AP157 Output 4 - February 20, 2026

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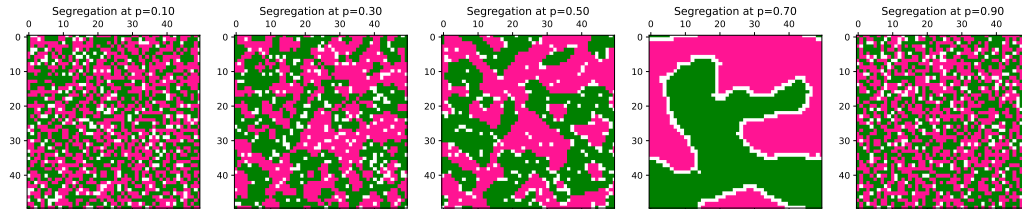
Figure 1: **Residential Layout per Ideology** A "city" of size 50×50 showing the evolution of the spatial distribution of "Kakampinks" and "DDS" at changing tolerances from $p = 0.10$ (leftmost; most tolerant) to $p = 0.90$ (right-most; most intolerant) assuming p is homogeneous across ideological camp

City Map

```python
# Define a city_map
N = 50
total = N * N

# exact counts
num_empty = 250
num_agents = total - num_empty
num_neg = num_agents // 2
num_pos = num_agents - num_neg # handles odd case
    safely

# build flat array
values = np.array([-1]*num_neg + [1]*num_pos +
    [0]*num_empty)

# shuffle and reshape
realtor.shuffle(values)
city_map = values.reshape(N, N)
```

Setting up the "Final" Clustering

Since we need to get an output, we allow the citizens to move one thousand times, motivated by their set tolreance p. Trial on an error-based threshold of loop termination yielded an underwhelming clustering pattern. Happiness is calculated via Moore's Neighboring.

```python
def equilibrate(matrix, p, max_steps=1000):

    for step in range(max_steps):

        happiness = compute_happiness(matrix)
        unhappy = np.argwhere((matrix != 0) & (
            happiness < p))
        empty  = np.argwhere(matrix == 0)

        if len(unhappy) == 0 or len(empty) == 0:
            break

        np.random.shuffle(unhappy)
        np.random.shuffle(empty)

        moves = min(len(unhappy), len(empty))

        for k in range(moves):
            old_x, old_y = unhappy[k]
            new_x, new_y = empty[k]

            matrix[new_x, new_y] = matrix[old_x,
                old_y]
            matrix[old_x, old_y] = 0

    return matrix
```

As seen in Fig. 1, most emphatic segregation is visible at $p = 0.7$ (close to 0.65 in the lecture earlier.) With least clustering both in $p = 0.1$ and $p = 0.9$. This peaking around 0.7 is likely explained by the maximization of the available empty spaces and happiness thresholds beyond which there are no available space for pretty much everyone to move into. For low thresholds however (around 0.1), the constraint in movement is caused by comfort-induced immobility of a bulk of the citizens in the city.