

# 1. Algorithms

Name	Worst	Average	Hidden constants	In place
Insertion sort	$\Theta(n^2)$	$\Theta(n^2)$	small	yes
Merge sort	$\Theta(n * \log n)$	$\Theta(n * \log n)$	large	no
Heap sort	$O(n * \log n)$	-	small	yes
Quicksort	$\Theta(n^2)$	$\Theta(n * \log n)$ expected	small	yes
Counting sort	$\Theta(k + n)$	$\Theta(k + n)$	large	no
Radix sort	$\Theta(d * (k + n))$	$\Theta(d * (k + n))$	large	no
Bucket sort	$\Theta(n^2)$	$\Theta(n)$	large	no

Key: k - constant, d - constant

# 2. Sum

Name	Formula
Arithmetic	$\sum_{k=1}^n k = \frac{n(n+1)}{2}$
Arithmetic	$\sum_{k=0}^n k^2 = \frac{n(n+1)(2n+1)}{6}$
Arithmetic	$\sum_{k=0}^n k^3 = \frac{n^2(n+1)^2}{4}$
Geometric	$\sum_{k=0}^n x^k = \frac{x^{n+1}-1}{x-1}$
Geometric	$\sum_{k=0}^{\infty} x^k = \frac{1}{1-x}$ , where $x < 1$
Harmonic	$\sum_{k=1}^n 1/k = \ln(n)$
Integrating	$\sum_{k=0}^{\infty} kx^k = \frac{x}{(1-x)^2}$ , where $x < 1$

# 3. Logs

Exp	Equiv
$\$ \log(\prod_{k=1}^n a_k) \$$	$= \$ \sum_{k=1}^n \log(a_k) \$$
$\$ \log_b a \$$	$= \$ \frac{\log_c a}{\log_c b} \$$

## 4. Finance

---

- Black Scholes

$$C(S_t, t) = N(d_1) * S_t - N(d_2) * K e^{-r(T-t)}$$

$$d_1 = \frac{1}{\sigma(T-t)^{1/2}} \left[ \ln\left(\frac{S_t}{K}\right) + \left(r + \frac{\sigma^2}{2} * (T-t)\right) \right]$$

$$d_2 = d_1 - \sigma(T-t)^{1/2}$$

$$N(\cdot) =$$

the cumulative distribution function of the standard normal distribution

$$S_t$$

the spot price of the underlying asset

$$K$$

the strike price

$$r$$

the risk free rate (annual rate, expressed in terms of continuous compounding)

$$\sigma$$

the volatility of returns of the underlying asset

- TBU