25 times, i have cleaned 1 cells.  
Hi, I am agent 22 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 30 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 36 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 19 and i have moved 25 times, i have cleaned 1 cells.  
Hi, I am agent 16 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 20 and i have moved 25 times, i have cleaned 2 cells.  
Hi, I am agent 44 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 17 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 48 and i have moved 25 times, i have cleaned 1 cells.  
Hi, I am agent 35 and i have moved 25 times, i have cleaned 1 cells.  
Hi, I am agent 12 and i have moved 25 times, i have cleaned 6 cells.  
Hi, I am agent 0 and i have moved 25 times, i have cleaned 3 cells.  
Hi, I am agent 4 and i have moved 25 times, i have cleaned 5 cells.  
Hi, I am agent 26 and i have moved 25 times, i have cleaned 2 cells.  
Hi, I am agent 34 and i have moved 25 times, i have cleaned 1 cells.  
Hi, I am agent 21 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 9 and i have moved 25 times, i have cleaned 1 cells.  
Hi, I am agent 1 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 42 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 49 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 32 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 2 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 15 and i have moved 25 times, i have cleaned 2 cells.  
Hi, I am agent 39 and i have moved 25 times, i have cleaned 2 cells.  
Hi, I am agent 37 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 38 and i have moved 25 times, i have cleaned 2 cells.  
Hi, I am agent 43 and i have moved 25 times, i have cleaned 1 cells.  
Hi, I am agent 24 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 25 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 6 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 40 and i have moved 25 times, i have cleaned 2 cells.  
Hi, I am agent 7 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 27 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 8 and i have moved 25 times, i have cleaned 2 cells.  
Hi, I am agent 46 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 41 and i have moved 25 times, i have cleaned 1 cells.  
Hi, I am agent 13 and i have moved 25 times, i have cleaned 2 cells.  
Hi, I am agent 23 and i have moved 25 times, i have cleaned 1 cells.  
Hi, I am agent 3 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 47 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 18 and i have moved 25 times, i have cleaned 3 cells.  
Hi, I am agent 10 and i have moved 25 times, i have cleaned 3 cells.  
Hi, I am agent 11 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 5 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 33 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 29 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 45 and i have moved 25 times, i have cleaned 4 cells.  
Hi, I am agent 31 and i have moved 25 times, i have cleaned 0 cells.  
Interface starting at http://127.0.0.1:8521  
Socket opened!  
{"type":"reset"}
```

```
Hi, I am agent 27 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 48 and i have moved 25 times, i have cleaned 3 cells.  
Hi, I am agent 13 and i have moved 25 times, i have cleaned 2 cells.  
Hi, I am agent 47 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 30 and i have moved 25 times, i have cleaned 1 cells.  
Hi, I am agent 33 and i have moved 25 times, i have cleaned 2 cells.  
Hi, I am agent 11 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 2 and i have moved 25 times, i have cleaned 2 cells.  
Hi, I am agent 14 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 39 and i have moved 25 times, i have cleaned 1 cells.  
Hi, I am agent 28 and i have moved 25 times, i have cleaned 1 cells.  
Hi, I am agent 5 and i have moved 25 times, i have cleaned 1 cells.  
Hi, I am agent 20 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 35 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 41 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 38 and i have moved 25 times, i have cleaned 1 cells.  
Hi, I am agent 15 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 43 and i have moved 25 times, i have cleaned 2 cells.  
Hi, I am agent 34 and i have moved 25 times, i have cleaned 2 cells.  
Hi, I am agent 25 and i have moved 25 times, i have cleaned 1 cells.  
Hi, I am agent 3 and i have moved 25 times, i have cleaned 1 cells.  
Hi, I am agent 6 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 49 and i have moved 25 times, i have cleaned 1 cells.  
Hi, I am agent 37 and i have moved 25 times, i have cleaned 3 cells.  
Hi, I am agent 29 and i have moved 25 times, i have cleaned 3 cells.  
Hi, I am agent 0 and i have moved 25 times, i have cleaned 1 cells.  
Hi, I am agent 46 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 40 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 26 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 1 and i have moved 25 times, i have cleaned 2 cells.  
Hi, I am agent 8 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 16 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 22 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 18 and i have moved 25 times, i have cleaned 1 cells.  
Hi, I am agent 21 and i have moved 25 times, i have cleaned 1 cells.  
Hi, I am agent 36 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 10 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 24 and i have moved 25 times, i have cleaned 1 cells.  
Hi, I am agent 44 and i have moved 25 times, i have cleaned 3 cells.  
Hi, I am agent 42 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 19 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 7 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 31 and i have moved 25 times, i have cleaned 2 cells.  
Hi, I am agent 32 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 4 and i have moved 25 times, i have cleaned 3 cells.  
Hi, I am agent 17 and i have moved 25 times, i have cleaned 5 cells.  
Hi, I am agent 9 and i have moved 25 times, i have cleaned 1 cells.  
Hi, I am agent 23 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 45 and i have moved 25 times, i have cleaned 0 cells.  
Hi, I am agent 12 and i have moved 25 times, i have cleaned 3 cells.  
Interface starting at http://127.0.0.1:8521  
Socket opened!  
{ "type": "reset"}
```

Cabe destacar por los resultados obtenidos que más de la mitad de los agentes en el modelo no limpiaron una sola celda, por lo que existe la posibilidad obtener un resultado similar con muchos menos agentes.

Sabiendo todo esto, podemos concluir que la cantidad de agentes en el tablero minimiza la cantidad de tiempo que se necesita para limpiarlo, pero muchos de estos no estarán haciendo nada. Sin embargo el quitar suficientes agentes, mientras que distribuiría más los movimientos realizados por cada uno, también incrementa la posibilidad de que aun queden

celdas sucias al finalizar la simulación, por lo que habría que incrementar el límite de tiempo para garantizar que el modelo tuviera éxito.

Al final de cuentas, todos los limpiadores del tablero se están moviendo aleatoriamente, por lo que varía grandemente el tiempo que necesitan para limpiar. Si estos pudiesen aprender de su entorno y desarrollar una estrategia, llegaría a un punto en el que sería posible limpiar el cuarto completo con un solo agente, que haya encontrado la ruta más óptima para recorrerlo. Para esto, sin embargo, es necesario realizar corridas aleatorias para familiarizarse con su entorno, por lo que ahí radica la importancia de este ejercicio.