

Leslie Matrices are tables used for population projection. A transition matrix is a table with rows and columns showing the expected number of people who END up in the state with the label on the ROW per person at the START in the state with the label on the COLUMN. A Leslie matrix is a special case of a transition matrix in which the states correspond to age groups. We begin by defining a transition matrix. Although the choice of assumptions about the future course of fertility, mortality, marriage, divorce, and immigration is fraught with problems, the methods for using those assumptions to calculate future population sizes and age distributions are very well-developed and satisfactory. Much of the mathematics of projection was developed treating time and age as continuous variables, but projections on computers generally are done with populations split into age groups and with discrete steps of time. The choice of credible assumptions about vital rates is as much a part of the art and science of projection as are the formulas we use to implement the calculations. Sophisticated projections treat a population classified by many characteristics including race, ethnicity, marital status, income, education, and locality as well as sex and age. Current thinking about plausible assumptions for predicting populations around the world is presented in a recent book called *Beyond Six Billion* edited by Bongaarts and Bulatao (2000). Official presentations of projections are often filled with disclaimers cautioning the reader that projections are not predictions. It largely failed to predict the continuing trend toward lower mortality in industrialized countries. But the basic ideas are well-illustrated by simpler projections which focus on a single sex and on all races and ethnicities together and which subdivide the population only by age. When demographers project a distribution of marital status, parity, educational level, or other variables into the future, they use general transition matrices.

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The kind of calculations we shall be doing are closely related to the subject of Markov chains in probability theory. Generally speaking, however, we shall be projecting expected numbers of people rather than probabilities, and that makes the demographic theory slightly different from the theory of Markov chains. They do not tell us what the world will be like but only what the world would be like if a particular set of stated assumptions about future vital rates turned out to be true. Here we study the discrete versions of projection, which use matrices and project populations one step at a time. are called "Leslie matrices". It was P. H. Leslie who published a description of their use in 1945. The same theory was developed a few years earlier by H. Bernardelli and by E. G. Lewis, but their work did not become widely known until Leslie published his. Leslie matrices are a special case of "transition matrices". Such disclaimers, however, are disingenuous.

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