

Probability**And****Statistics*****Introduction:***

Statistics is used in almost all fields of human endeavor. In sports, for example, a statistician may keep records of the number of yards a running back gains during a football game, or the number of hits a baseball player gets in a season. In other areas, such as public health, an administrator might be concerned with the number of residents who contract a new strain of flu virus during a certain year. In education, a researcher might want to know if new methods of teaching are better than old ones. These are only a few examples of how statistics can be used in various occupations.

Furthermore, statistics is used to analyze the results of surveys and as a tool in scientific research to make decisions based on controlled experiments. Other uses of statistics include operations research, quality control, estimation, and prediction.

Most people become familiar with probability and statistics through radio, television, newspapers, and magazines. For example, the following statements were found in newspapers:

1. Nearly one in seven U.S. families are struggling with bills from medical expenses even though they have health insurance.
2. Eating 10 grams of fiber a day reduces the risk of heart attack by 14%.
3. The average credit card debt per household in 2003 was \$9205.
4. About 15% of men in the United States are left handed and 9% of women are left handed.
5. The median age of couples who watch jay leno is 48.1 years.

Definitions and basic concepts:

- **Probability:** as a general concept can be defined as the chance of an event occurring.
- **Probability experiment:** is a chance process that leads to well-defined results called outcomes.
- **Outcome:** is the result of a single trial of a probability experiment.
- **Sample space:** is the set all possible outcomes of probability experiment and denoted by (Ω) .
- **Event:** An *event* consists of a set of outcomes of a probability experiment.
- **Equally likely events:** are events that have the same probability of occurring.

Example 1:

Toss **one** coin

$$\Omega = \{\text{Head, Tail}\}.$$

Example 2:

Toss **two** coins

$$\Omega = \{\text{Head Head, Tail Tail, Head Tail, Tail Head}\}.$$

Example 3:

Roll a die

$$\Omega = \{1, 2, 3, 4, 5, 6\}.$$

**Example 4:**

Answer a true, false question

$$\Omega = \{\text{true, false}\}$$

Example 5:

Find the sample space for the **gender** of the children if a family has **three** children. Use **B** for boy and **G** for girl.

$$\Omega = \{\text{BBB, BBG, BGB, GBB, GGG, GGB, GBG, BGG}\}.$$

Formula for classical probability:

The probability of any event E is:
$$\frac{\text{Number of outcomes in } E}{\text{Total number of outcomes in the sample space}}$$

This probability is denoted by $P(E) = \frac{n(E)}{n(\Omega)}$.

This probability is called **classical probability**, and it uses the sample space Ω .

Example 4:

If a family has three children, find the **probability** that all the children are **girls** (Example 5).

Solution:

The sample space of the gender of children for a family that has three children is:

$$\Omega = \{\text{BBB, BBG, BGB, GBB, GGG, GGB, GBG, BGG}\}.$$

Since there is one way in eight possibilities for all three children by girls, $P(\text{GGG}) = \frac{1}{8}$.

