3.3 EXAMPLE PROBLEMS

TOY PROBLEMS
REAL-WORLD PROBLEMS

The range of task environments that can be characterized by well-defined problems is vast. We can distinguish between so-called **toy problems**, which are intended to illustrate or exercise various problem-solving methods, and so-called **real-world problems**, which tend to be more difficult and whose solutions people actually care about. In this section, we will give examples of both. By nature, toy problems can be given a concise, exact description. This means that they can be easily used by different researchers to compare the performance of algorithms. Real-world problems, on the other hand, tend not to have a single agreed-upon description, but we will attempt to give the general flavor of their formulations.

Toy problems

The 8-puzzle

8-PUZZLE

The **8-puzzle**, an instance of which is shown in Figure 3.4, consists of a 3×3 board with eight numbered tiles and a blank space. A tile adjacent to the blank space can slide into the space. The object is to reach the configuration shown on the right of the figure. One important trick is to notice that rather than use operators such as "move the 4 tile into the blank space," it is more sensible to have operators such as "the blank space changes places with the tile to its left." This is because there are fewer of the latter kind of operator. This leads us to the following formulation:

- ◊ **States**: a state description specifies the location of each of the eight tiles in one of the nine squares. For efficiency, it is useful to include the location of the blank.
- ◊ **Operators**: blank moves left, right, up, or down.
- ◊ **Goal test**: state matches the goal configuration shown in Figure 3.4.
- ◊ **Path cost**: each step costs 1, so the path cost is just the length of the path.

SLIDING-BLOCK PUZZLES

The 8-puzzle belongs to the family of **sliding-block puzzles**. This general class is known to be NP-complete, so one does not expect to find methods significantly better than the search

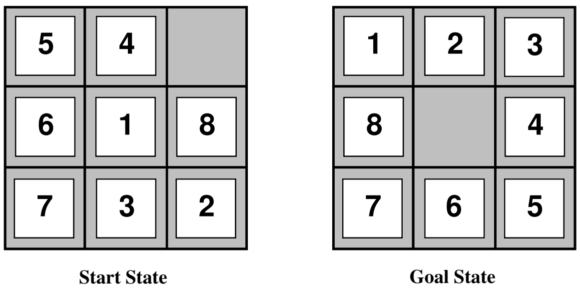

Figure 3.4 A typical instance of the 8-puzzle.