

# Summation

## Notation:

$$\sum_{i=1}^n x_i = x_1 + x_2 + x_3 + \cdots + x_n$$

$\Sigma$  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.

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

**Example:** Compute the following.

1.  $\sum_{i=1}^4 i = 1 + 2 + 3 + 4 = 10$

2.  $\sum_{i=1}^4 i^2 = 1^2 + 2^2 + 3^2 + 4^2 = 30$

## Exercises:

Compute the following summations.

1.  $\sum_{i=1}^8 i$

2.  $\sum_{i=1}^{10} i^2$

3.  $\sum_{i=1}^6 5i$

4.  $\sum_{i=1}^4 (10 - i)^2$

In many statistics books, the index is often omitted.

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

**Example:** Given a data set:

3, 2, 5, 9, 11

a. Find  $\sum x$

$$\sum x = 3 + 2 + 5 + 9 + 11 = 30$$

b. Find  $\sum x^2$

$$\sum x^2 = 3^2 + 2^2 + 5^2 + 9^2 + 11^2 = 240$$

c. Find  $\frac{\sum x}{6}$

$$\frac{\sum x}{5} = \frac{30}{5} = 6$$

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

$$\sum (x - 6)^2 = (3 - 6)^2 + (2 - 6)^2 + (5 - 6)^2 + (9 - 6)^2 + (11 - 6)^2 = 60$$

### Exercises:

Answer the following question using the given data

12    10    9    7    13    18    14    11    9    7

5. Find  $\sum x$

6. Find  $\sum x^2$

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

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