

# Chapter 2

## Probability and probability distributions

### 2.1 INTRODUCTION

The methods for reducing and analyzing data described in the previous chapter are not only useful in helping understand what happened in the past. Patterns, trends, and characteristics identified through studies of past data can be of assistance in establishing the likelihood of future events.

For example, life insurance companies invest heavily in studies of past patterns of mortality. The studies have a certain historical interest, but their main use is in allowing the companies to estimate the number of their customers that are expected to die next year, the year after, etc. These estimates, in turn, influence the premiums which the companies must charge if they are to meet the claims arising from these deaths in the future and still make a profit.

In this chapter, we turn away from studying the past for its own sake, and, among other issues, consider how it may be used to estimate the likelihood of future events.

### 2.2 PROBABILITY

It is impossible to think of any course of action, decision, or choice whose consequences do not depend on the outcomes of some “random process.” By “random process”—and here we make no attempt to be precise—we understand any physical or social process the outcomes of which cannot be predicted with certainty. For example, the toss of a coin may be described as a random process having two possible outcomes—“heads” and “tails.” The roll of a die, the spin of a roulette wheel, the draw of a bridge hand or of a lottery ticket, tomorrow’s closing price of a certain stock at the stock exchange, the number of units of a particular product demanded by customers during a one-month period—all these can be viewed as processes with random outcomes.

In many cases, there is some indication of the likelihood or *probability* that a particular outcome will occur. The term “probability” is part of our everyday speech. We say, for example, that the probability of heads in the