Simple Sieve

n
10

2 5 7

n log log n | n

b = [ ]
9

seive_size = 10

bunch of prime nos upto n

not including n.

Segmented Seive

11 13 17 19

n m

10 20 — 4

2 ~~5~~ = 10

[100]

1000 — 2000

~~5~~ 10

Incremental Sieve

b = 0 1 2 3 4 9   n = 10

2   4 8 2   odd-prime

ArrayList<Integers> odds;

n → [3 5 7 9]   p → p2
10

Euler Phi

$$\phi(n) = \begin{cases} n-1, & \text{prime} \quad 5 \to 4, \quad 7 \to 6 \\ (p-1)(q-1), & 35 = 7 \times 5 \to 6 \times 4 = 24 \\ n\left(1-\frac{1}{p_1}\right)\left(1-\frac{1}{p_2}\right)\cdots \end{cases}$$

$$\phi(140) = 140\left(1-\frac{1}{7}\right)\left(1-\frac{1}{5}\right)\left(1-\frac{1}{2}\right) = \underline{\qquad}$$

$140 = 7 \times 20$
5×4
2×2

$= \underset{p_1}{7} \times \underset{p_2}{5} \times \underset{p_3}{2^2} \to (140, 1)$

Chinese Remainder Theorem

CRT

$$\left.\begin{aligned} x_1 &\equiv 10 \bmod 5 \\ x_2 &\equiv 12 \bmod 5 \\ x_3 &\equiv 10 \bmod 2 \end{aligned}\right\} n$$

Strobogrammatic Number

1 8 6 0 not 7 →

1 → 1

n

n m →

2 → X

8 8 8

8 5 8 X

6 → 9

9 → 6

8 → 8

6 8 9

n = 1
{0, 1, 8}

{0, 1, 8, 9, 6}

n = 2
{11, 88, 69, 96}

1 6 9 8 0
1 9 6 8 0

Binary Palindrome

5 = 101

101 =

10

8 4 2 1

9 = 1001

1001

1010

0101

X

Not

Booth's Algorithm

COA.

0100

1100

0101 $\{x - 4$

(bit = 4)

A Q Q_{-1} M

n iterations what A Q Q_{-1}

2nd A Q Q_{-1}

Block Swap / Rotating Array

[2 4 5 6 9 7] k = 3

4 5 6 9 7 $\boxed{2}$ → 1

k-- → 2

$\boxed{6\ 9\ 7}\ \boxed{2\ 4\ 5}$

→ 1 6 2 5

Euclid's Algorithm

5   20 b

a   5xy

$\log(\min(a,b))$

5

5 3

1

Karatsuba Algorithm

Divide and Conquer

$T(n) = 3T(n/2) + O(n)$

$5 \times 7 = 20$

result

$2|8$ $3|8$ $\longrightarrow$ 1
a b c d

$= ac \times 10^m$

$+ ((a+c)(b+d) - ac - bd) \times 10^{m/2}$

2

$+ bd$

Longest Sequence of 1s After Flip

1 0 1 0 1 1 0 0 1 $K = 2$

6

max 6 n max

1 1 1 1 1 1 0 0 1 } modification

Max Product Subarray

[1 -1 0 4 8 2 -2 1 -3]

-1 0

-<0 4

1 -1 4 8 -2 3 1

7

no –
product

Swap 2 Nibbles

byte – _ _ _ _ | _ _ _ _

C 3

3 C

BM 1 | 1

Leaders in Array

6 9 9 8 5 0 1

x 9 9 8 5 x 1

9 9 8 5 1

Lexicographically First Palindrome

aabbccd~~e~~e

1 1

1 1

abcd c ba

>1 odd count char

we can't find

mid = 1

Majority Element

elements freq

$> \text{length}/2 = \text{ME}$

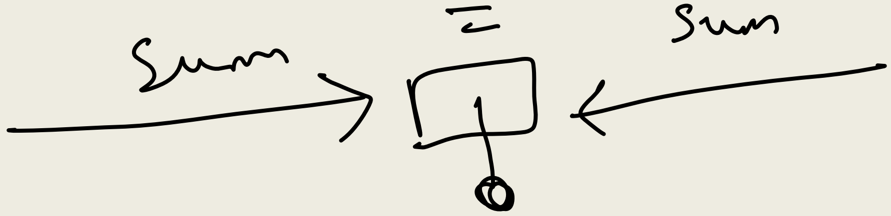
1 1 2 2 2 2 3 2 8 no ME

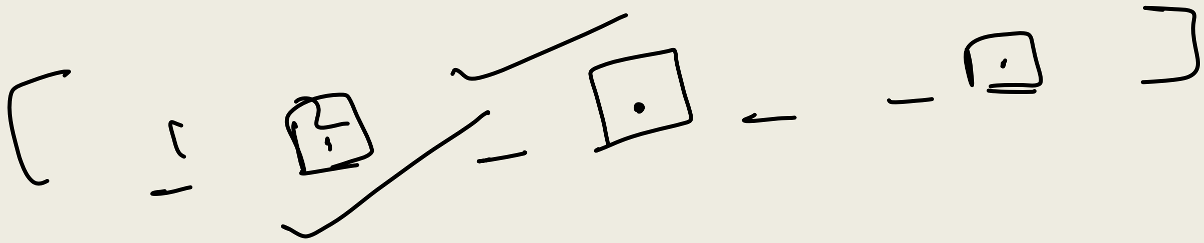
$\frac{}{2} = 4$

1 1 2 2 2 2 2 2 2

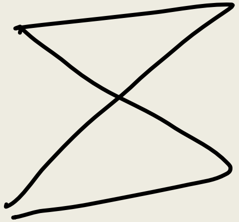
2 ME $\frac{9}{2} = 4.5 \approx 5$

Max Equilibrium Sum





Max Sum of HourGlass



a b c
d
e f g

7

no. of HG

max sum

min size m x n

3 x 3

2 x 2

m < 3
n < 3

>= 3 m n } atleast 1 HG

m = 5 n = 5 }
(m - 2)(n - 2)
3 x 3 = 9
HG

Selection Sort

n^2 $\frac{n}{2}$

in place

Arrays.sort(arr)

Quick Sort

pvt

7 $\boxed{7}$

5 7 9 10 7 7 3 0

5 3 0 7 7 7 | 9 10

Weighted Substring

abcdefg →

1 2 3

abc → 1+2+3 = 6

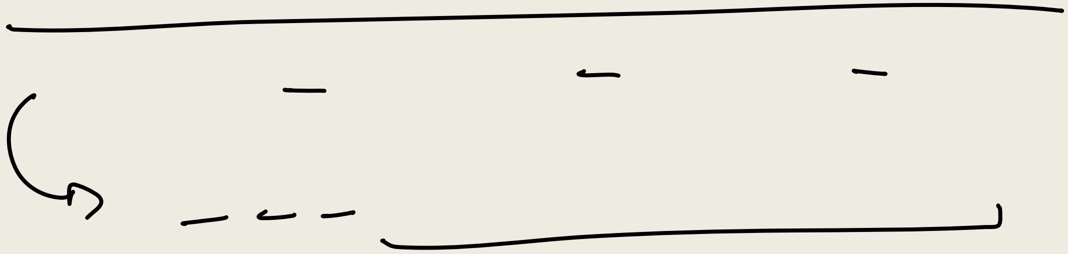
= k
< k
> k

chun

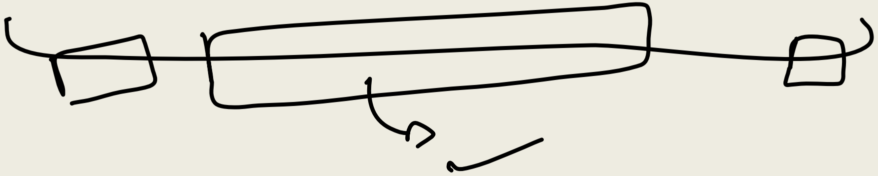
a = 1
⋮
z = 26

P = { a b c d -- 26 }

Move Hyphens to Beginning



Manacher's Algorithm / Longest Palindromic Substring



dp → 2d n^2 →

1d n →

Josephus Problem

$n = 14 \quad k = 2$

1 W

~~1~~ ~~2~~ ~~3~~ ~~4~~ ~~5~~ ~~6~~ ~~7~~ ~~8~~ ~~9~~

~~10~~ ~~11~~ ~~12~~ $\boxed{13}$ ~~14~~

0

Ans 13 12

n

Activity Selection

$\geq$ prev

S[ ] = {10 20 30}

f[ ] = {15 50 40}

{0, 1} $\longrightarrow$ 2

0 1

Unique Sorted Permutations

${}^{n}P_{n}$ ${}^{n}C_{n}$

ABC $= n!$ 6

AAC $= n!$ $\frac{6}{2} = 3$

AAC
ACA
CAA

Combinations

1 2 3 4 5 $k = 2$

1 2

1 3

1 4 3 4

1 5 3 5

2 3 4 5

2 4

2 5

Maze Solving

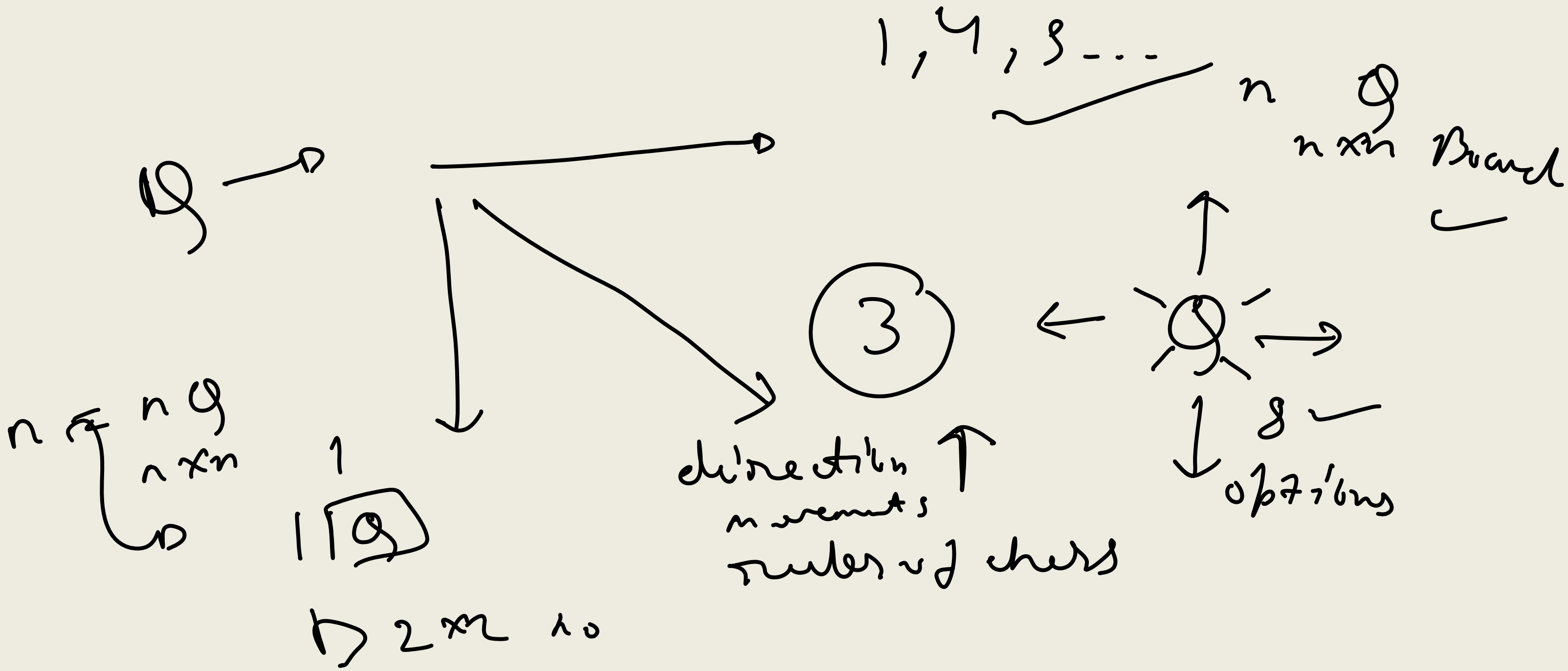
$$\begin{bmatrix} 1 & 0 & 0 & 0 \\ 1 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 1 & 1 & 1 \end{bmatrix}$$

input

output

$$\begin{matrix} 1 & 0 & 0 & 0 \\ 1 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 1 & 1 & 1 \end{matrix}$$

N Queens



1, 4, 8 . . .
n Q
n x n Board
3
direction
movements
rules of chess
8
options
n ≠ n Q
n x n
1
1 Q
2 x 2 no

Huffman Coding

P Q

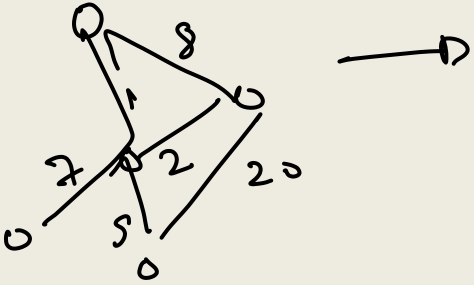
Compress message length

to f v ~ no bits

v s

Kruskal's Algorithm

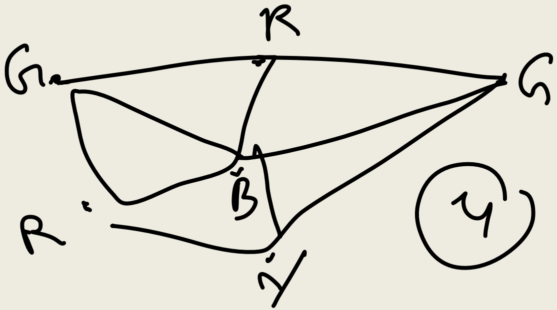
MST



MST

Graph Coloring

Chromatic no
is



4

Hamiltonian Cycle

Vertex 1

S → E

Warnsdorff's Rule / The Knight's Tour Problem

Horse Chess

n x n

□ at least 1

Cover n x n board

5x5