Assignment 6: Life Cycle Diagrams and Projection Matrices

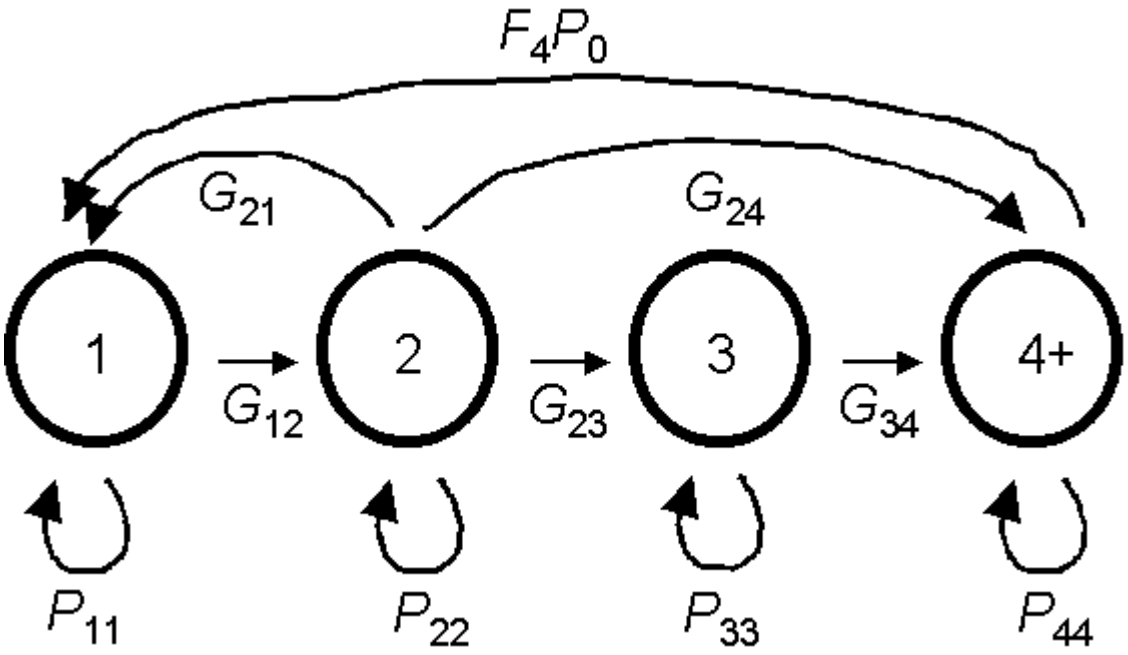
Life-cycle diagrams are generally structured in one of three ways: by age, stage or size. Age or Leslie models typically have no self-loops. Stage or Lefkovitch models have self-loops on the nodes. Size models have self-loops and arcs that permit regression back to earlier nodes. Projection matrices allow one to take a life cycle diagram and use it to calculate population size at a future time. Both life-cycle diagrams and projection matrices are a fundamental part of demographic analyses.

Objective: The purpose of this assignment is to get you working with life-cycle diagrams and matrices, and to familiarize you with their structure.

Question 1: The following life table is a simple age-structured model that could be used to model many different taxa. Draw nodes, arcs and self-loops to convert this life table to a life cycle diagram, and then develop the associated projection matrix. First, develop this population model as if it were based on a prebreeding population census. Second, create a second life cycle diagram and projection matrix for this population based on post-breeding population surveys in the fall. *Hint:* the timing of census will determine whether you will include a node for young of the year or not.

Age (x)	Survival (p_x)	Fecundity (m_x)
0	P_0	0
1	P_1	0
2	P_2	0
3	P_3	0
4	P_4	F_4
5	P_5	F_5
6+	P_{6+}	F_{6+}

Question 2: The following life cycle diagram is an example of a size-structured model for a hypothetical plant. The four nodes correspond to different size categories: 1 = 0.1 to 2.0 m in diameter, 2 = 2.1 to 4.0 m, 3 = 4.1 to 6.0 m and 4 = > 6 m. The different arcs include growth or regression (*G*), survival within a size class (*P*) and fecundity (*F*). Can you develop the projection matrix for this prebreeding model? *Hints*: The columns and rows of the projection matrix are labelled population size at time *t* and *t+1*, respectively. To identify the nodes that contribute to changes in population size in a particular node, look at the arrowheads on the arcs and self-loops coming into the node.



Hand in: Copies of your life-cycle diagrams and matrices. Hand written notes are fine but must be legible.