

## Summation

Notation:

$$\sum_{i=1}^n a_i = a_1 + a_2 + a_3 + \cdots + a_n$$

$\Sigma$  is a Greek letter sigma, this is an instruction to find the sum.

$i$  is the index of the sum, it tells where to start the sum and where to end it.

Example:

$$a_1 = 1, a_2 = 3, a_3 = 5, a_4 = 7, a_5 = 9, a_6 = 0, a_7 = 2, a_8 = 4, a_9 = 6$$

$\sum_{i=1}^5 x_i$  is to add the terms  $x_i$ , starting with  $i = 1$ , and ending with  $i = 5$ .

$$\sum_{i=1}^5 a_i = a_1 + a_2 + a_3 + a_4 + a_5 = 1 + 3 + 5 + 7 + 9 =$$

$$\sum_{i=3}^4 a_i =$$

Example: (Computer the following)

1.  $\sum_{i=1}^5 i = 1 + 2 + 3 + 4 + 5 =$

2.  $\sum_{i=1}^5 i^2 = 1^2 + 2^2 + 3^2 + 4^2 + 5^2 =$

3.  $\sum_{i=1}^4 4i =$

In many statistics books, the index is often omitted.

$\Sigma x$  : sum of all  $x$  values.

**Example:** Given a data set:

3, 2, 5, 9, 11

a. Find  $\Sigma x$

$$\Sigma x = 3 + 2 + 5 + 9 + 11 =$$

b. Find  $\sum x^2$

c. Find  $\frac{\sum x}{5} =$

d. Find  $\sum(x - 6)^2$

**Exercises:**

Answer the following question using the given data

12    10    9    7    13    18    14    11    9    7

1. Find  $\sum x$

2. Find  $\sum x^2$

3. Find  $(\sum x)^2$

4. Find  $\sum(x - 11)^2$