Algorithms Cheat Sheet
Pocket Edition

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Matrix Algebra

Operation	Name	Input	Output	Bound	Year
Multiplication	Schoolbook	Two $n \times n$ matrices	One $n \times n$ matrix	$O(n^3)$	
Multiplication	Strassen's	Two $n \times n$ matrices	One $n \times n$ matrix	$O(n^{\log_2 7}) = O(n^{2.807})$	1969
Multiplication	Alman-Williams	Two $n \times n$ matrices	One $n \times n$ matrix	$O(n^{2.3728596})$	2020
Multiplication	Schoolbook	One $n \times m$ matrix, one $m \times p$ matrix	One $n \times p$ matrix	$O(nmp)$	
Inversion	Gauss-Jordan elimination	One $n \times n$ matrix	One $n \times n$ matrix	$O(n^3)$	
Inversion	Strassen algorithm	One $n \times n$ matrix	One $n \times n$ matrix	$O(n^{2.807})$	
Inversion	Coppersmith-Winograd algorithm	One $n \times n$ matrix	One $n \times n$ matrix	$O(n^{2.376})$	
Inversion	Optimised CW algorithm	One $n \times n$ matrix	One $n \times n$ matrix	$O(n^{2.373})$	
SVD	Bidiagonalization, QR algorithm	One $m \times n$ matrix ($m \leq n$)	One $m \times m$ One $m \times n$ matrix One $n \times n$	$O(m^2 n)$	
Determinant	Laplace expansion	One $n \times n$ matrix	One number	$O(n!)$	
Determinant	Division free algorithm	One $n \times n$ matrix	One number	$O(n^4)$	
Determinant	LU decomposition	One $n \times n$ matrix	One number	$O(n^3)$	
Determinant	Bareiss algorithm	One $n \times n$ matrix	One number	$O(n^3)$	
Determinant	Fast matrix multiplication	One $n \times n$ matrix	One number	$O(n^{2.373})$	
Back substitution	Back substitution algorithm	Triangular matrix	n solutions	$O(n^2)$	

Graphs

Operation	Name	Input	Comment	Bound	Year
Explicit Graph Search	Depth First Search	V - vertices, E - edges		$O(\|V\| + \|E\|)$	19th century
Implicit Graph Search	Depth First Search	b - branching factor, d - depth		$O(b^d)$	19th century
Explicit Graph Search	Breadth First Search	V - vertices, E - edges		$O(\|V\| + \|E\|)$	19th century
Implicit Graph Search	Breadth First Search	b - branching factor, d - depth		$O(b^d)$	19th century
Shortest Path	Dijkstra's Algorithm	V - vertices, E - edges	Priority queue/heap	$O(\|V\| + \|E\|)log\|V\|$	19th century
Shortest Path	Dijkstra's Algorithm	V - vertices, E - edges	Array	$O(\|V\|^2$	19th century

Sorting

Name	Average	Worst	Stable
Quicksort	$n \log n$	n^2	No
Merge sort	$n \log n$	$n \log)$	Yes
In-place merge sort	-	$n \log^2 n$	Yes
Introsort	$n \log n$	$n \log n$	No
Heapsort	$n \log n$	$n \log n$	No
Insertion sort	n^2	n^2	Yes
Block sort	$n \log n$	$n \log n$	Yes
Timsort	$n \log n$	$n \log n$	Yes
Selection sort	n^2	n^2	No
Cubesort	$n \log)$	$n \log n$	Yes
Shellsort	$n^{\frac{4}{3}}$	$n^{\frac{3}{2}}$	No
Bubble sort	n^2	n^2	Yes
Exchange sort	n^2	n^2	No
Tree sort	$n \log n$	$n \log n$	Yes
Cycle sort	n^2	n^2	No
Library sort	$n \log)$	n^2	No
Patience sort	$n \log n$	$n \log n$	No
Smoothsort	$n \log n$	$n \log n$	No
Strand sort	n^2	n^2	Yes
Tournament sort	$n \log n$	$n \log n$	No
Cocktail shaker sort	n^2	n^2	Yes
Comb sort	n^2	n^2	No
Gnome sort	n^2	n^2	Yes
Odd-even sort	n^2	n^2	Yes