

# Algorithm Analysis Tools

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## 1 Mathematical Theory

### 1.1 Summation Notation

Summation is the addition of numbers and is specified by a rule defined in the notation using the upper case Greek letter sigma  $\sum$ .

$$\sum_{i=1}^n i = 1 + 2 + 3 + \cdots + n$$

- $i$  is the index of summation
- 1 is the starting point (lower limit of summation)
- $n$  is the stopping point (upper limit of summation)
- $i$  is the summation element

When we use the summation symbol, it is useful to remember the following rules:

## 1.2 Double Sum

In certain situations, using a double sum may be necessary.  
which can be visualised as the sum of items of matrix:

## 1.3 Double Index

To represent the data of a table or a matrix, double index notation is commonly used. Where  $x_{ij}$  corresponds to the  $i$ th row and the  $j$ th column item.

# 2 Recurrence Relations

## 2.1 Arithmetic Sequence

This is a **linear** changing sequence shown by:

**Example**

## 2.2 Geometric Sequence

This is an **exponential** changing sequence shown by:

# 3 Proof by Induction

There are 4 steps of math induction:

- Show  $P(1)$
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