Homework 4, Game Theory

Erik Norlin

December, 2022

13.1: a, b, c

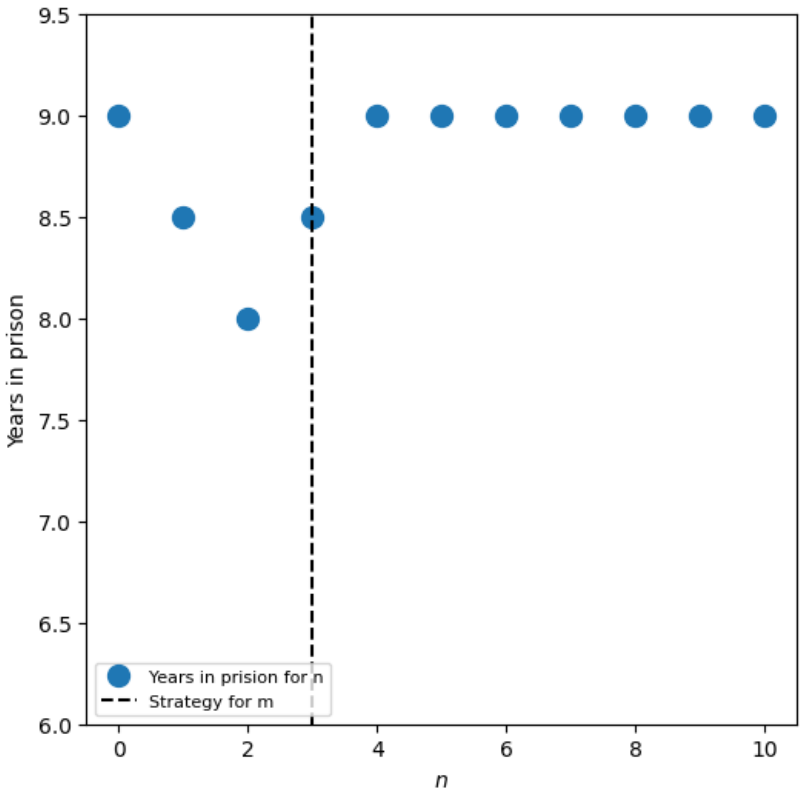

Figure 1: T = 0, R = 0.5, P = 1, S = 1.5.

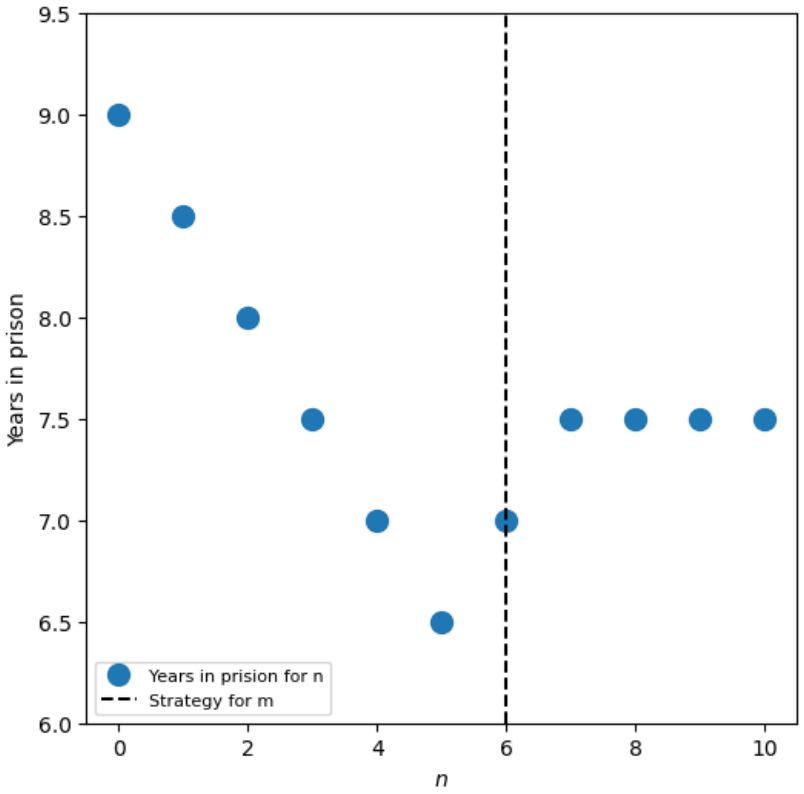

Figure 2: T = 0, R = 0.5, P = 1, S = 1.5.

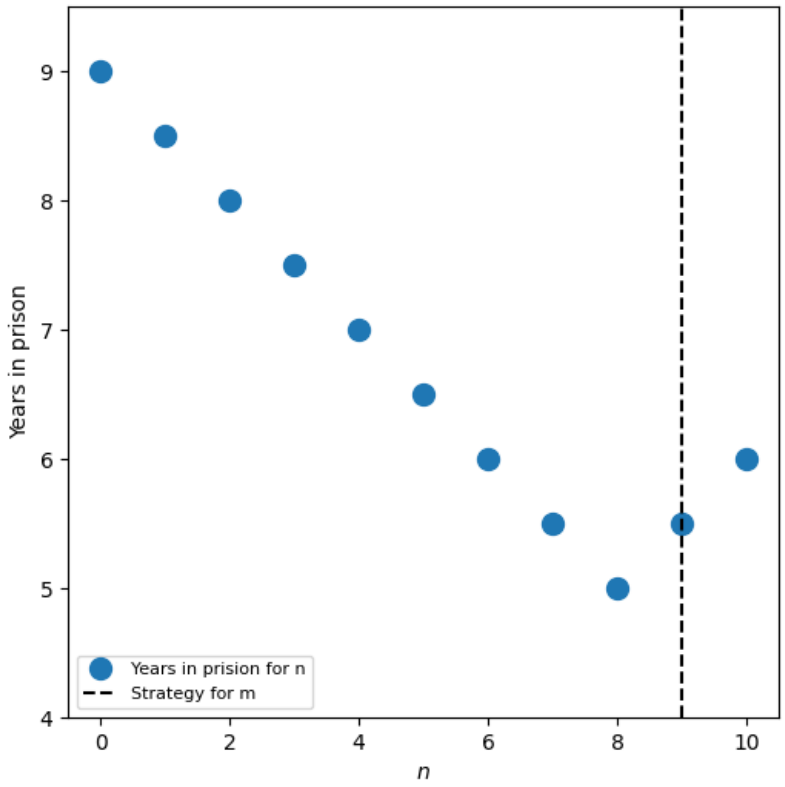

Figure 3: T = 0, R = 0.5, P = 1, S = 1.5.

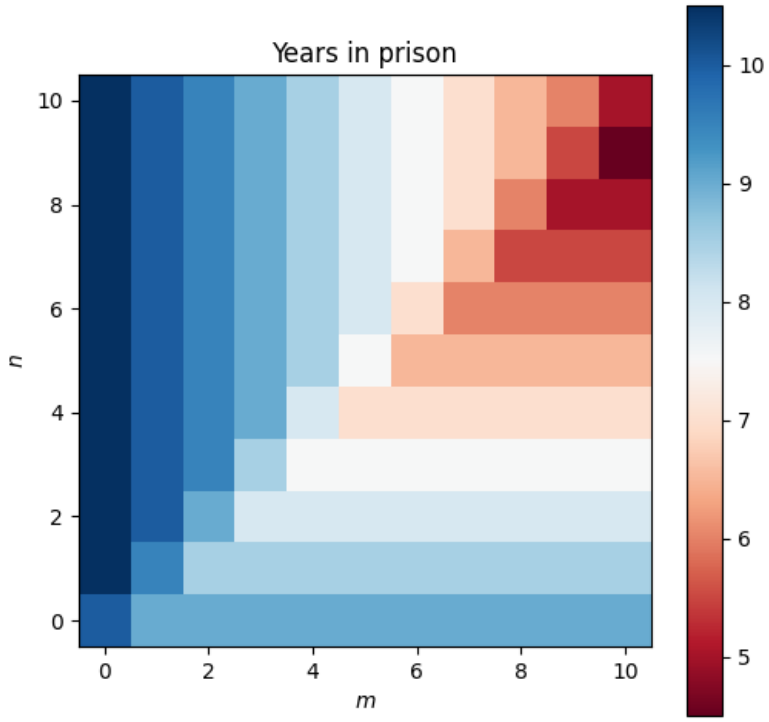

Figure 4: T = 0, R = 0.5, P = 1, S = 1.5.

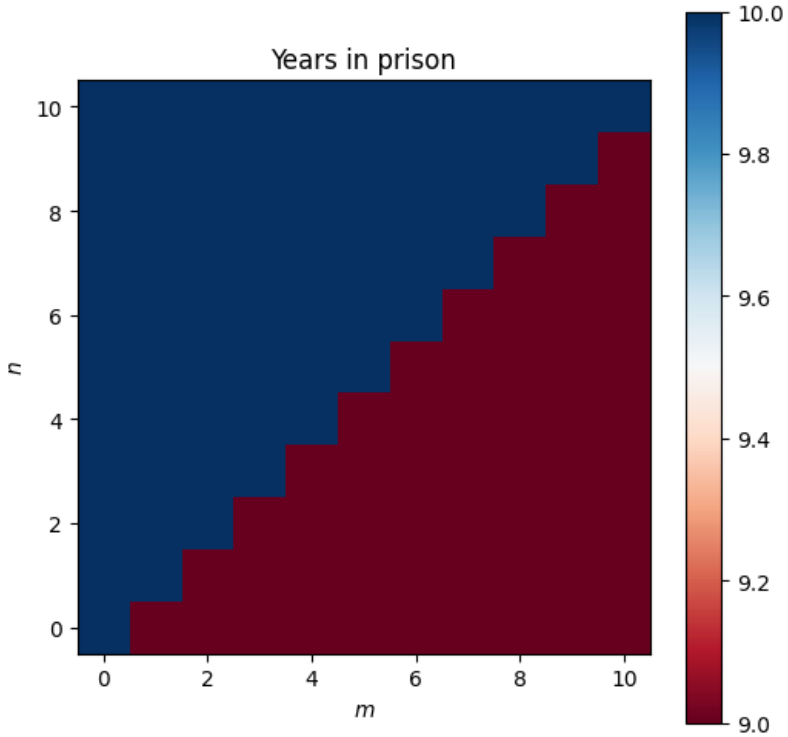

Figure 5: T = 0, R = 1, P = 1, S = 1.

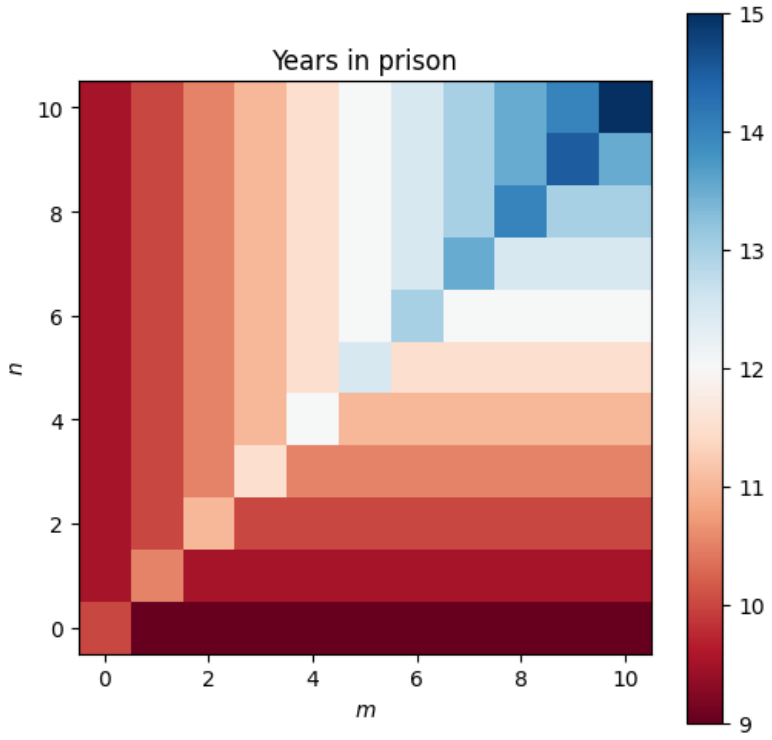

Figure 6: T = 0, R = 1.5, P = 1, S = 0.5

13.2: a, b, c

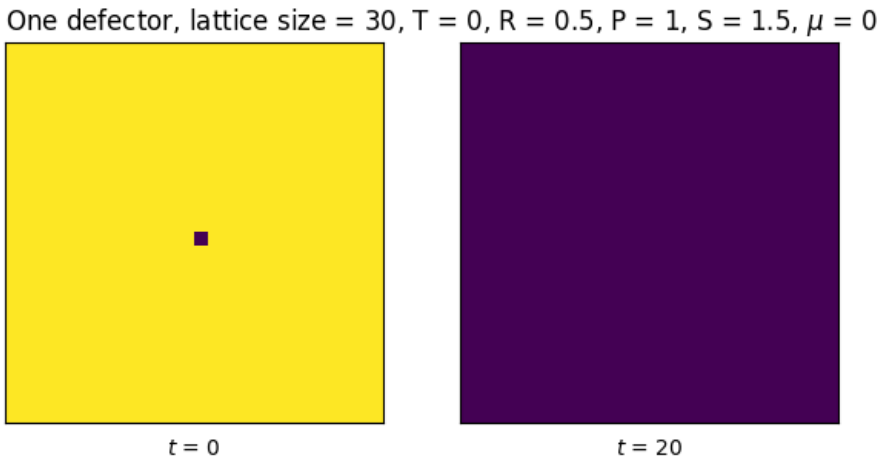

Figure 7: Left: yellow = 7, purple = 0. Right: purple = 7 (colors switched).

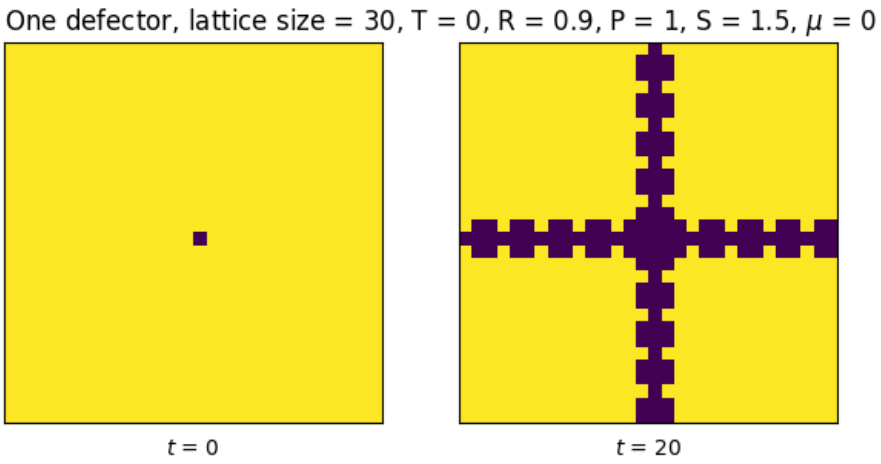

Figure 8: Yellow = 7, purple = 0.

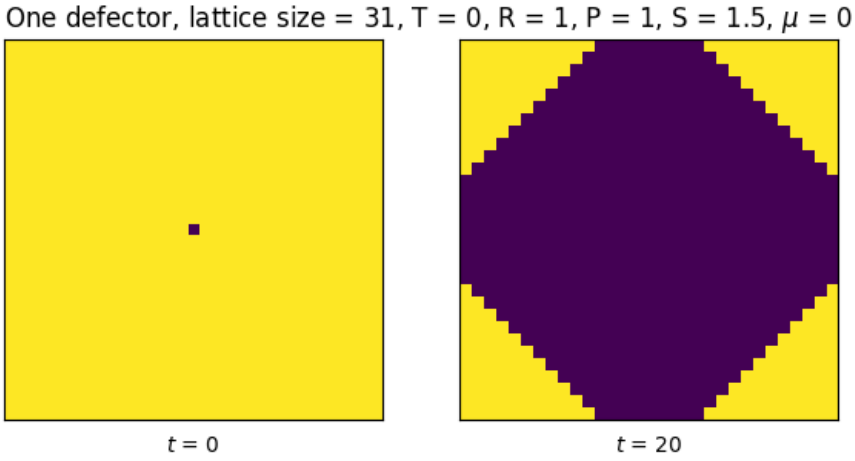

Figure 9: Yellow = 7, purple = 0.

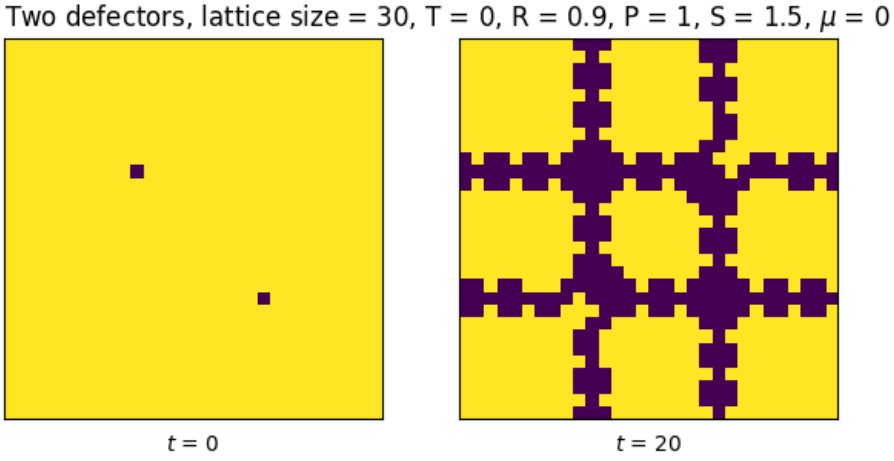

Figure 10: Yellow = 7, purple = 0.

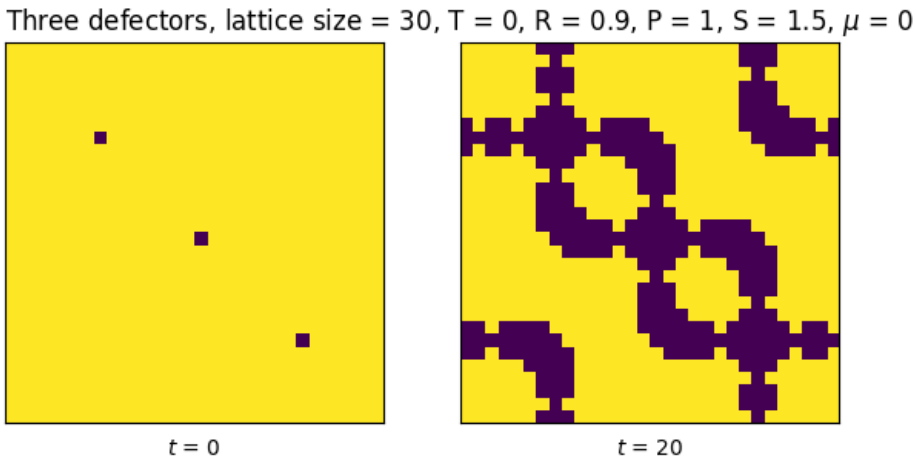

Figure 11: Yellow = 7, purple = 0.

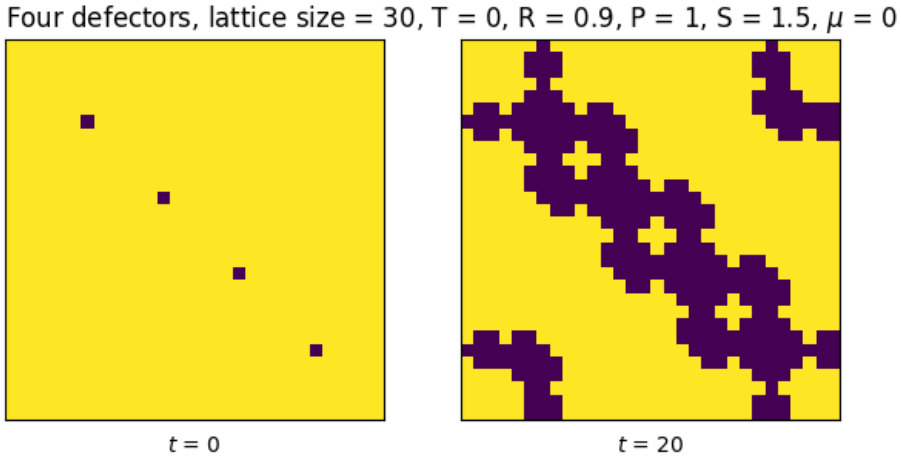

Figure 12: Yellow = 7, purple = 0.

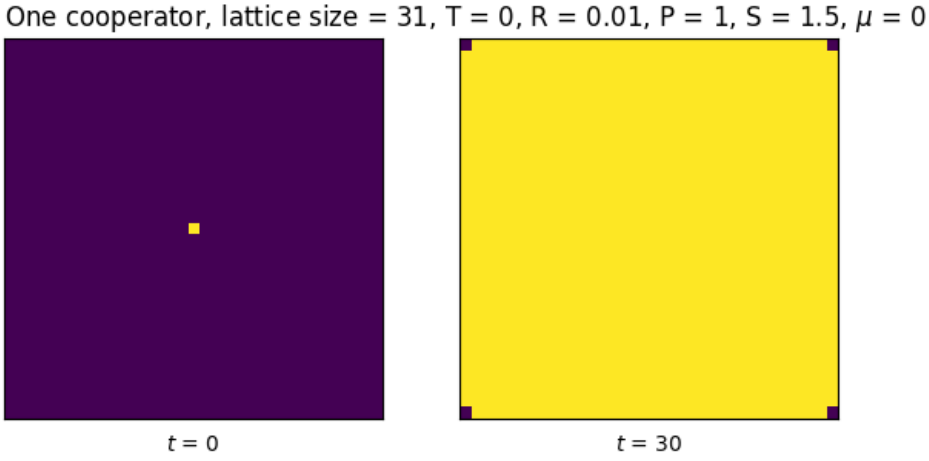

Figure 13: Yellow = 7, purple = 0.

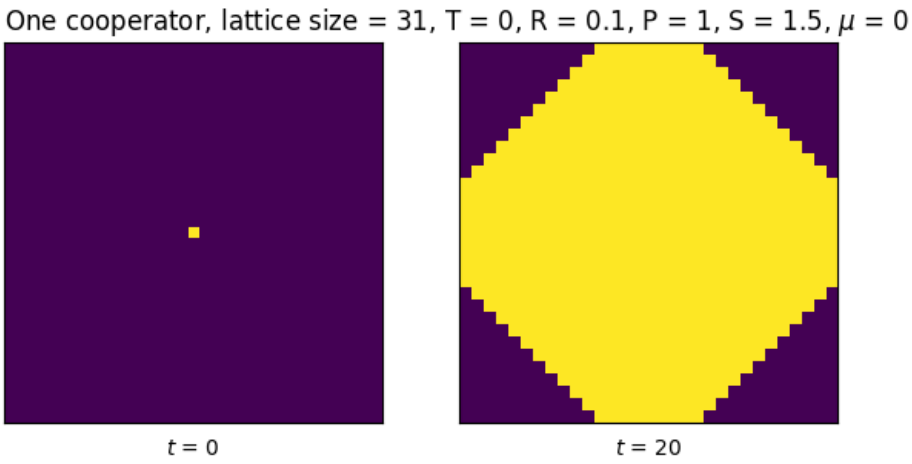

Figure 14: Yellow = 7, purple = 0.

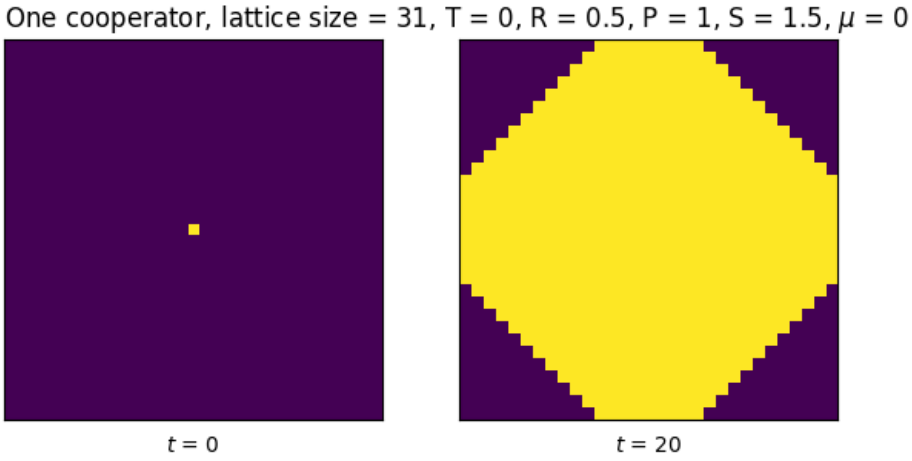

Figure 15: Yellow = 7, purple = 0.

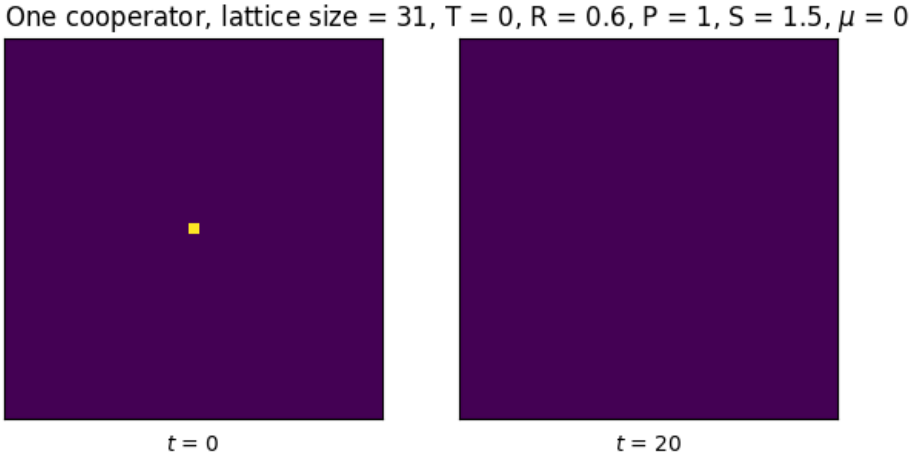

Figure 16: Yellow = 7, purple = 0.

13.3: a, b, c, d, e

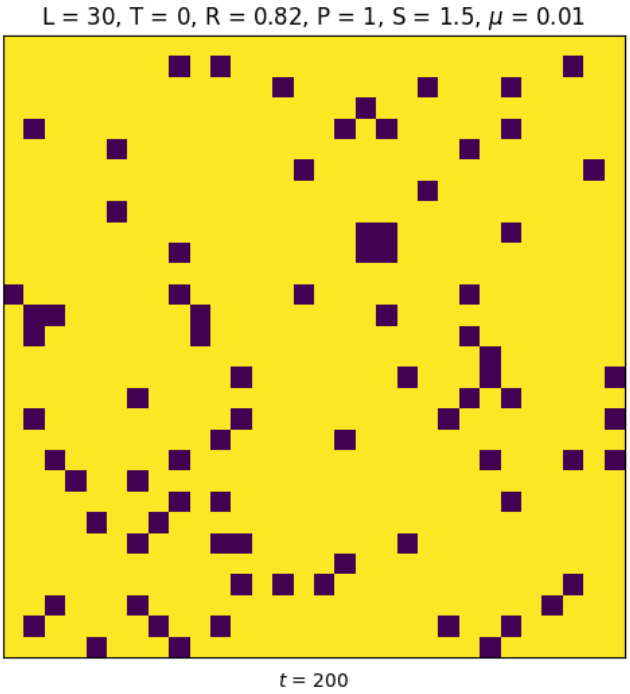

Figure 17: Yellow = 7, purple = 0.

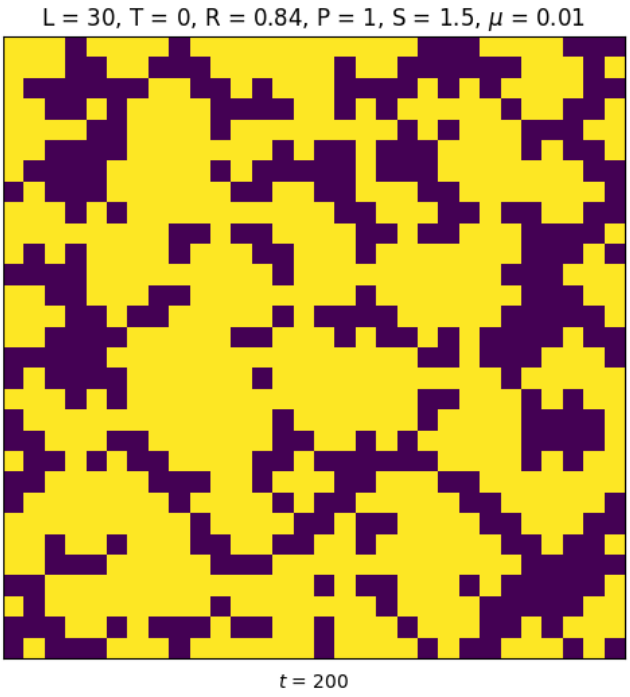

Figure 18: Yellow = 7, purple = 0.

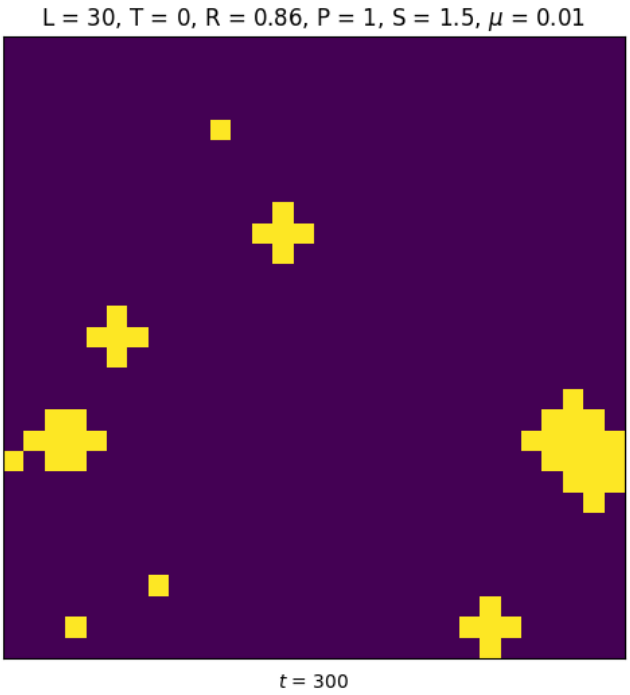

Figure 19: Yellow = 7, purple = 0.

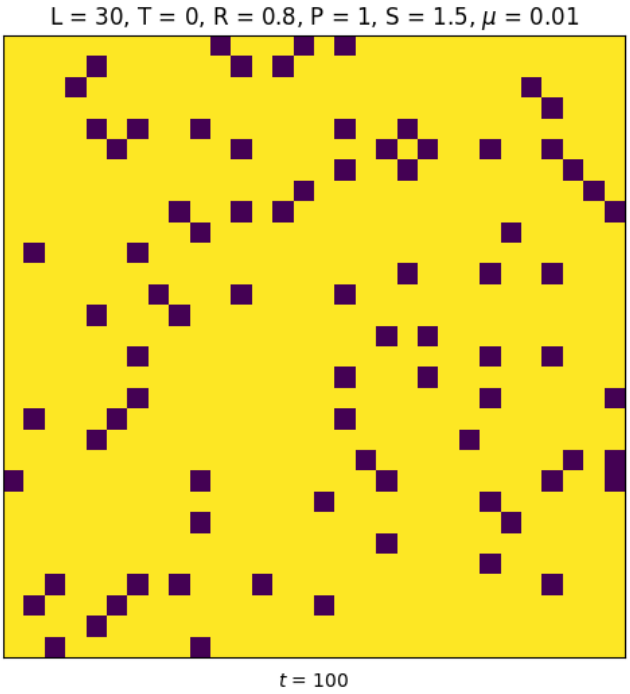

Figure 20: Yellow = 7, purple = 0.

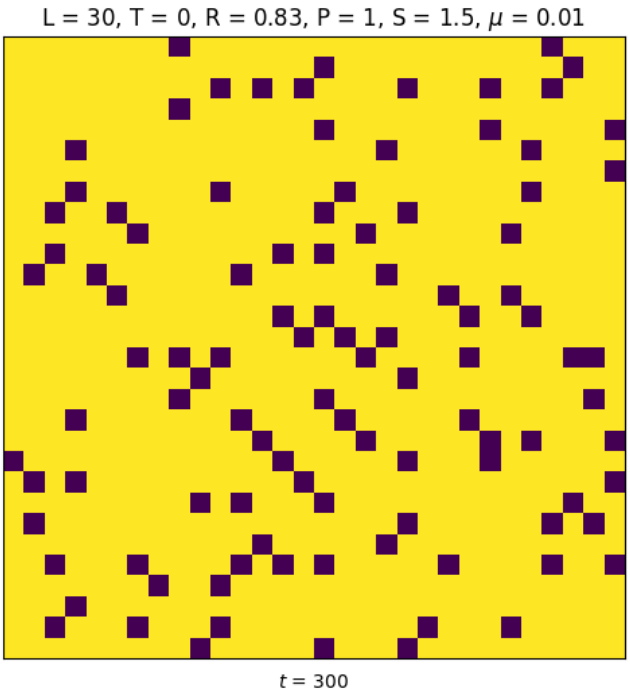

Figure 21: Yellow = 7, purple = 0.

Shift Between R = 0.83 and R = 0.835

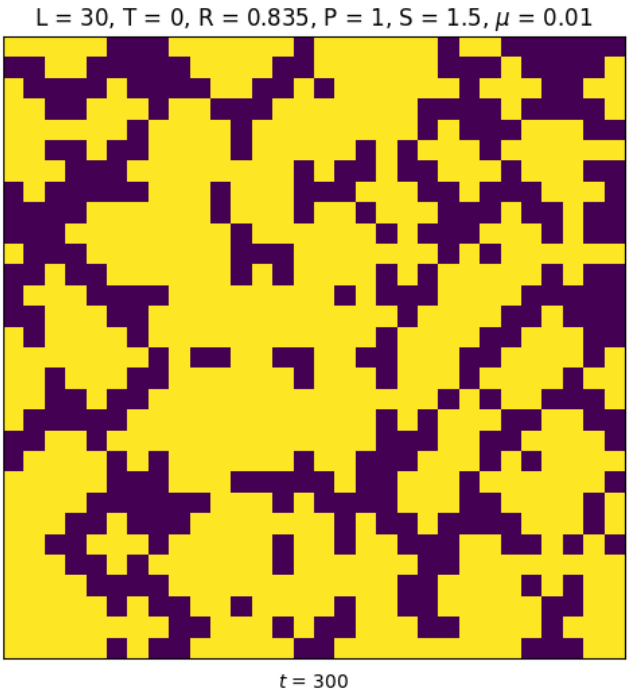

Figure 22: Yellow = 7, purple = 0.

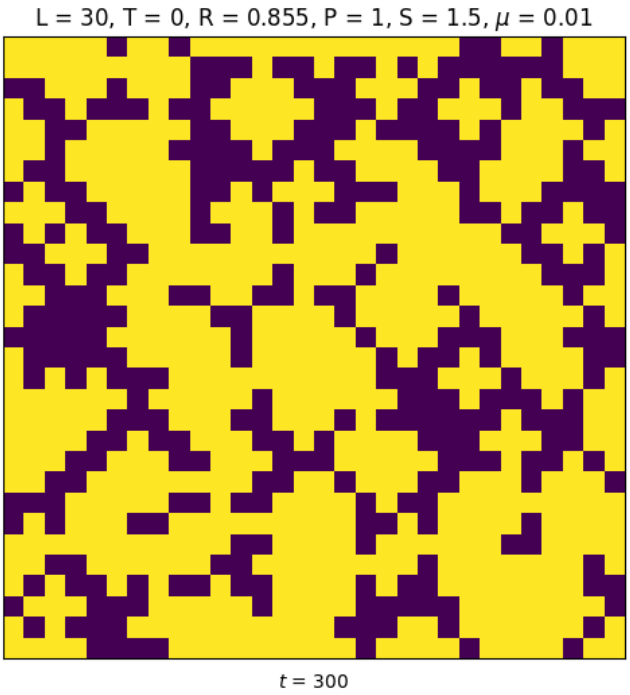

Figure 23: Yellow = 7, purple = 0.

Shift Between R = 0.855 and R = 0.8575

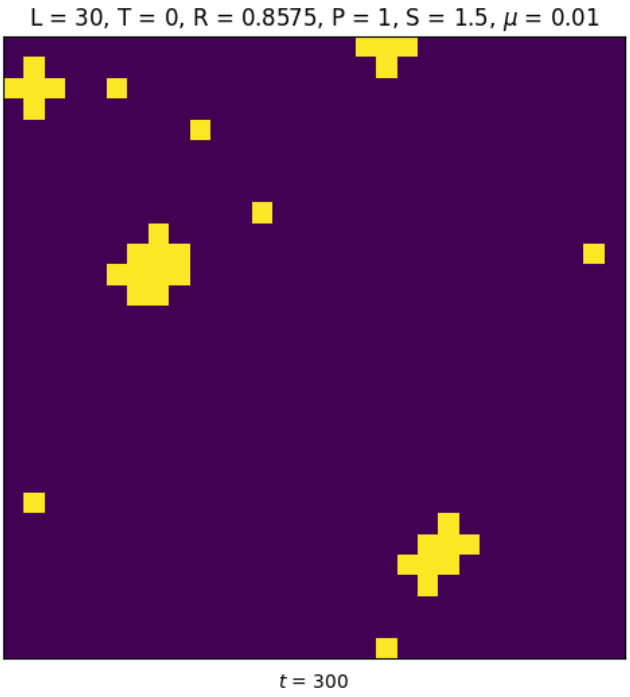

Figure 24: Yellow = 7, purple = 0.

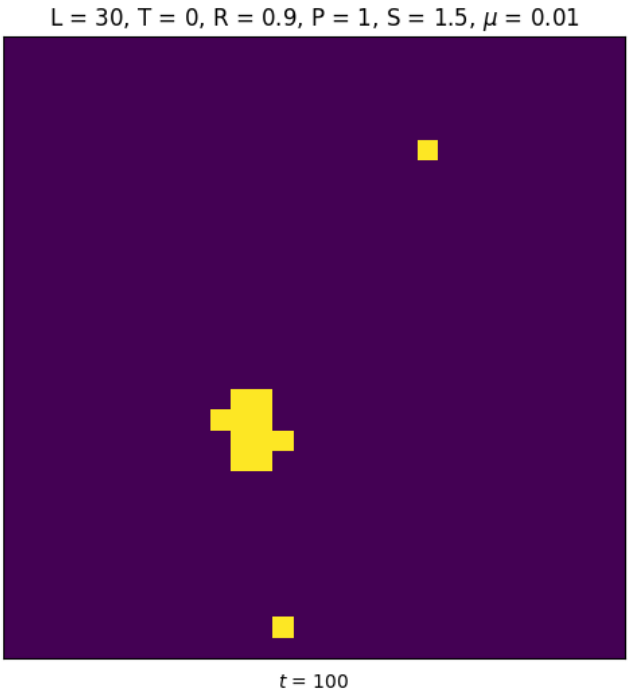

Figure 25: Yellow = 7, purple = 0.

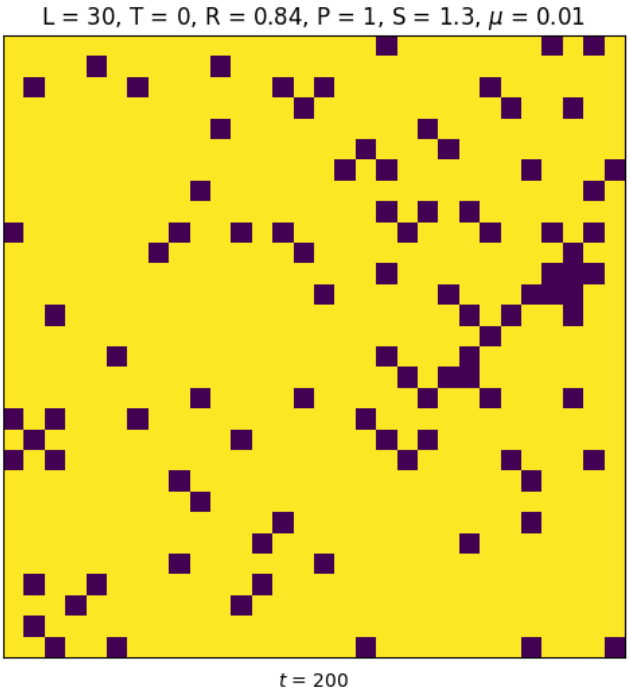

Figure 26: Yellow = 7, purple = 0.

Shift Between S = 1.3 and S = 1.4.

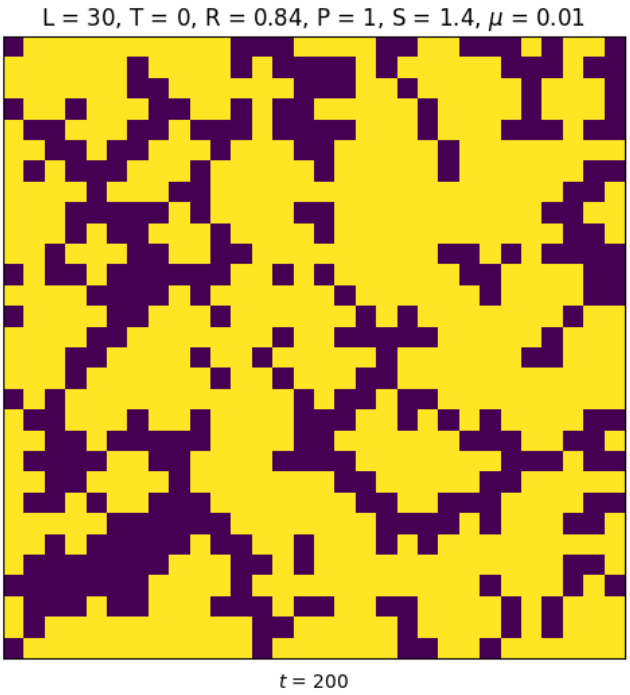

Figure 27: Yellow = 7, purple = 0.

Shifts slowly between S = 1.7 and S = 2.5. Major shift at S = 2.5.

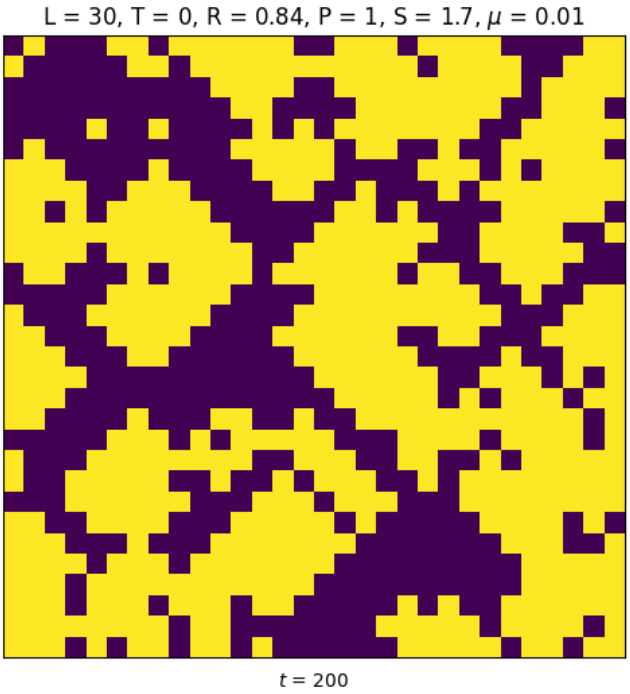

Figure 28: Yellow = 7, purple = 0.

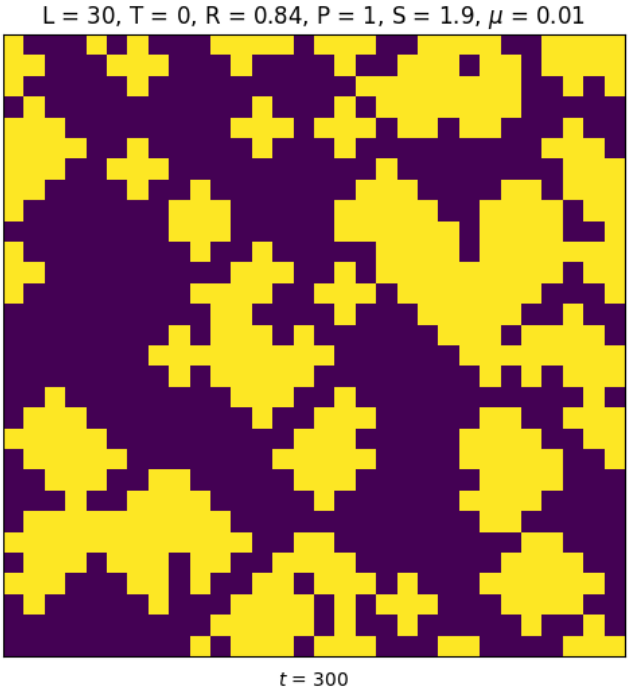

Figure 29: Yellow = 7, purple = 0.

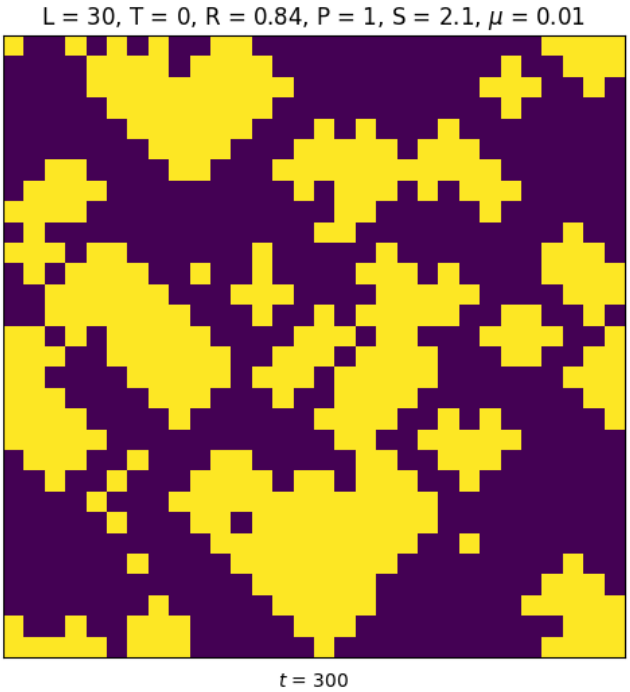

Figure 30: Yellow = 7, purple = 0.

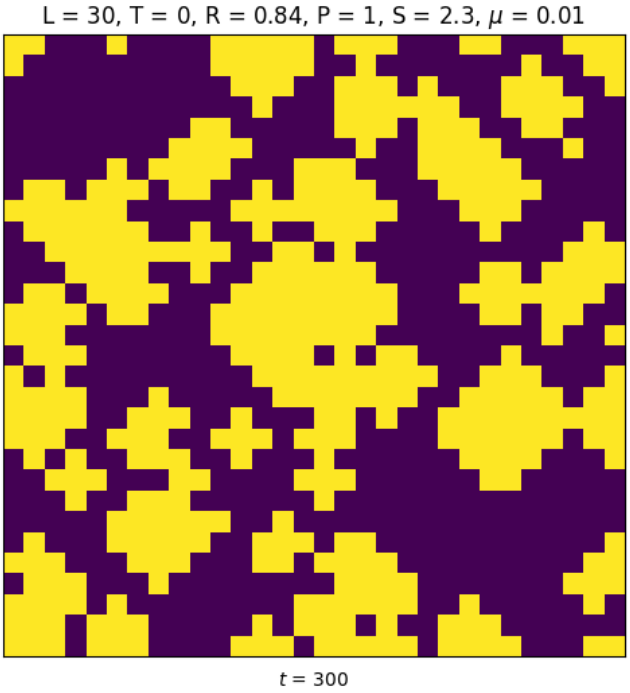

Figure 31: Yellow = 7, purple = 0.

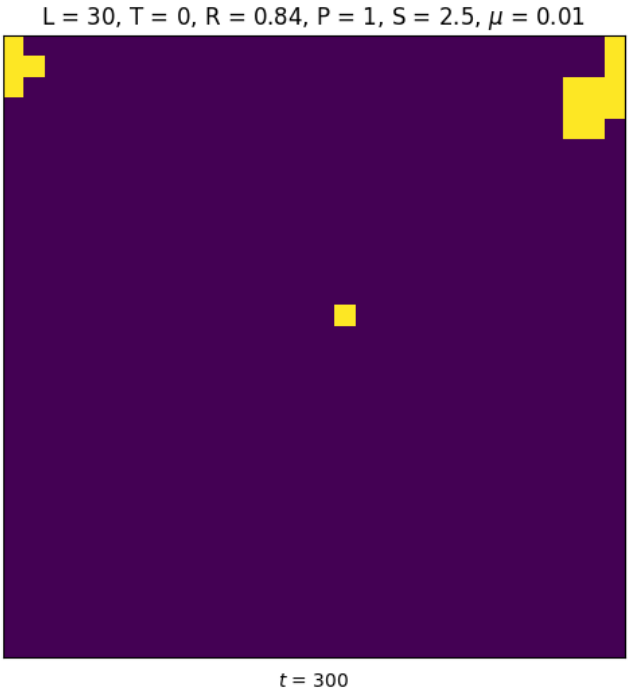

Figure 32: Yellow = 7, purple = 0.

13.4: a, b, c

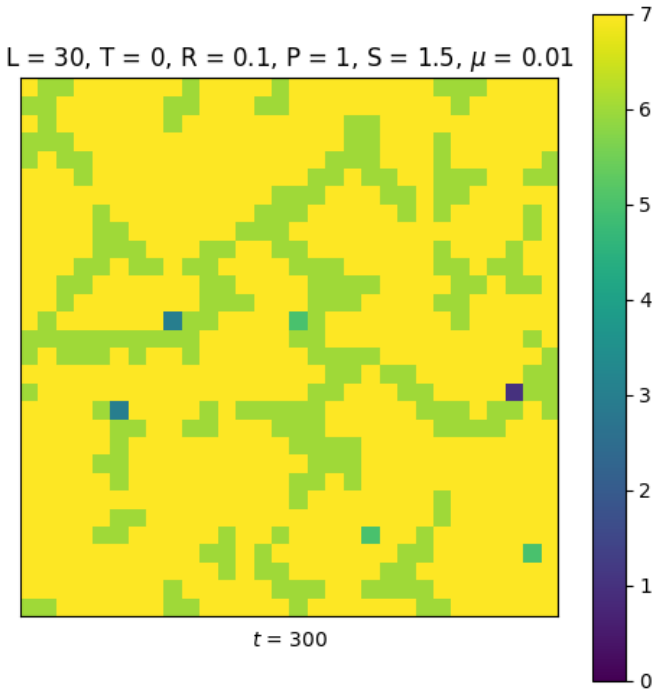

Figure 33

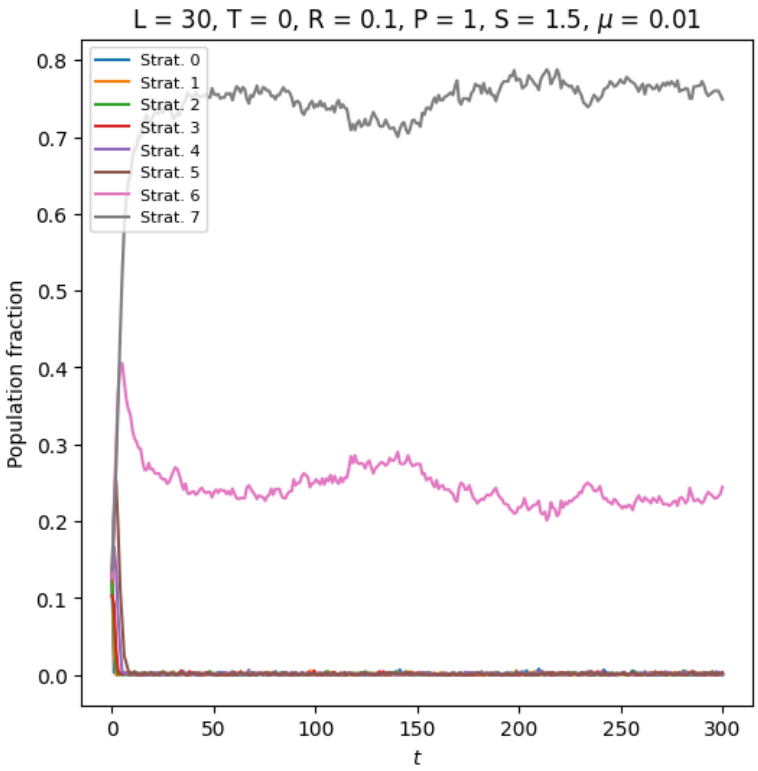

Figure 34

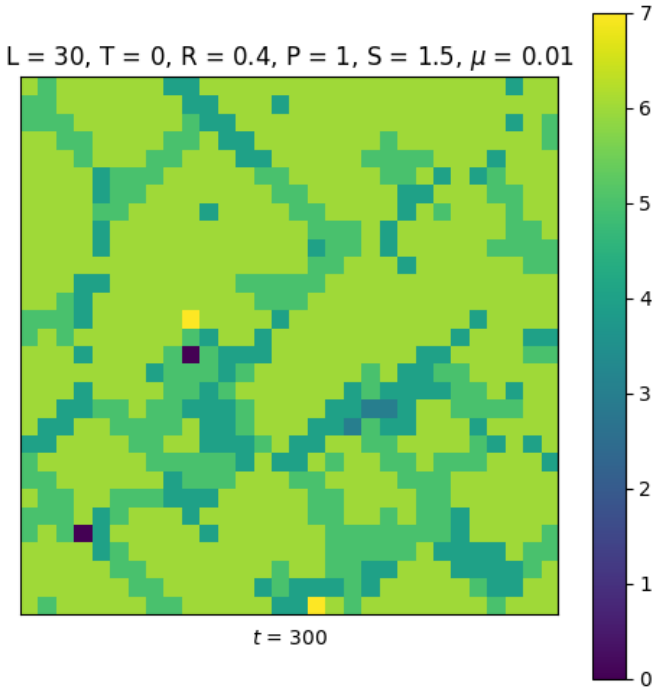

Figure 35

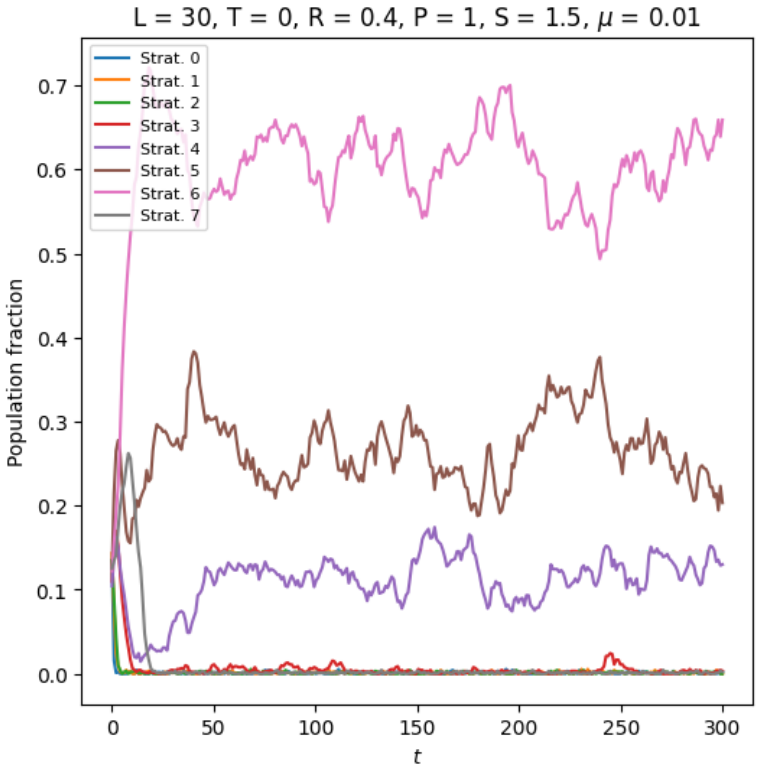

Figure 36

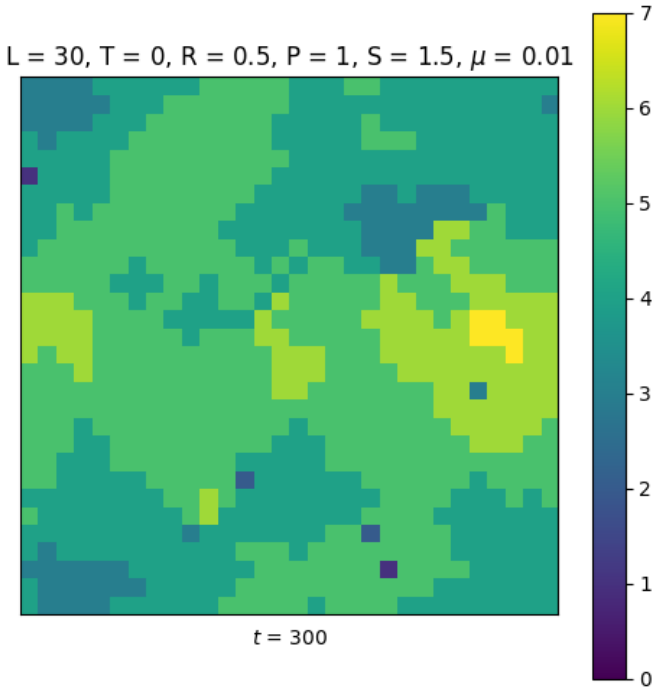

Figure 37

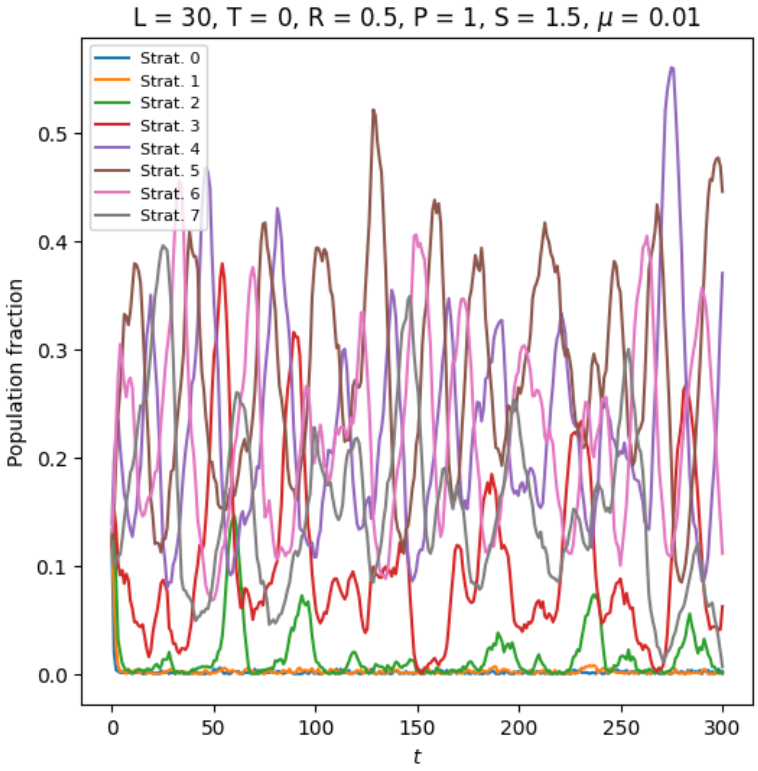

Figure 38

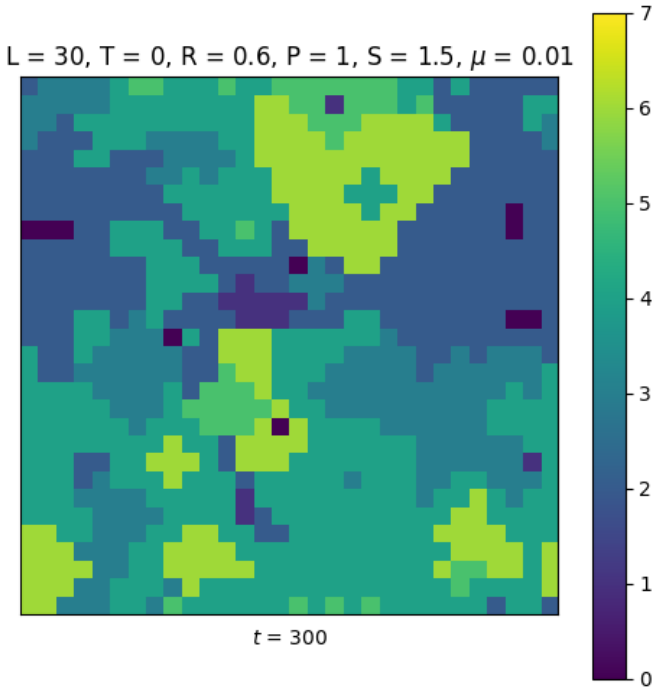

Figure 39

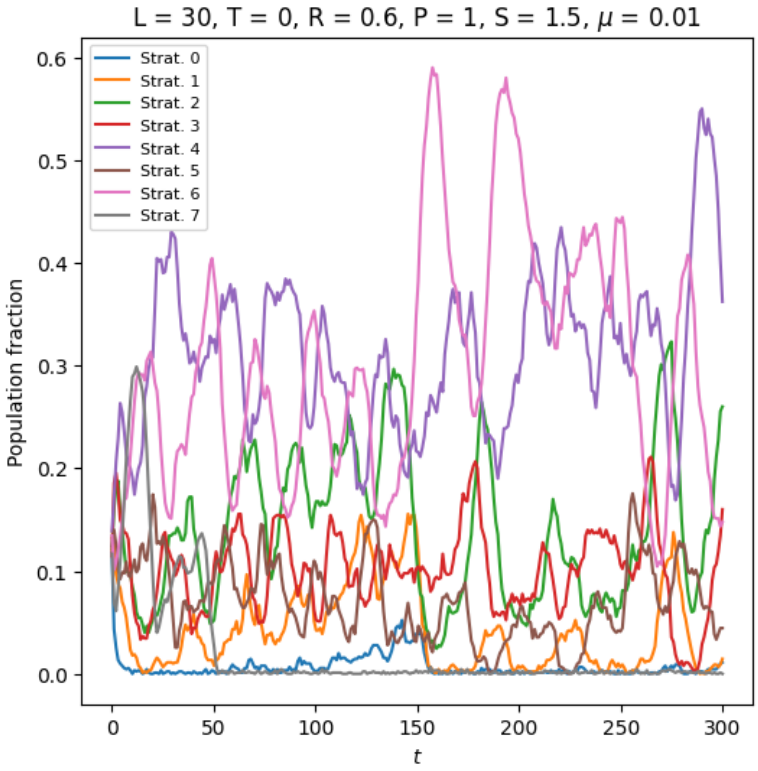

Figure 40

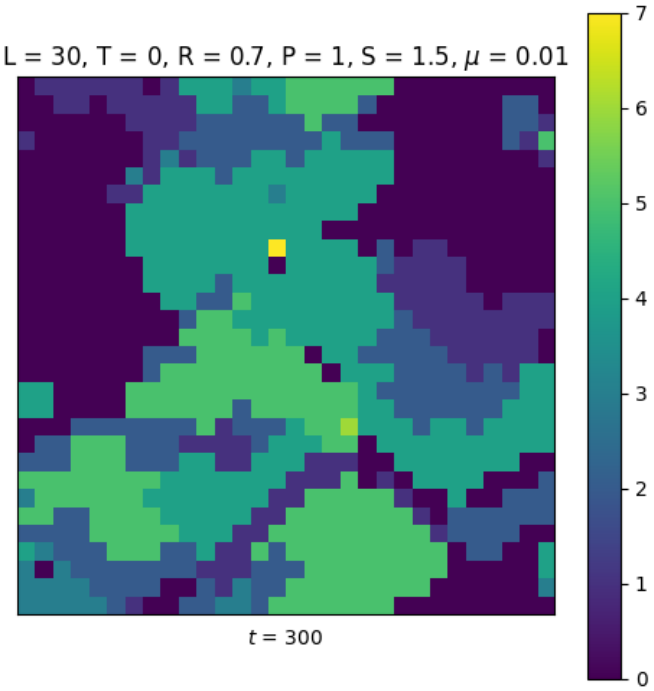

Figure 41

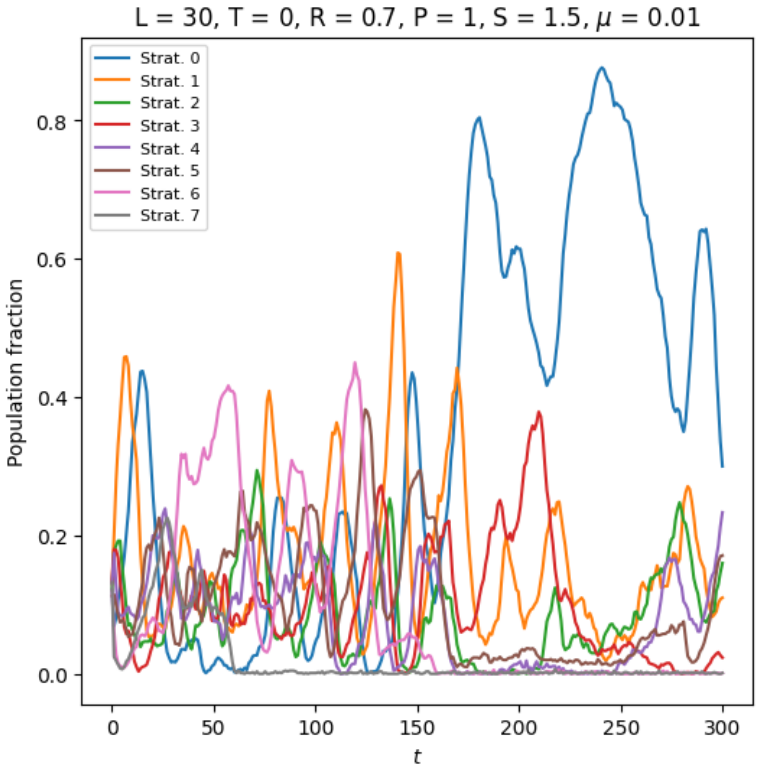

Figure 42

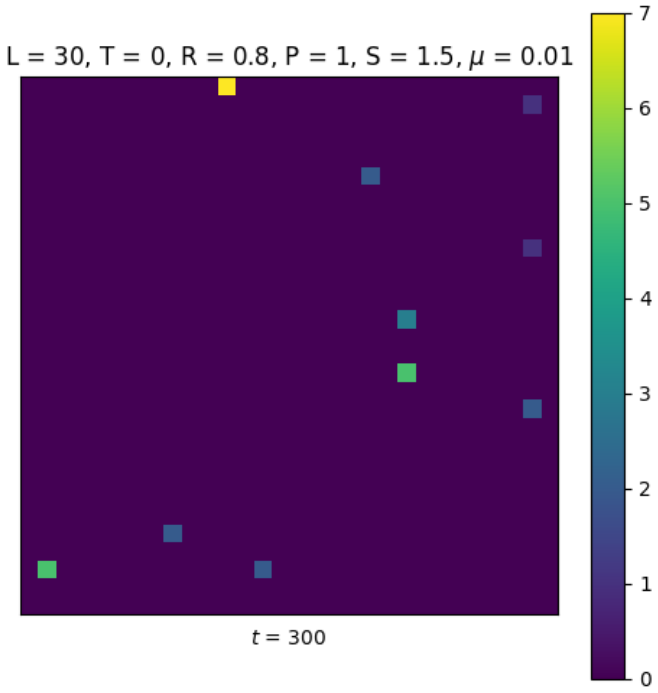

Figure 43

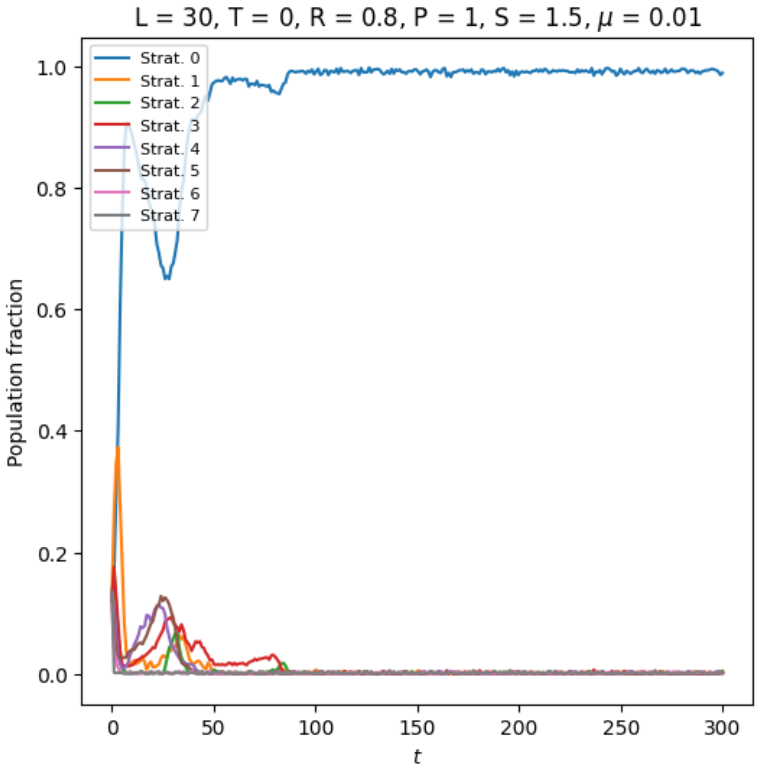

Figure 44

The larger R is (punishment for cooperation) the more the population defects. The smaller R is, the more the population cooperates. Stable strategies are: defect every time, cooperate almost all the time to all the time. Which strategy that will become

stable depends on R. Cooperation and defection fluctuates past each other continuously if R is in between 0.5 and 0.75.

13.5: a, b

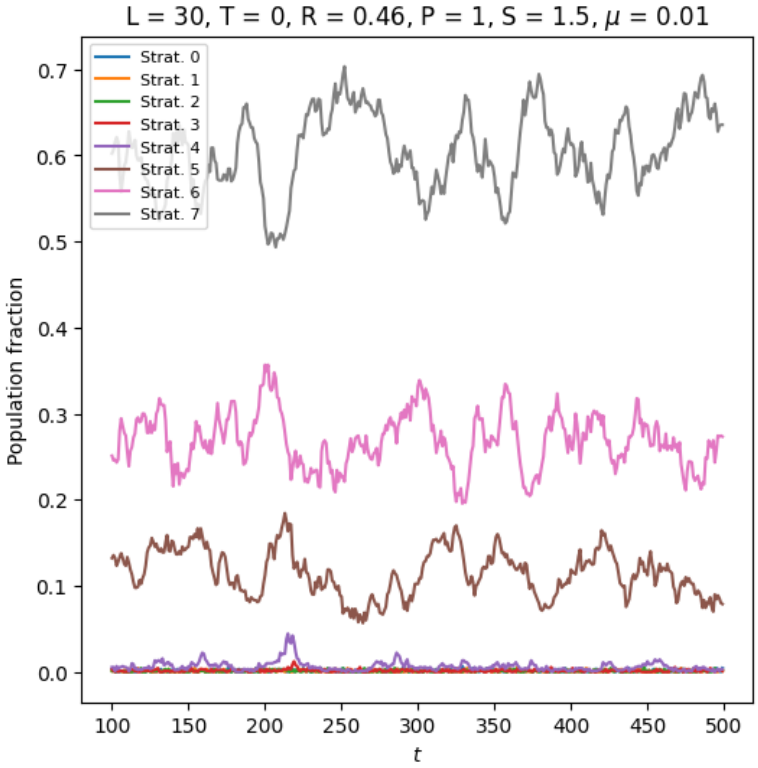

Figure 45: No competition.

Table 1: Variances for R = 0.46, S = 1.5.

n	σ_n^2
0	1.24
1	1.21
2	1.11
3	1.76
4	27.53
5	596.1
6	825.52
7	1660.53
Sum	3115

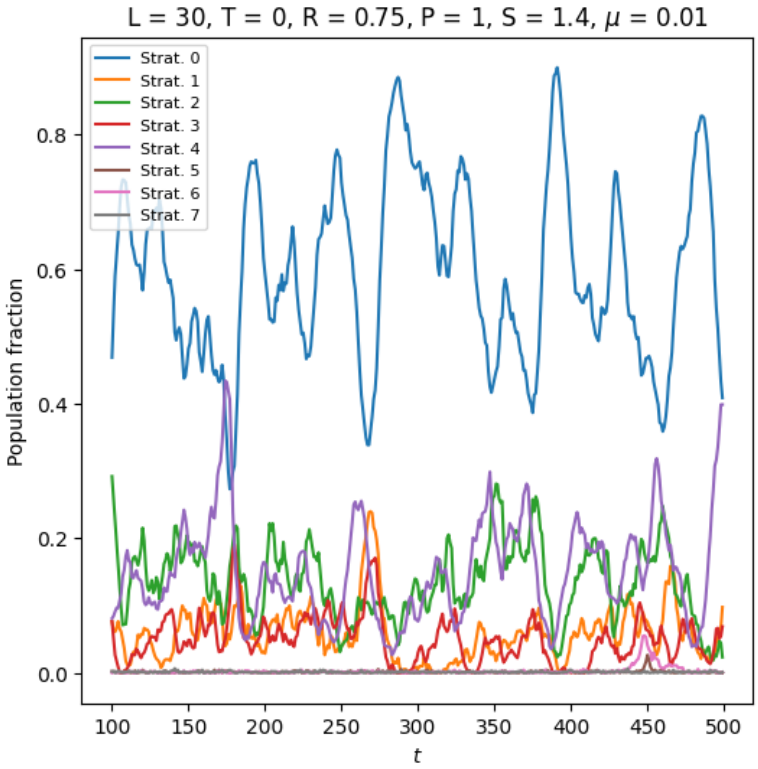

Figure 46: No competition.

Table 2: Variances for R = 0.75, S = 1.4.

n	σ_n^2
0	14344.6
1	1349.99
2	2460.17
3	993.29
4	4655.47
5	3.83
6	37.44
7	1.15
Sum	23845.94

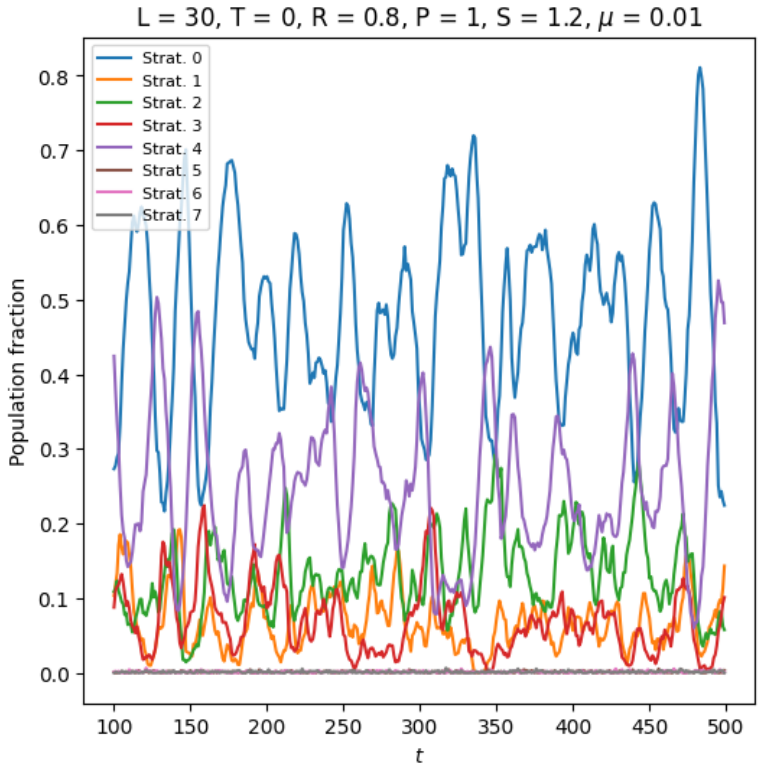

Figure 47: Competition between strategies 0 and 4 starting to become visible.

Table 3: Variances for R = 0.8, S = 1.2.

n	σ_n^2
0	12301.95
1	1174.64
2	2342.39
3	1630.79
4	8088.33
5	1.1
6	1.2
7	1.23
Sum	25541.63

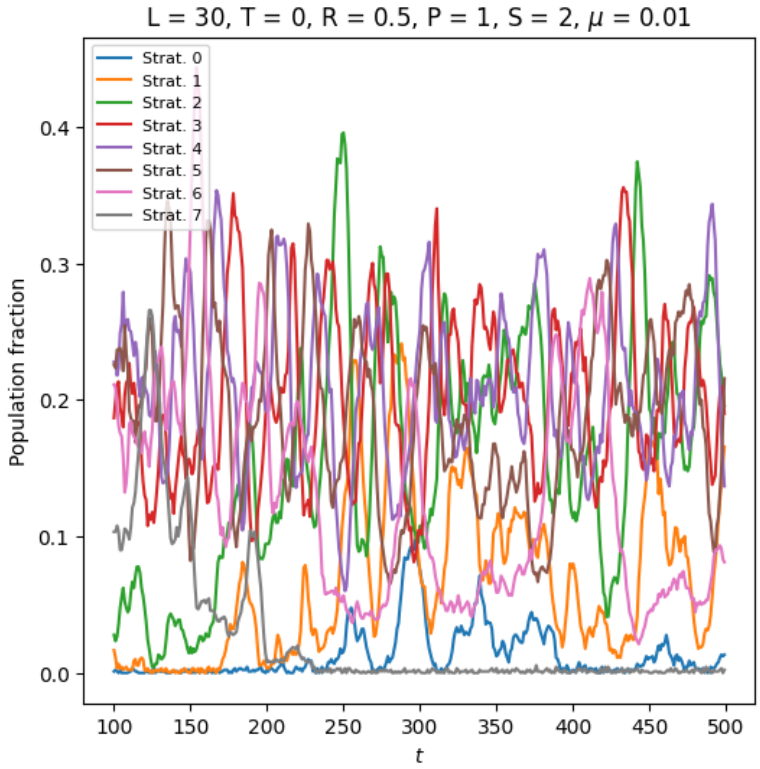

Figure 48: Competition between most strategies are visible.

Table 4: Variances for R = 0.5, S = 2.

n	σ_n^2
0	292.8
1	2889.92
2	6212.41
3	2850.66
4	2638.49
5	3235.15
6	5608.2
7	2307.93
Sum	26035.56

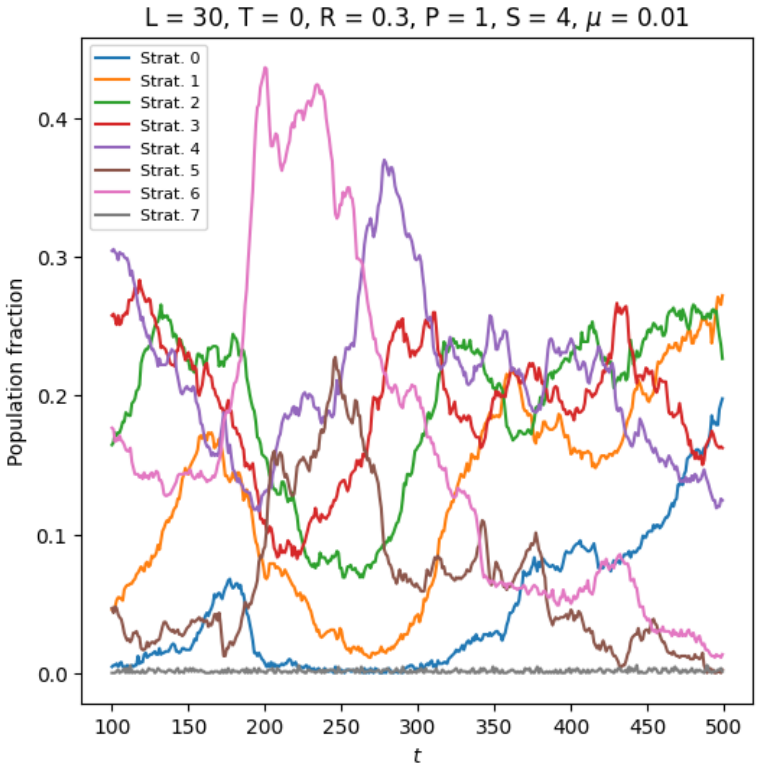

Figure 49: Competition between most strategies are visible here too.

Table 5: Variances for R = 0.3, S = 4.

n	σ_n^2
0	1896.55
1	4212.72
2	2837.26
3	1844.99
4	2647.15
5	2382.78
6	11940.04
7	1.21
Sum	27762.7

Based on these observations we can conclude that there's active competition between populations if

$$\sum_{n=0}^{N} \sigma_n^2 > \approx 26000$$

.