••• **P6.10** *The Game of Life* is a well-known mathematical game that gives rise to amazingly complex behavior, although it can be specified by a few simple rules. (It is not actually a game in the traditional sense, with players competing for a win.) Here are the rules. The game is played on a rectangular board. Each square can be either empty or occupied. At the beginning, you can specify empty and occupied cells in some way; then the game runs automatically. In each *generation*, the next generation is computed. A new cell is born on an empty square if it is surrounded by exactly three occupied neighbor cells. A cell dies of overcrowding if it is surrounded by four or more neighbors, and it dies of loneliness if it is surrounded by zero or one neighbor. A neighbor is an occupant of an adjacent square to the left, right, top, or bottom or in a diagonal direction. Figure 16 shows a cell and its neighbor cells.
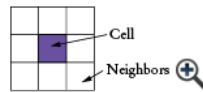
**Figure 16** Neighborhood of a Cell

Many configurations show interesting behavior when subjected to these rules. Figure 17 shows a *glider*, observed over five generations. After four generations, it is transformed into the identical shape, but located one square to the right and below.
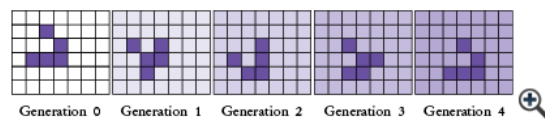
Generation 0  Generation 1  Generation 2  Generation 3  Generation 4

**Figure 17** Glider

One of the more amazing configurations is the glider gun: a complex collection of cells that, after 30 moves, turns back into itself and a glider (see Figure 18).

Program the game to eliminate the drudgery of computing successive generations by hand. Use a two-dimensional array to store the rectangular configuration. Write a program that shows successive generations of the game. Ask the user to specify the original configuration, by typing in a configuration of spaces and o characters.
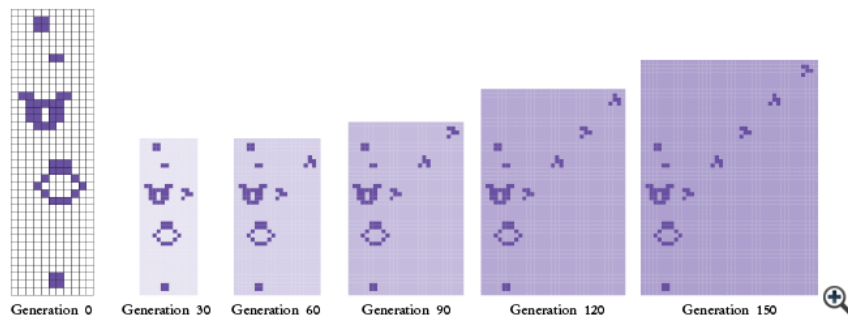
Generation 0  Generation 30  Generation 60  Generation 90  Generation 120  Generation 150

**Figure 18** Glider Gun