M1. Actividad 1

Daniel Antonio Melgar Orellana - A00839106 Link GitHub:
https://github.com/dmelgar1110/TC2008B.103-Multiagentes

In [61]:
```
!pip install agentpy
!pip install seaborn
```

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Requirement already satisfied: agentpy in c:\users\manuel\appdata\roaming\python\pyt
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```

In [62]:

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!pip install nbconvert
```

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[notice] A new release of pip is available: 24.3.1 -> 25.2
[notice] To update, run: C:\Python313\python.exe -m pip install --upgrade pip
```

In [63]:
```python
import numpy as np
import random
```

Las siguientes entradas definirán los parámetros del agente y el modelo

- Filas y columnas: Para definir el tamaño del tablero.
- Número de agentes: Cantidad de agentes.
- Porcentaje de celdas sucias: Porcentaje de celdas que estarán sucias.
- Tiempo máximo de ejecución: Número máximo de pasos que durará la simulación.

In [64]:
```python
n = int(input("Filas del tablero:"))
m = int(input("Columnas del tablero:"))

nAgentes = int(input("Número agentes:"))
celdasSucias = int(input("Porcentaje de celdas sucias:"))
tiempoMax = int(input('Tiempo máximo de ejecución: '))
```

- DummyAgent: Es la clase modificada de agente para que puede moverse y limpiar celdas en el entorno. Cada agente lleva un registro de sus movimientos y celdas limpiadas.
- DummyEnvironment: Es la clase modificada que modela el entorno como una cuadrícula donde algunas celdas están sucias y otras limpias. Permite ubicar a los agentes y gestionar el estado de limpieza de cada celda.
- DummyModel: Esta clase casi no fue modificada ya que solo se encarga de controlar la relación de los agentes con el ambiente.

In [65]:
```python
debug = True
import agentpy as ap

'''
```

```
A simple agent that moves in a random direction without using a directions array
'''
class DummyAgent(ap.Agent):

    def setup(self):
        # Agent's position. It is regarded as its state.
        self.pos = (0, 0)
        self.movimientos = 0
        self.celdasLimpiadas = 0

    def get_position(self):
        return self.model.environment.positions[self]

    def execute(self):
        #obtener x y del agente
        x, y = self.get_position()
        # Si la celda está sucia, limpia
        if not self.model.environment.sucias[x, y]:
            self.model.environment.sucias[x, y] = True
            self.celdasLimpiadas += 1
        else:
            # Generar dx y dy aleatorios entre -1 y 1, pero no puede ser (0,0)
            while True:
                cambioX = random.randint(-1, 1)
                cambioY = random.randint(-1, 1)
                if cambioX != 0 or cambioY != 0:
                    break
            nuevoX = x + cambioX
            nuevoY = y + cambioY
            if 0 <= nuevoX < self.model.environment.shape[0] and 0 <= nuevoY < self
                self.model.environment.move_to(self, (nuevoX, nuevoY))
                self.movimientos += 1


class DummyEnvironment(ap.Grid):
    def setup(self):
        # Matriz de celdas sucias (False = sucia, True = limpia)
        self.sucias = np.full(self.shape, True)
        porcentaje_sucias = self.model.p.porcentaje_sucias
        num_sucias = int(np.prod(self.shape) * porcentaje_sucias / 100)
        contador = 0
        while contador < num_sucias:
            i = random.randint(0, self.shape[0]-1)
            j = random.randint(0, self.shape[1]-1)
            if self.sucias[i, j]:
                self.sucias[i, j] = False
                contador += 1

class DummyModel(ap.Model):

    def setup(self):
        n, m = self.p.tablero
        nAgentes = self.p.nAgentes

        self.environment = DummyEnvironment(self, (n, m))
        self.environment.setup()
```

```
        self.agentes = ap.AgentList(self, nAgentes, DummyAgent)
        self.environment.add_agents(self.agentes, positions=[(1,1)]*nAgentes)

    def step(self):
        if self.p.print:
            print("*******************\n1 Agent's state: \t\t{}\nPosition in envir
        self.environment.agents.execute()

    def update(self):
        if self.environment.sucias.all():
            self.stop()

# Usar las variables del usuario para los parámetros
parameters = {
    'print': False,
    'tablero': (n, m),
    'porcentaje_sucias': celdasSucias,
    'nAgentes': nAgentes,
    'steps': tiempoMax
}

dummyModel = DummyModel(parameters)
result = dummyModel.run()

total_movimientos = sum(agent.movimientos for agent in dummyModel.agentes)
total_limpiezas = sum(agent.celdasLimpiadas for agent in dummyModel.agentes)
celdas_limpias = np.sum(dummyModel.environment.sucias)
porcentaje_limpias = 100 * celdas_limpias / (parameters['tablero'][0] * parameters[

print(f"Tiempo transcurrido: {dummyModel.t}")
print(f"Porcentaje de celdas limpias: {porcentaje_limpias:.2f}%")
print(f"Total de movimientos realizados: {total_movimientos}")
```

```
Completed: 1000 steps
Run time: 0:00:00.061310
Simulation finished
Tiempo transcurrido: 1000
Porcentaje de celdas limpias: 99.11%
Total de movimientos realizados: 2602
```

Animación del proceso de limpieza

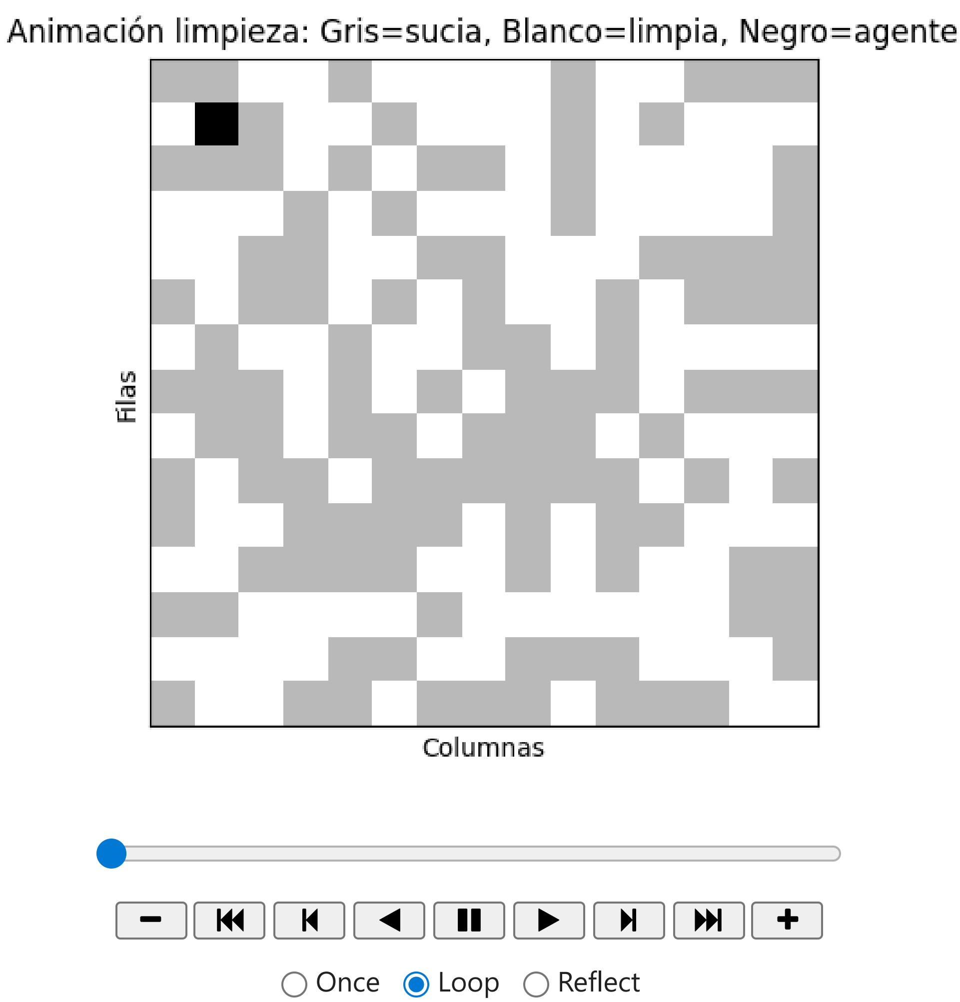
Para la gráfica y animación utilicé el negro para que sea el color de el/los agentes, gris para las celdas sucias y blanco para las limpias.

In [66]:

```
from IPython.display import HTML
import matplotlib.pyplot as plt
import seaborn as sns

def my_plot(model, ax):
    grid = np.zeros(model.environment.shape)
    # 0 = sucia (gris), 1 = limpia (blanco)
    grid[model.environment.sucias] = 1
```

```
    # Mostrar agentes en el grid con valor 2 (negro)
    for agent, pos in model.environment.positions.items():
        grid[pos] = 2
    ax.clear()
    # 0=gris, 1=blanco, 2=negro
    from matplotlib.colors import ListedColormap
    cmap = ListedColormap(['#bdbdbd', '#ffffff', '#000000'])
    ax.imshow(grid, cmap=cmap, vmin=0, vmax=2)
    ax.set_title('Animación limpieza: Gris=sucia, Blanco=limpia, Negro=agente')
    ax.set_xlabel('Columnas')
    ax.set_ylabel('Filas')
    ax.set_xticks([])
    ax.set_yticks([])

dummyModel = DummyModel(parameters)

fig, ax = plt.subplots()
animation = ap.animate(dummyModel, fig, ax, my_plot)
HTML(animation.to_jshtml())
```

Out[66]:



Conclusión y hallazgos

Con esta simulación de multiagente, se logró modelar y visualizar el comportamiento colectivo de agentes simples encargados de limpiar un entorno. Los movimientos de los agentes en este caso no fueron inteligentes, se utilizó una randomización de -1 0 o 1 para elegir cual era su movimiento en x y en y, evitando también que un movimiento sea 0,0 ya que esto significa quedarse parado, y eso no puede pasar.

Luego de haber desarrollado el código y visto la simulaión pude observar que la parametrización del entorno influye directamente en la eficiencia y el tiempo requerido para limpiar el tablero, por el número de agentes, o el porcentaje de celdas sucias, etc. La animación permite identificar visualmente patrones de movimiento y eficiencia de los agentes, facilitando el análisis del comportamiento colectivo.

Para concluir, esta simulación es un ejemplo que las simulaciones como estas pueden funcionar para analizar sistemas complejos y experimentar con diferentes comportamientos.