[Viola Chen]
[Andrew ID:yitaoche]

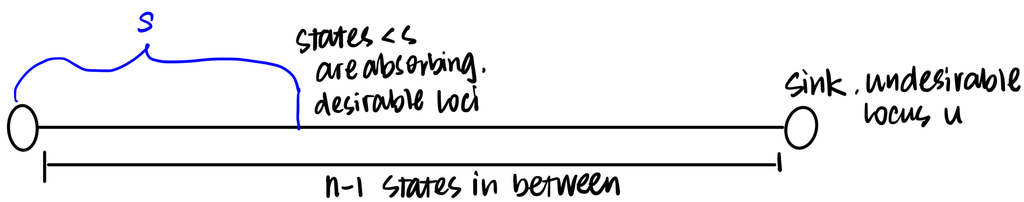
Model setup and fitness distribution

Recall from last time that we decided to update our model setup to a simpler and analytically solvable Markov model. The goal is for it to be

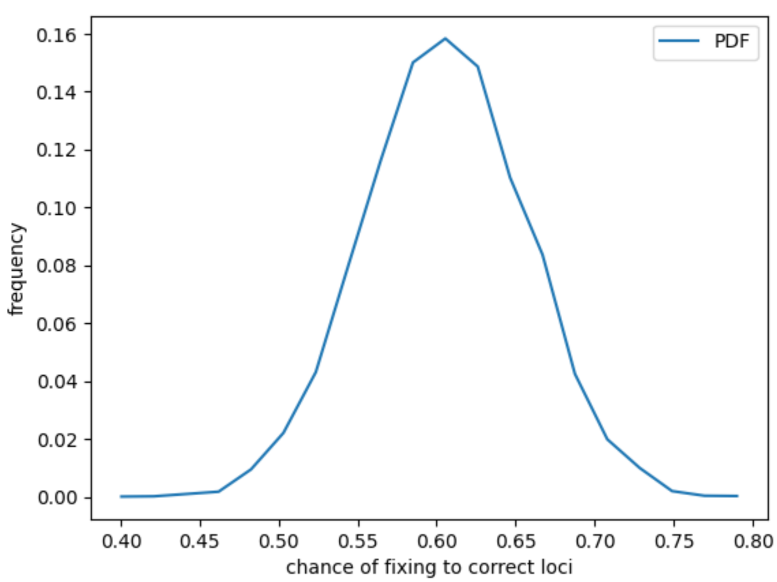
1. analytically predictable so we can always compare our model with the analytical results
2. less stochastic with fewer model parameters

one-dimensional Markov model

To start off, and to make things simpler, we set up the following one dimensional Markov model, assuming a random walk with probability 0.5 to both sides,some states are absorbing, and the intermediate states are omitted.

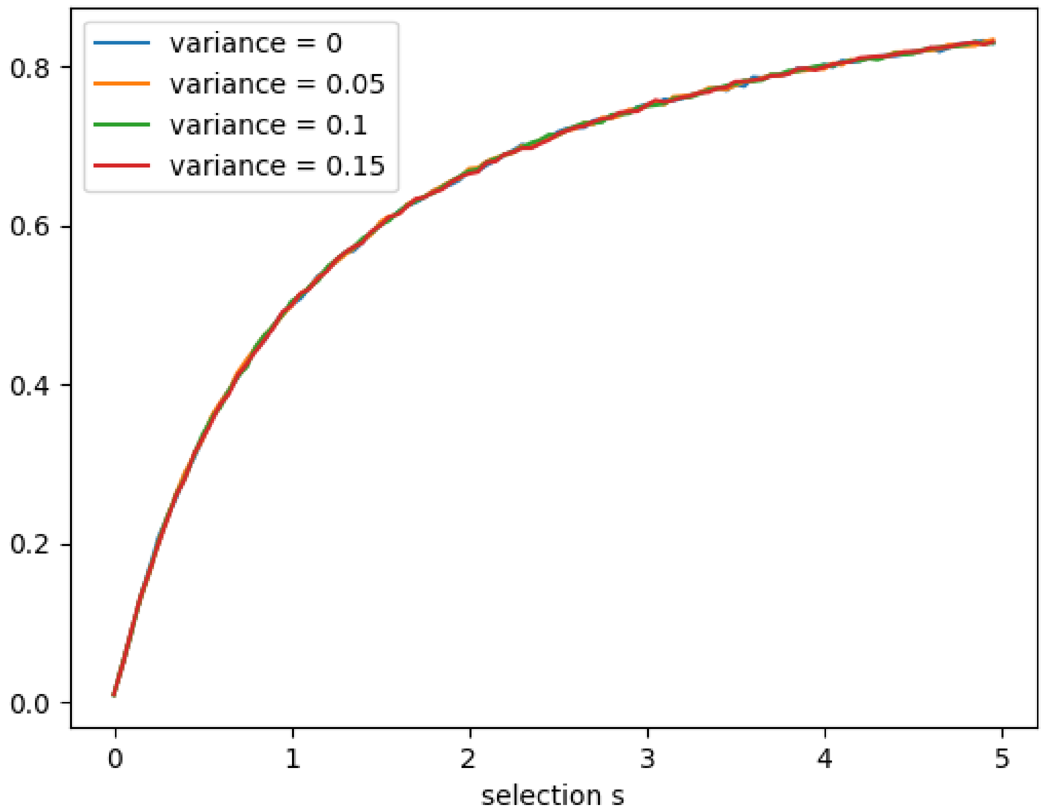


In this model, agents are uniformly randomly initialized to one of the states, and eventually they will converge to either the desirable loci or the undesirable sink.
To study the distribution of "convergence" in this model, we did many runs and plotted the probability density function of the distribution.



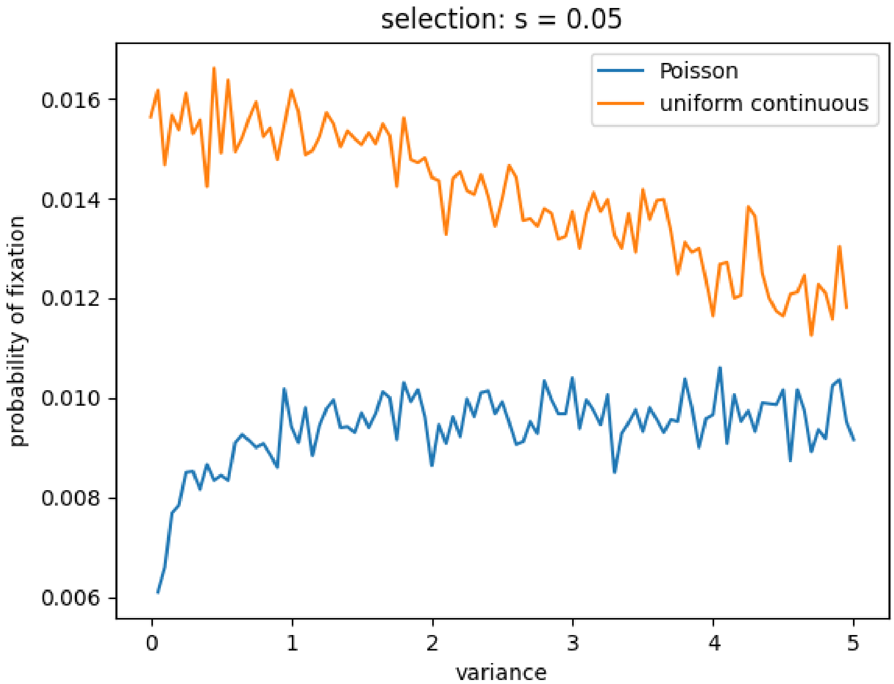
The bell shape is expected since we did a decent number of runs, but the specific distribution still needs more work to be figured out. Knowing this distribution is important in aiding simulations of birth-death on a network graph. The mean is about 0.6, which is consistent with analytical solution when setting $s = 20, n = 100$. The standard deviation based on sample variance is approximately 0.05.

Fixation probability with different selection strength and different variance



Unfortuantely it seems like the variance does not make any differences here.

Fixation probability under different fitness distribution for mutant



We expected that the distribution of the fitness mean may have an effect on fixation probability, so we experimented a few distributions, discrete or continuous, across different variance. (Previous simulations done shows that the mean has no effect on fixation probability).
This figure is interesting but more work need to be done to understand intuitively the reason behind this.