```
Estimated expected survival times by start state:
0: x=[0], p=0.5882352941176472 --> N=334 T=7.271 +/- 0.310 (4.3%)
1: x=[1], p=0.411764705882353 --> N=233 T=5.727 +/- 0.362 (6.3%)
------ Total: N=567
simulate_expected_survival_time: Total simulation time: 0.1 min

# particles by start_state:
0: x=[2], p=1.0 --> N=567
Block of particle indices to simulate #0: [0, 566] (N=567)
# particles processed so far: 1
# particles processed so far: 2
# particles processed so far: 3
# particles processed so far: 58
# particles processed so far: 115
# particles processed so far: 172
# particles processed so far: 228
# particles processed so far: 285
# particles processed so far: 342
# particles processed so far: 398
# particles processed so far: 455
# particles processed so far: 512
simulate_survival: Total simulation time: 0.0 min

# particles by start_state:
0: x=[2], p=1.0 --> N=567
Block of particle indices to simulate #0: [0, 566] (N=567)
# particles processed so far: 1
# particles processed so far: 2
# particles processed so far: 3
# particles processed so far: 58
# particles processed so far: 115
# particles processed so far: 172
# particles processed so far: 228
# particles processed so far: 285
# particles processed so far: 342
# particles processed so far: 398
# particles processed so far: 455
# particles processed so far: 512
Generating trajectories for each particle until END OF SIMULATION TIME (T=71.42857142857143)...
execution time: 94.0 sec
        P(K) by MC: 5.900%, E(T) = 6.6 (simulation time = 40500.0)
        P(K) estimated by FV1: 4.683% (simulation time = 71.4)
        P(K) estimated by FV2: 13.415% (simulation time = 71.4)
        True P(K): 5.714%
        Replication 9 of 10... # particles processed so far: 1
Generating trajectories for each particle until END OF SIMULATION TIME (T=40500.0)...
# particles by start_state:
0: x=[0], p=0.5882352941176472 --> N=334
1: x=[1], p=0.411764705882353 --> N=233
Block of particle indices to simulate #0: [0, 333] (N=334)
Block of particle indices to simulate #1: [334, 566] (N=233)
simulate_expected_survival_time: Generating trajectories for 567 particles until absorption...
# particles processed so far: 1
# particles processed so far: 2
# particles processed so far: 3
# particles processed so far: 58
# particles processed so far: 115
# particles processed so far: 172
# particles processed so far: 228
# particles processed so far: 285
# particles processed so far: 342
# particles processed so far: 398
# particles processed so far: 455
# particles processed so far: 512
Total simulation time for Expected Survival Time estimation (E(T)): 0.0 min
Estimated expected survival times by start state:
0: x=[0], p=0.5882352941176472 --> N=334 T=7.239 +/- 0.322 (4.5%)
1: x=[1], p=0.411764705882353 --> N=233 T=5.933 +/- 0.370 (6.2%)
------ Total: N=567
simulate_expected_survival_time: Total simulation time: 0.0 min

# particles by start_state:
0: x=[2], p=1.0 --> N=567
```

```
Block of particle indices to simulate #0: [0, 566] (N=567)
# particles processed so far: 1
# particles processed so far: 2
# particles processed so far: 3
# particles processed so far: 58
# particles processed so far: 115
# particles processed so far: 172
# particles processed so far: 228
# particles processed so far: 285
# particles processed so far: 342
# particles processed so far: 398
# particles processed so far: 455
# particles processed so far: 512
simulate_survival: Total simulation time: 0.0 min

# particles by start_state:
0: x=[2], p=1.0 --> N=567
Block of particle indices to simulate #0: [0, 566] (N=567)
# particles processed so far: 1
# particles processed so far: 2
# particles processed so far: 3
# particles processed so far: 58
# particles processed so far: 115
# particles processed so far: 172
# particles processed so far: 228
# particles processed so far: 285
# particles processed so far: 342
# particles processed so far: 398
# particles processed so far: 455
# particles processed so far: 512
Generating trajectories for each particle until END OF SIMULATION TIME (T=71.42857142857143)...
execution time: 91.2 sec
        P(K) by MC: 5.536%, E(T) = 6.7 (simulation time = 40500.0)
        P(K) estimated by FV1: 4.575% (simulation time = 71.4)
        P(K) estimated by FV2: 12.198% (simulation time = 71.4)
        True P(K): 5.714%
        Replication 10 of 10... # particles processed so far: 1
Generating trajectories for each particle until END OF SIMULATION TIME (T=40500.0)...
# particles by start_state:
0: x=[0], p=0.5882352941176472 --> N=334
1: x=[1], p=0.411764705882353 --> N=233
Block of particle indices to simulate #0: [0, 333] (N=334)
Block of particle indices to simulate #1: [334, 566] (N=233)
simulate_expected_survival_time: Generating trajectories for 567 particles until absorption...
# particles processed so far: 1
# particles processed so far: 2
# particles processed so far: 3
# particles processed so far: 58
# particles processed so far: 115
# particles processed so far: 172
# particles processed so far: 228
# particles processed so far: 285
# particles processed so far: 342
# particles processed so far: 398
# particles processed so far: 455
# particles processed so far: 512
Total simulation time for Expected Survival Time estimation (E(T)): 0.0 min
Estimated expected survival times by start state:
0: x=[0], p=0.5882352941176472 --> N=334 T=7.293 +/- 0.308 (4.2%)
1: x=[1], p=0.411764705882353 --> N=233 T=5.638 +/- 0.372 (6.6%)
------ Total: N=567
simulate_expected_survival_time: Total simulation time: 0.0 min

# particles by start_state:
0: x=[2], p=1.0 --> N=567
Block of particle indices to simulate #0: [0, 566] (N=567)
# particles processed so far: 1
# particles processed so far: 2
# particles processed so far: 3
# particles processed so far: 58
# particles processed so far: 115
# particles processed so far: 172
# particles processed so far: 228
```

```
# particles processed so far: 285
# particles processed so far: 342
# particles processed so far: 398
# particles processed so far: 455
# particles processed so far: 512
simulate_survival: Total simulation time: 0.0 min

# particles by start_state:
0: x=[2], p=1.0 --> N=567
Block of particle indices to simulate #0: [0, 566] (N=567)
# particles processed so far: 1
# particles processed so far: 2
# particles processed so far: 3
# particles processed so far: 58
# particles processed so far: 115
# particles processed so far: 172
# particles processed so far: 228
# particles processed so far: 285
# particles processed so far: 342
# particles processed so far: 398
# particles processed so far: 455
# particles processed so far: 512
Generating trajectories for each particle until END OF SIMULATION TIME (T=71.42857142857143)...
execution time: 89.2 sec
        P(K) by MC: 5.691%, E(T) = 6.6 (simulation time = 40500.0)
        P(K) estimated by FV1: 4.671% (simulation time = 71.4)
        P(K) estimated by FV2: 11.745% (simulation time = 71.4)
        True P(K): 5.714%
Total execution time: 39.0 min
Simulation results for c=1, K=5, rhos=[0.7], (50<=N<=600), T<=71
Raw results by N:
      N replication    Pr(MC)      Time(MC)      E(T)    Pr(FV)   Time(FV)  \
1    50           1  0.065763   3571.428571  6.873666  0.010598  71.428571
1    50           2  0.056653   3571.428571  7.333581  0.045420  71.428571
1    50           3  0.069424   3571.428571  7.752060  0.038979  71.428571
1    50           4  0.059306   3571.428571  8.012776  0.030495  71.428571
1    50           5  0.055095   3571.428571  8.273113  0.046618  71.428571
1    50           6  0.049727   3571.428571  7.535544  0.023923  71.428571
1    50           7  0.055748   3571.428571  7.275008  0.039697  71.428571
1    50           8  0.065814   3571.428571  5.568150  0.075475  71.428571
1    50           9  0.048400   3571.428571  6.143795  0.045694  71.428571
1    50          10  0.060833   3571.428571  7.109948  0.020225  71.428571
2    75           1  0.059838   5357.142857  7.409746  0.021015  71.428571
2    75           2  0.064875   5357.142857  7.145593  0.042821  71.428571
2    75           3  0.069354   5357.142857  7.177443  0.041648  71.428571
2    75           4  0.054375   5357.142857  7.253945  0.031832  71.428571
2    75           5  0.051728   5357.142857  7.372886  0.035572  71.428571
2    75           6  0.054722   5357.142857  6.910593  0.022414  71.428571
2    75           7  0.061356   5357.142857  7.779453  0.046460  71.428571
2    75           8  0.057477   5357.142857  6.064476  0.054383  71.428571
2    75           9  0.051663   5357.142857  6.627983  0.039330  71.428571
2    75          10  0.062387   5357.142857  7.912942  0.027842  71.428571
3   112           1  0.060985   8000.000000  6.873718  0.028263  71.428571
3   112           2  0.058179   8000.000000  7.475278  0.037323  71.428571
3   112           3  0.064481   8000.000000  7.092182  0.046974  71.428571
3   112           4  0.052649   8000.000000  7.536498  0.033671  71.428571
3   112           5  0.053223   8000.000000  7.861759  0.036625  71.428571
3   112           6  0.057401   8000.000000  6.786561  0.031918  71.428571
3   112           7  0.063599   8000.000000  6.933399  0.044596  71.428571
3   112           8  0.054899   8000.000000  5.621526  0.053227  71.428571
3   112           9  0.054375   8000.000000  6.457939  0.035662  71.428571
3   112          10  0.063615   8000.000000  6.872825  0.035327  71.428571
..  ...         ...       ...           ...       ...       ...       ...
5   252           1  0.055652  18000.000000  6.518977  0.039517  71.428571
5   252           2  0.057110  18000.000000  7.432924  0.039134  71.428571
5   252           3  0.060726  18000.000000  7.276640  0.041089  71.428571
5   252           4  0.054983  18000.000000  6.719045  0.043063  71.428571
5   252           5  0.054756  18000.000000  6.595712  0.055319  71.428571
5   252           6  0.054541  18000.000000  6.715444  0.044714  71.428571
5   252           7  0.061333  18000.000000  6.852993  0.040379  71.428571
5   252           8  0.057369  18000.000000  6.715903  0.039566  71.428571
5   252           9  0.055200  18000.000000  6.479858  0.043705  71.428571
5   252          10  0.057864  18000.000000  6.705088  0.033714  71.428571
```

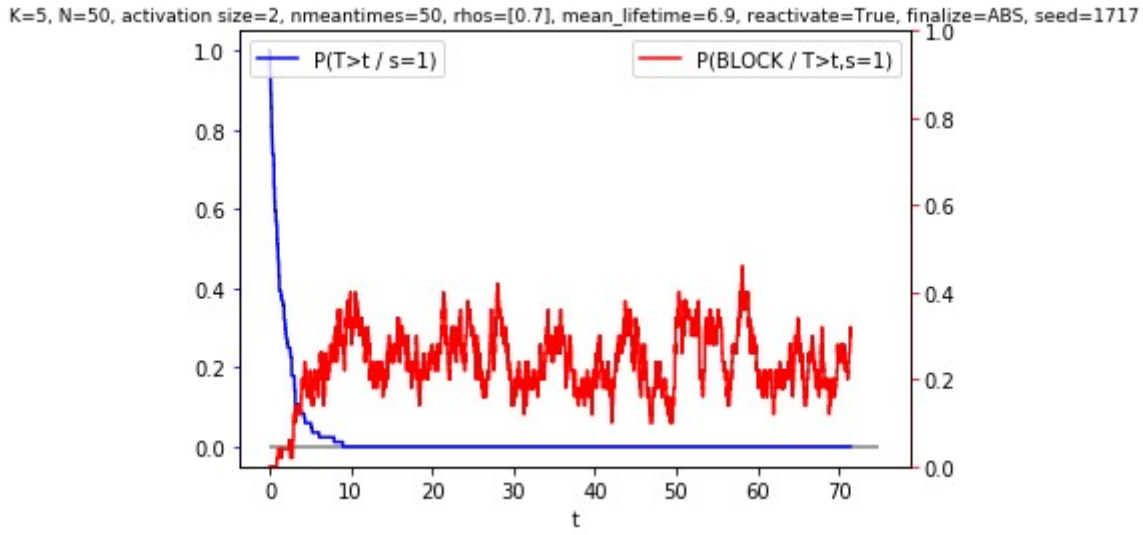
6	378	1	0.055397	27000.000000	6.814916	0.041611	71.428571
6	378	2	0.055412	27000.000000	7.444464	0.047618	71.428571
6	378	3	0.058552	27000.000000	7.053295	0.041547	71.428571
6	378	4	0.053646	27000.000000	6.740980	0.046206	71.428571
6	378	5	0.055771	27000.000000	7.035928	0.055396	71.428571
6	378	6	0.057239	27000.000000	6.908980	0.041442	71.428571
6	378	7	0.059209	27000.000000	6.717959	0.044214	71.428571
6	378	8	0.058271	27000.000000	6.895481	0.040059	71.428571
6	378	9	0.054937	27000.000000	6.703634	0.045543	71.428571
6	378	10	0.056493	27000.000000	6.660674	0.046419	71.428571
7	567	1	0.057801	40500.000000	6.660442	0.036979	71.428571
7	567	2	0.058567	40500.000000	7.399971	0.045890	71.428571
7	567	3	0.058120	40500.000000	6.829571	0.043573	71.428571
7	567	4	0.053438	40500.000000	6.924200	0.045809	71.428571
7	567	5	0.057602	40500.000000	6.979780	0.058767	71.428571
7	567	6	0.056209	40500.000000	6.790975	0.049672	71.428571
7	567	7	0.059129	40500.000000	7.027431	0.053160	71.428571
7	567	8	0.059000	40500.000000	6.636141	0.046833	71.428571
7	567	9	0.055356	40500.000000	6.702507	0.045746	71.428571
7	567	10	0.056912	40500.000000	6.612859	0.046709	71.428571

	Pr(K)	exec_time(s)
1	0.057144	5.394300
1	0.057144	5.226670
1	0.057144	5.340783
1	0.057144	5.558171
1	0.057144	6.268520
1	0.057144	6.080410
1	0.057144	5.731022
1	0.057144	5.640939
1	0.057144	6.018536
1	0.057144	8.104944
2	0.057144	9.955087
2	0.057144	8.951068
2	0.057144	10.811963
2	0.057144	9.552924
2	0.057144	8.985104
2	0.057144	10.206133
2	0.057144	9.363191
2	0.057144	9.145666
2	0.057144	9.511020
2	0.057144	11.736620
3	0.057144	16.782656
3	0.057144	13.884484
3	0.057144	15.735974
3	0.057144	18.171098
3	0.057144	15.165880
3	0.057144	14.081859
3	0.057144	20.374883
3	0.057144	17.132548
3	0.057144	16.966583
3	0.057144	13.701153
..	...	...
5	0.057144	34.467599
5	0.057144	35.009234
5	0.057144	34.194567
5	0.057144	35.050870
5	0.057144	34.223001
5	0.057144	33.642534
5	0.057144	33.695260
5	0.057144	35.467036
5	0.057144	38.431440
5	0.057144	34.181941
6	0.057144	53.859091
6	0.057144	53.331795
6	0.057144	54.051658
6	0.057144	53.391778
6	0.057144	58.212300
6	0.057144	53.709187
6	0.057144	52.435055
6	0.057144	53.430316
6	0.057144	52.731931
6	0.057144	53.557966

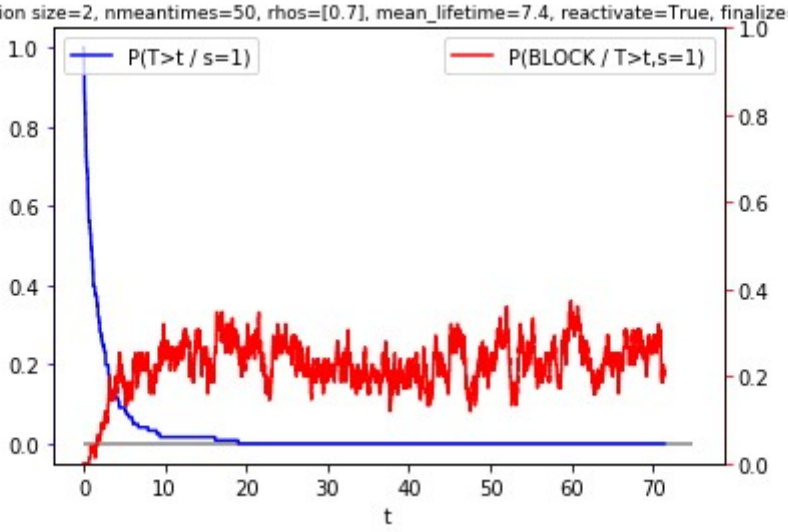
```
7   0.057144     92.669091
7   0.057144     88.085045
7   0.057144     85.627935
7   0.057144     90.154181
7   0.057144     88.939713
7   0.057144     94.341787
7   0.057144     91.484135
7   0.057144     93.954785
7   0.057144     91.176601
7   0.057144     89.243846

[70 rows x 9 columns]
Aggregated results by N:
         n             mean                 std                 min           \
    Pr(MC) Pr(FV)    Pr(MC)    Pr(FV)    Pr(MC)    Pr(FV)    Pr(MC)    Pr(FV)
N
50      10     10  0.058676  0.037712  0.006936  0.018004  0.048400  0.010598
75      10     10  0.058777  0.036332  0.005847  0.010693  0.051663  0.021015
112     10     10  0.058341  0.038358  0.004561  0.007602  0.052649  0.028263
168     10     10  0.058680  0.041894  0.003770  0.005468  0.054700  0.032519
252     10     10  0.056953  0.042020  0.002444  0.005590  0.054541  0.033714
378     10     10  0.056493  0.045006  0.001788  0.004470  0.053646  0.040059
567     10     10  0.057213  0.047314  0.001789  0.005764  0.053438  0.036979

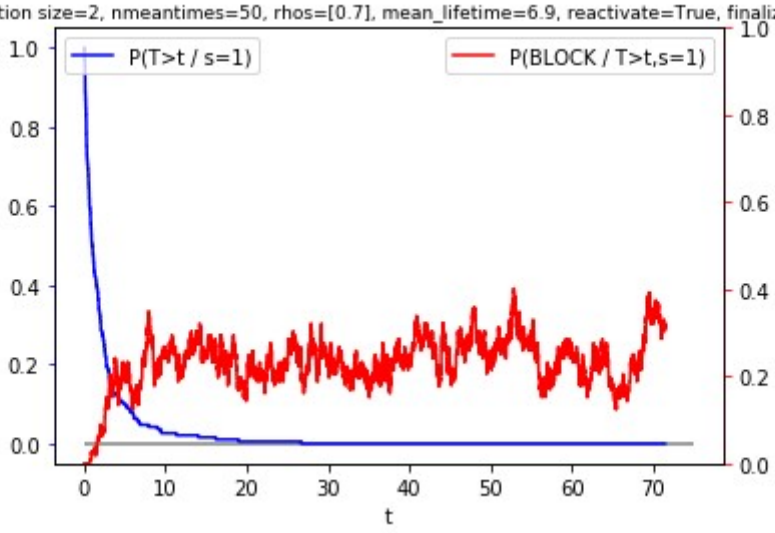
          max                   SE
       Pr(MC)    Pr(FV)    Pr(MC)    Pr(FV)
N
50   0.069424  0.075475  0.002193  0.005693
75   0.069354  0.054383  0.001849  0.003381
112  0.064481  0.053227  0.001442  0.002404
168  0.065492  0.052510  0.001192  0.001729
252  0.061333  0.055319  0.000773  0.001768
378  0.059209  0.055396  0.000565  0.001413
567  0.059129  0.058767  0.000566  0.001823
C:\ProgramData\Anaconda\Anaconda3\lib\site-packages\pandas\core\groupby.py:4291: FutureWarning: using a
dict with renaming is deprecated and will be removed in a future version
  return super(DataFrameGroupBy, self).aggregate(arg, *args, **kwargs)
```



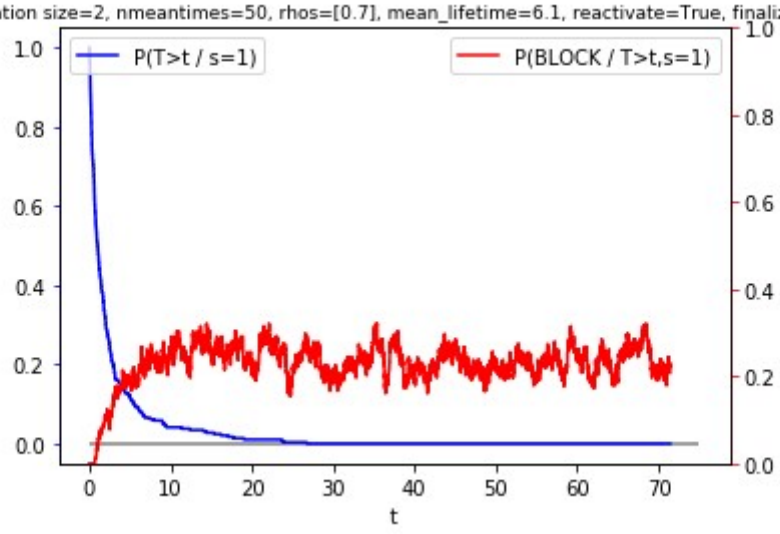
K=5, N=75, activation size=2, nmeantimes=50, rhos=[0.7], mean_lifetime=7.4, reactivate=True, finalize=ABS, seed=1717



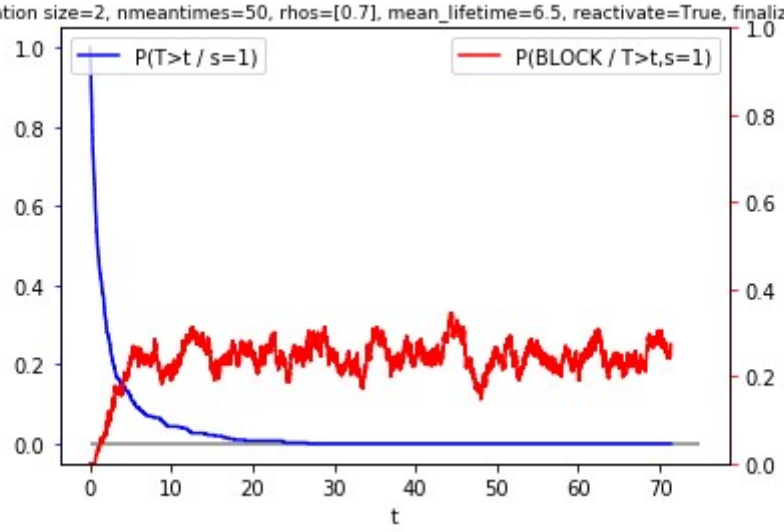
K=5, N=112, activation size=2, nmeantimes=50, rhos=[0.7], mean_lifetime=6.9, reactivate=True, finalize=ABS, seed=1717



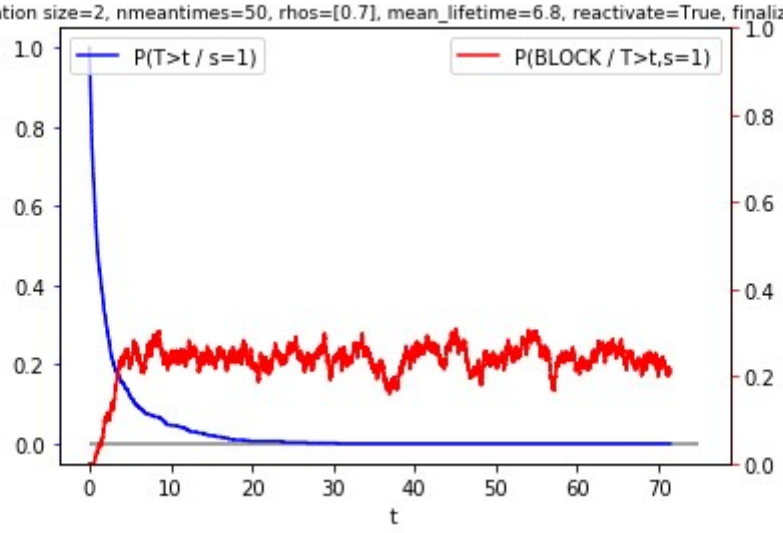
K=5, N=168, activation size=2, nmeantimes=50, rhos=[0.7], mean_lifetime=6.1, reactivate=True, finalize=ABS, seed=1717



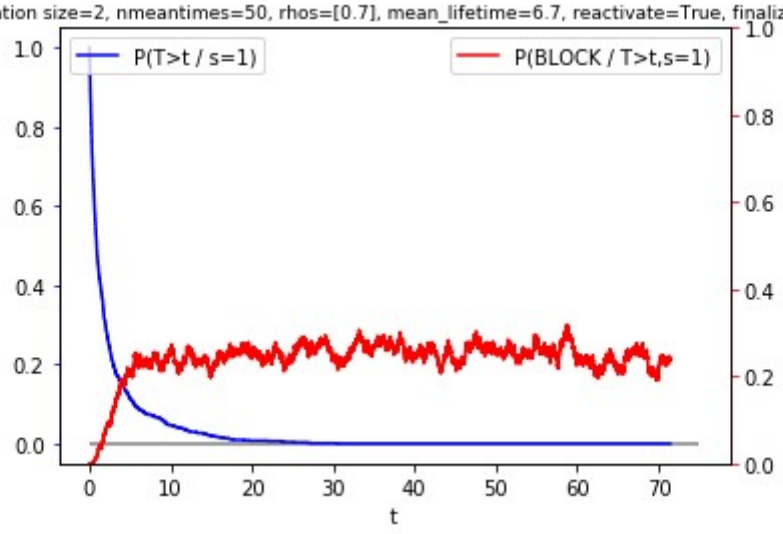
K=5, N=252, activation size=2, nmeantimes=50, rhos=[0.7], mean_lifetime=6.5, reactivate=True, finalize=ABS, seed=1717

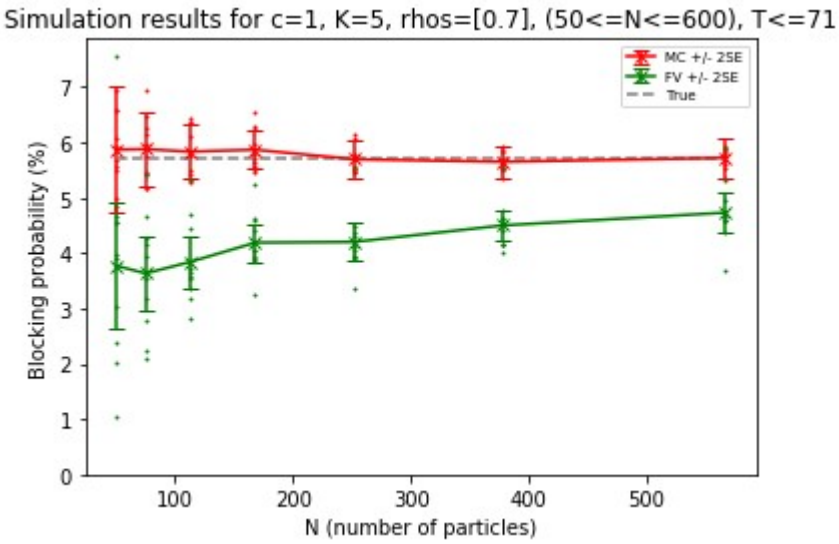


K=5, N=378, activation size=2, nmeantimes=50, rhos=[0.7], mean_lifetime=6.8, reactivate=True, finalize=ABS, seed=1717



K=5, N=567, activation size=2, nmeantimes=50, rhos=[0.7], mean_lifetime=6.7, reactivate=True, finalize=ABS, seed=1717






```
In [2]: results
Out[2]:
      N replication    Pr(MC)      Time(MC)      E(T)    Pr(FV)   Time(FV)  \
1    50           1  0.065763   3571.428571  6.873666  0.010598  71.428571
1    50           2  0.056653   3571.428571  7.333581  0.045420  71.428571
1    50           3  0.069424   3571.428571  7.752060  0.038979  71.428571
1    50           4  0.059306   3571.428571  8.012776  0.030495  71.428571
1    50           5  0.055095   3571.428571  8.273113  0.046618  71.428571
1    50           6  0.049727   3571.428571  7.535544  0.023923  71.428571
1    50           7  0.055748   3571.428571  7.275008  0.039697  71.428571
1    50           8  0.065814   3571.428571  5.568150  0.075475  71.428571
1    50           9  0.048400   3571.428571  6.143795  0.045694  71.428571
1    50          10  0.060833   3571.428571  7.109948  0.020225  71.428571
2    75           1  0.059838   5357.142857  7.409746  0.021015  71.428571
2    75           2  0.064875   5357.142857  7.145593  0.042821  71.428571
2    75           3  0.069354   5357.142857  7.177443  0.041648  71.428571
2    75           4  0.054375   5357.142857  7.253945  0.031832  71.428571
2    75           5  0.051728   5357.142857  7.372886  0.035572  71.428571
2    75           6  0.054722   5357.142857  6.910593  0.022414  71.428571
2    75           7  0.061356   5357.142857  7.779453  0.046460  71.428571
2    75           8  0.057477   5357.142857  6.064476  0.054383  71.428571
2    75           9  0.051663   5357.142857  6.627983  0.039330  71.428571
2    75          10  0.062387   5357.142857  7.912942  0.027842  71.428571
3   112           1  0.060985   8000.000000  6.873718  0.028263  71.428571
3   112           2  0.058179   8000.000000  7.475278  0.037323  71.428571
3   112           3  0.064481   8000.000000  7.092182  0.046974  71.428571
3   112           4  0.052649   8000.000000  7.536498  0.033671  71.428571
3   112           5  0.053223   8000.000000  7.861759  0.036625  71.428571
3   112           6  0.057401   8000.000000  6.786561  0.031918  71.428571
3   112           7  0.063599   8000.000000  6.933399  0.044596  71.428571
3   112           8  0.054899   8000.000000  5.621526  0.053227  71.428571
3   112           9  0.054375   8000.000000  6.457939  0.035662  71.428571
3   112          10  0.063615   8000.000000  6.872825  0.035327  71.428571
..  ...         ...       ...           ...       ...       ...        ...
5   252           1  0.055652  18000.000000  6.518977  0.039517  71.428571
5   252           2  0.057110  18000.000000  7.432924  0.039134  71.428571
5   252           3  0.060726  18000.000000  7.276640  0.041089  71.428571
5   252           4  0.054983  18000.000000  6.719045  0.043063  71.428571
5   252           5  0.054756  18000.000000  6.595712  0.055319  71.428571
5   252           6  0.054541  18000.000000  6.715444  0.044714  71.428571
5   252           7  0.061333  18000.000000  6.852993  0.040379  71.428571
5   252           8  0.057369  18000.000000  6.715903  0.039566  71.428571
5   252           9  0.055200  18000.000000  6.479858  0.043705  71.428571
5   252          10  0.057864  18000.000000  6.705088  0.033714  71.428571
6   378           1  0.055397  27000.000000  6.814916  0.041611  71.428571
6   378           2  0.055412  27000.000000  7.444464  0.047618  71.428571
6   378           3  0.058552  27000.000000  7.053295  0.041547  71.428571
6   378           4  0.053646  27000.000000  6.740980  0.046206  71.428571
6   378           5  0.055771  27000.000000  7.035928  0.055396  71.428571
6   378           6  0.057239  27000.000000  6.908980  0.041442  71.428571
6   378           7  0.059209  27000.000000  6.717959  0.044214  71.428571
```

6	378	8	0.058271	27000.000000	6.895481	0.040059	71.428571
6	378	9	0.054937	27000.000000	6.703634	0.045543	71.428571
6	378	10	0.056493	27000.000000	6.660674	0.046419	71.428571
7	567	1	0.057801	40500.000000	6.660442	0.036979	71.428571
7	567	2	0.058567	40500.000000	7.399971	0.045890	71.428571
7	567	3	0.058120	40500.000000	6.829571	0.043573	71.428571
7	567	4	0.053438	40500.000000	6.924200	0.045809	71.428571
7	567	5	0.057602	40500.000000	6.979780	0.058767	71.428571
7	567	6	0.056209	40500.000000	6.790975	0.049672	71.428571
7	567	7	0.059129	40500.000000	7.027431	0.053160	71.428571
7	567	8	0.059000	40500.000000	6.636141	0.046833	71.428571
7	567	9	0.055356	40500.000000	6.702507	0.045746	71.428571
7	567	10	0.056912	40500.000000	6.612859	0.046709	71.428571

	Pr(K)	exec_time(s)
1	0.057144	5.394300
1	0.057144	5.226670
1	0.057144	5.340783
1	0.057144	5.558171
1	0.057144	6.268520
1	0.057144	6.080410
1	0.057144	5.731022
1	0.057144	5.640939
1	0.057144	6.018536
1	0.057144	8.104944
2	0.057144	9.955087
2	0.057144	8.951068
2	0.057144	10.811963
2	0.057144	9.552924
2	0.057144	8.985104
2	0.057144	10.206133
2	0.057144	9.363191
2	0.057144	9.145666
2	0.057144	9.511020
2	0.057144	11.736620
3	0.057144	16.782656
3	0.057144	13.884484
3	0.057144	15.735974
3	0.057144	18.171098
3	0.057144	15.165880
3	0.057144	14.081859
3	0.057144	20.374883
3	0.057144	17.132548
3	0.057144	16.966583
3	0.057144	13.701153
..	...	...
5	0.057144	34.467599
5	0.057144	35.009234
5	0.057144	34.194567
5	0.057144	35.050870
5	0.057144	34.223001
5	0.057144	33.642534
5	0.057144	33.695260
5	0.057144	35.467036
5	0.057144	38.431440
5	0.057144	34.181941
6	0.057144	53.859091
6	0.057144	53.331795
6	0.057144	54.051658
6	0.057144	53.391778
6	0.057144	58.212300
6	0.057144	53.709187
6	0.057144	52.435055
6	0.057144	53.430316
6	0.057144	52.731931
6	0.057144	53.557966
7	0.057144	92.669091
7	0.057144	88.085045
7	0.057144	85.627935
7	0.057144	90.154181
7	0.057144	88.939713
7	0.057144	94.341787
7	0.057144	91.484135

```
7   0.057144     93.954785
7   0.057144     91.176601
7   0.057144     89.243846

[70 rows x 9 columns]
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In [3]: results_agg

Out[3]:

	n		mean		std		min		\
	Pr(MC)	Pr(FV)	Pr(MC)	Pr(FV)	Pr(MC)	Pr(FV)	Pr(MC)	Pr(FV)	
N									
50	10	10	0.058676	0.037712	0.006936	0.018004	0.048400	0.010598	
75	10	10	0.058777	0.036332	0.005847	0.010693	0.051663	0.021015	
112	10	10	0.058341	0.038358	0.004561	0.007602	0.052649	0.028263	
168	10	10	0.058680	0.041894	0.003770	0.005468	0.054700	0.032519	
252	10	10	0.056953	0.042020	0.002444	0.005590	0.054541	0.033714	
378	10	10	0.056493	0.045006	0.001788	0.004470	0.053646	0.040059	
567	10	10	0.057213	0.047314	0.001789	0.005764	0.053438	0.036979	

	max		SE	
	Pr(MC)	Pr(FV)	Pr(MC)	Pr(FV)
N				
50	0.069424	0.075475	0.002193	0.005693
75	0.069354	0.054383	0.001849	0.003381
112	0.064481	0.053227	0.001442	0.002404
168	0.065492	0.052510	0.001192	0.001729
252	0.061333	0.055319	0.000773	0.001768
378	0.059209	0.055396	0.000565	0.001413
567	0.059129	0.058767	0.000566	0.001823

In [4]: