

Analysis of Algorithms

Here are some equalities that are useful for analyzing algorithms:

Arithmetic series

$$\sum_{i=1}^n i = 1 + 2 + 3 + \dots + n = \frac{n(n+1)}{2} \quad \dots (1)$$

More generally, if $a_n = a_{n-1} + c$, where c is a constant, then

$$\sum_{i=1}^n a_i = a_1 + a_2 + a_3 + \dots + a_n = \frac{n(a_n + a_1)}{2} \quad \dots (2)$$

Geometric series

$$\sum_{i=0}^n 2^i = 1 + 2 + 4 + \dots + 2^n = 2^{n+1} - 1 \quad \dots (3)$$

More generally, if $a_n = ca_{n-1}$, where $c \neq 1$ is a constant, then

$$\sum_{i=1}^n a_i = a_1 + a_2 + a_3 + \dots + a_n = a_1 \frac{c^n - 1}{c - 1} \quad \dots (4)$$

If $0 < c < 1$, then the sum of the infinite geometric series is

$$\sum_{i=1}^{\infty} a_i = \frac{a_1}{1 - c} \quad \dots (5)$$

Sum of squares

$$\sum_{i=1}^n i^2 = 1 + 4 + 9 + \dots + n^2 = \frac{n(n+1)(2n+1)}{6} \quad \dots (6)$$

Logarithms

$$\log_b a = \frac{1}{\log_a b} \quad \dots (7)$$

$$\log_a x = \frac{\log_b x}{\log_b a} \quad \dots (8)$$