DIMACS
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Theoretical Computer Science

DIMACS EDUCATIONAL MODULE SERIES

MODULE 07-3
Using Population Models in the Teaching of Eigenvalues
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Module Description Information

- **Title:**

  Using Population Models in the Teaching of Eigenvalues

- **Author(s):**

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- **Abstract:**

Leslie Matrix and Modified Leslie Matrix (Lefkovitch Matrix) are discussed in this module. These two matrices help us to discover that how the population structure changes with time. We take the approach of introducing the concepts through the real life examples i.e. we use biological data available for different populations. The examples and questions are constructed in such a way that after going through these, hopefully, the students will appreciate the importance of the eigenvalues and eigenvectors. This module can be used in a Linear Algebra class or any other appropriate level math course. A project is also added which one can use as a group project.

- **Informal Description:**

In this module we discuss how one can use matrix theory and eigenvalues to describe the way the population structure varies over time. We will use the real life examples (biological models) to explain and introduce concepts. In particular we will discuss two methods to study the population structure: Leslie Matrix and Modified Leslie Matrix (Lefkovitch Matrix). Leslie matrix is based on age-specific biological models while Lefkovitch matrix is based on stage-specific biological models. Exploratory exercises are presented throughout the module for the reader to work on whenever a new concept is introduced.

- **Target Audience:**

This module is aimed at the undergraduate students who are taking Linear Algebra, Differential Equations, Dynamical Systems or Mathematical Modeling course. Usually the students registered in these courses are at sophomore, junior or senior level.

- **Prerequisites:**

Basic knowledge of matrix theory like matrix operations, independent/dependent vectors, basis vectors, eigenvectors, eigenvalues and some probability theory.

- **Mathematical Field:**

Linear Algebra, Differential Equations, Dynamical Systems, Mathematical Modeling.

- **Application Areas:**

Dynamical systems, Biology, Ecology

- **Mathematics Subject Classification:**

MSC (2000): 37N25, 92B05, 78A70, 97D80

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- **Other DIMACS modules related to this module:**

None