Activities I: Bug Dynamics: The Logistic Map

6.2 Checking Validity of Model

You should have found by now that with positive growth rates λ, this model does yield a variety of stable populations, with the bugs approaching the maximum population more rapidly for larger values of λ. This also serves in part as a validation of the model, that is, a test that this simple model predicts stable populations. Next, check the validity of this model, that is, that it is general and is not highly dependent upon the specific values of the parameters:

1. For fixed values of the growth rate λ and initial population N_0, try different values for the maximum population N_{max}. Verify that increasing values of N_{max} lead to proportionally larger maximum populations, but do not affect that rate at which the maximum is attained. The transients may be affected.
2. For a fixed value of maximum population N_{max} and growth rate λ, try different values for the seed population N_0. Verify that differing values of N_0 do not affect the values of the maximum populations, although it may take longer to reach that maximum. Again, transients may be affected, but not the values for the stable populations.
3. For several combinations of N_{max}, λ and N_0, record the number of cycles that the system passes through before a stable population is obtained. (Variations of ~3% can be considered stable for this investigation.) This number will be useful when later when we create a bifurcation plot.