Math Review

Algorithms

Name	Worst	Average	Hidden constants	In place
Insertion sort	$\Theta(n^2)$	$\Theta(n^2)$	small	yes
Merge sort	$\Theta(n * logn)$	$\Theta(n * logn)$	large	no
Heap sort	$O(n * logn)$	-	small	yes
Quicksort	$\Theta(n^2)$	$\Theta(n * logn)$ 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

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	$\sum_{k=0}^{n} x^k = \frac{x^{n+1}-1}{x-1}$

Name	Formula
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

Logs

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

Finance

Black Scholes

- wikipedia.org/wiki/Black%E2%80%93Scholes_model
- $C(S_t, t) = N(d_1) * S_t - N(d_2) * Ke^{-r(T-t)}$
- $d_1 = \frac{1}{\sigma(T-t)^{1/2}}[\ln(\frac{S_t}{K}) + (r + \frac{\sigma^2}{2} * (T-t))]$
- $d_2 = d_1 - \sigma(T-t)^{1/2}$
    - $N(\cdot)$ = 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)
    - σ the volatility of returns of the underlying asset