

## Introduction

### Definitions:

**Statistics:** is the branch of scientific inquiry that provides methods for organizing and summarizing data, and for using information in the data to draw various conclusions.

**الاحصاء:** هو فرع من البحث العلمي الذي يوفر اساليب لتنظيم وتلخيص البيانات واستخدام المعلومات في البيانات لاستخلاص استنتاجات مختلفة.

**Descriptive Statistics:** The part of statistics that deals with methods for organization and summarization of data. Descriptive methods can be used with list of all population members (a census), or when the data consists of a samples.

**الاحصاء الوصفي:** هو جزء من الاحصاءات التي تتناول طرق تنظيم وتلخيص البيانات ويمكن استخدام الطرق الوصفية مع قائمة بجميع العناصر او المكونات او عندما تتكون البيانات من العينات.

**Inferential Statistics:** When the data is a sample and the objective is to go beyond the sample to draw conclusions about the population based on sample information.

**الاحصاء الاستنتاجي:** عندما تكون البيانات عينة والهدف هو تجاوز العينة لاستخلاص استنتاجات حول العينة الاساسية ( ) استنادا الى معلومات العينة.

**Population:** A population of participants or objects consists of all those participants or objects that are relevant in a particular study.

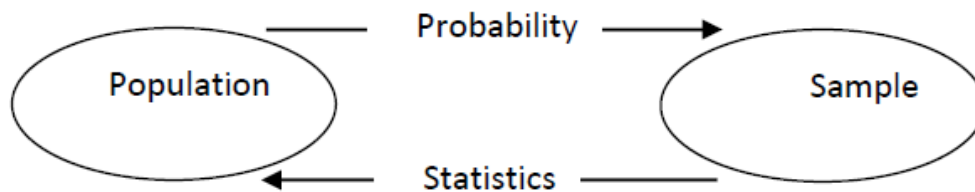
**المجتمع الاحصائي:** يتكون من المشاركين من الاشياء ذات الصلة في دراسة معينة.

**Sample:** A *sample* is any subset of the population of individuals or things under study.

**العينة الاحصائية:** جزء او مجموعة جزئية من المجتمع الاحصائي

**Probability function:** is a rule, denoted by  $p(x)$  that assigns numbers to elements of the sample space

## Link between statistics and Probability



### **Three fundamental components of statistics:**

Statistical techniques consist of a wide range of goals, techniques and strategies. Three fundamental components worth stressing are:

1. **Design**, meaning the planning and carrying out of a study.
2. **Description**, which refers to methods for summarizing data.
3. **Inference**, which refers to making predictions or generalizations about a Population of individuals or things based on a sample of observations available to us.

تشير الى جعل التنبؤات او التعميمات حول المجتمع او الافراد او الاشياء بالاستناد على الملاحظات المتوفرة من عينة معينة.

### **Numerical Summaries of Data:**

#### **Summation notation**

In symbols, adding the numbers  $X_1, X_2, \dots, X_n$  is denoted by

$$\sum_{i=1}^n X_i = X_1 + X_2 + \dots + X_n,$$

Where  $\Sigma$  is an upper case Greek sigma. The subscript  $i$  is the index of summation and the 1 and  $n$  that appear respectively below and above the symbol  $\Sigma$  designate the range of the summation

**Example 1:** If  $x$  equal the following:

$$1.2, 2.2, 6.4, 3.8, 0.9.$$

Then

$$\sum_{i=2}^4 X_i = 2.2 + 6.4 + 3.8 = 12.4$$

and

$$\sum X_i = 1.2 + 2.2 + 6.4 + 3.8 + 0.9 = 14.5.$$

$$\sum X_i^2 = 1.2^2 + 2.2^2 + 6.4^2 + 3.8^2 + 0.9^2 = 62.49$$

and

$$\left(\sum X_i\right)^2 = (1.2 + 2.2 + 6.4 + 3.8 + 0.9)^2 = 14.5^2 = 210.25.$$

### Problems

1. Given that

$$\begin{array}{lll} X_1 = 1 & X_2 = 3 & X_3 = 0 \\ X_4 = -2 & X_5 = 4 & X_6 = -1 \\ X_7 = 5 & X_8 = 2 & X_9 = 10 \end{array}$$

Find

- (a)  $\sum X_i$ , (b)  $\sum_{i=3}^5 X_i$ , (c)  $\sum_{i=1}^4 X_i^3$ , (d)  $(\sum X_i)^2$ , (e)  $\sum 3$ , (f)  $\sum (X_i - 7)$   
(g)  $3 \sum_{i=1}^5 X_i - \sum_{i=6}^9 X_i$ , (h)  $\sum 10X_i$ , (i)  $\sum_{i=2}^6 iX_i$ , (j)  $\sum 6$
2. Express the following in summation notation. (a)  $X_1 + \frac{X_2}{2} + \frac{X_3}{3} + \frac{X_4}{4}$ ,  
(b)  $U_1 + U_2^2 + U_3^3 + U_4^4$ , (c)  $(Y_1 + Y_2 + Y_3)^4$
3. Show by numerical example that  $\sum X_i^2$  is not necessarily equal to  $(\sum X_i)^2$ .