Alg420 Cheat Sheet

by cheatyboi via cheatography.com/55656/cs/14797/

Sieve of Erath

```
// Java program to print all primes
smaller than or equal to
// n using Sieve of Eratosthenes

class SieveOfEratosthenes
{
    void sieveOfEratosthenes(int n)
    {
        // Create a boolean array
"prime[0..n]" and initialize
        // all entries it as true.
A value in prime[i] will
        // finally be false if i is
Not a prime, else true.
        boolean prime[] = new
boolean[n+1];
        for(int i=0;i<n;i++)
            prime[i] = true;

        for(int p = 2; p*p <=n;
p++)
        {
            // If prime[p] is not
changed, then it is a prime
            if(prime[p] == true)
            {
                // Update all
multiples of p
                for(int i = p*2; i
<= n; i += p)
                    prime[i] =
false;
            }
        }

        // Print all prime numbers
        for(int i = 2; i <= n; i++)
        {
            if(prime[i] == true)
                System.out.print(i
+ " ");
        }
    }
```

3 Types of Decrease and Conquer

Decrease by constant	Decrease by constant factor	variable-Size decrease
insertion sort	binary search and bisection method	Euclid's algoirthm
topolgical sorting	exponentiation by squaring	selection by partition
algorithms for generating permutations, subsets	multiplication a la russe	nim-like games

Summations

$$\text{sum}(i,\ i=0..n)\quad \frac{n(n+1)}{2}$$

$$\text{sum}(i,i=1..n)\quad \frac{n(n+1)}{2}$$

$$\text{sum}(n,i=0..n)\quad n(n+1)$$

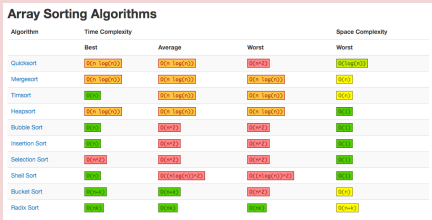
$$\text{sum}(2\text{^}i,\ i=0..n-1)\quad 2^n-1$$

$$\text{sum}(2\text{^}i,i=0..n-2)\quad 2^{n-1}-1$$

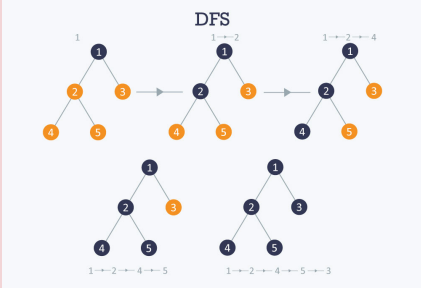
$$\text{sum}(i\text{^}2,i=0..n)\quad \frac{n(2n+1)(n+1)}{6}$$

$$\text{sum}(i\text{^}3,i=0..n)\quad \frac{n^2(n+1)^2}{4}$$

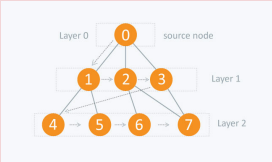
Complexities



DFS



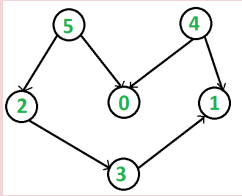
BFS



Brute-Force Problems

Problem	Method	Complexity
TSP	Exhaustive	N!
KnapSack	Exhaustive	n*W

Topological Sort



Order: 5,4,2,3,1,0

Generate Permutations

Example n=3:
start: 1
12, 21
123, 132, 312
321, 231, 213
finish

Euclidean Algorithm

Example:
GCD(270,192)
270/192 = 1 R 78
GCD(192, 78)
192/78 = 2 R 36
GCD(78,36)
78/36 = 2 R 6
GCD(36/6)
36/6 = 6 R0
since R = 0, 6 is GCD

Brute Force Pros vs Cons

Pros	Cons
Wide applicability	Rarely Yields Efficient
Simple	Unacceptably Slow
Reasonable Algorithms	Not as constructive as others

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