1. Consider the LPA model described on page 84. What are the dimensions of the various parameters ($b$, $c_{eas}$, $c_{el}$, $c_{pa}$, $d_{as}$, $d_{i}$) appearing in this model?

2. Write a model describing a situation analogous to that of the LPA model (with cannibalism), but such that the time for a pupa to become an adult is twice as long as the time it takes for a larva to pupate.

3. Write a model describing a population with two subgroups: juvenile and adults, assuming that adults eat some of their own eggs, and that it takes as long for a chick to be born as it takes for a chick to mature into an adult. You can use an exponential term similar to that appearing in the LPA model to describe cannibalism.

4. Consider the following model.

\[ J(t + \Delta t) = bA(t) \exp(-cA(t)) \]

\[ A(t + \Delta t) = (1 - d_{J})J(t) + (1 - d_{A})A(t), \]

where $b$, $d_{J}$ and $d_{A}$ are positive parameters.

a. Describe in words a situation modeled by the above equations.

b. Under what condition is there a non-trivial fixed point for this model? What is the biological significance of this condition?

c. Discuss the stability of the fixed points of this model.