How Probable?

How do we interpret such terms as *probable*, *improbable*, or *extremely improbable*? The FAA interprets these terms as follows.

- *Probable:* A probability on the order of 0.00001 or greater for each hour of flight. Such events are expected to occur several times during the operational life of each airplane.
- *Improbable:* A probability on the order of 0.00001 or less. Such events are not expected to occur during the total operational life of a single airplane of a particular type, but may occur during the total operational life of all airplanes of a particular type.
- *Extremely improbable:* A probability on the order of 0.000000001 or less. Such events are so unlikely that they need not be considered to ever occur.

the subject is randomly selected, each test result is equally likely, so we can apply the classical approach as follows:

$$P(\text{positive test result from Table 4-1}) = \frac{\text{number of positive test results}}{\text{total number of results}}$$

$$= \frac{134}{1000} = 0.134$$

Example 4 Classical Probability: Three Children of the Same Gender

When three children are born, the sample space of genders is as shown in Example 1: {bbb, bbg, bgb, bgg, gbb, gbg, ggb, ggg}. If boys and girls are equally likely, then the eight simple events are equally likely. Assuming that boys and girls are equally likely, find the probability of getting three children all of the same gender when three children are born. (In reality, a boy is slightly more likely than a girl.)

Solution

The sample space {bbb, bbg, bgb, bgg, gbb, gbg, ggb, ggg} in this case includes equally likely outcomes. Among the eight outcomes, there are exactly two in which the three children are of the same gender: bbb and ggg. We can use the classical approach to get

$$P(\text{three children of the same gender}) = \frac{2}{8} = 0.25$$

Example 5 Subjective Probability: Professorial Attire

Find the probability that in your next statistics class, the professor wears a hat with a huge feather protruding from the top.

Solution

The sample space consists of two simple events: Your professor wears a hat with a huge feather protruding from the top, or does not. We can't use the relative frequency approach because we lack data on past results. We can't use the classical approach because the two possible outcomes are events that are not equally likely. We are left with making a subjective estimate. The event is possible, but highly unlikely, so we can estimate its probability as something like 0.000001.

Example 6 Subjective Probability: Stuck in an Elevator

What is the probability that you will get stuck in the next elevator that you ride?

Solution

In the absence of historical data on elevator failures, we cannot use the relative frequency approach. There are two possible outcomes (becoming stuck or not becoming stuck), but they are not equally likely, so we cannot use the classical approach. That leaves us with a subjective estimate. In this case, experience suggests that the probability is quite small. Let's estimate it to be, say, 0.0001 (equivalent to 1 chance in 10,000). That subjective estimate, based on our general knowledge, is likely to be in the general ballpark of the true probability.