Hashing

int a[N]

"avichal" 5

"abcde"

basic hash $a \cdot 30^4 + b \cdot 30^3 + c \cdot 30^2 + d \cdot 30^1 + e$

polynomial hash

~~string~~ S $h(S) = \sum_{i=0}^{n-1} S[i] * b^{n-i-1} \% P$

abcdedcba $N \leq 10^5$

(l, r)

(r

$h[l] = d \cdot b^5 + e \cdot b^4 + d \cdot b^3 + c \cdot b^2 + b \cdot b + a \cdot b$

mods in division

$73 \cdot b^2 \% m$

5

$5 / 73 \neq 73$

$h[r] = c \cdot b^2 + b \cdot b + a \cdot b$

$h[l] - h[r]$ NOT POSSIBLE

$= r + 1$

$a^{p-1} \equiv 1 \pmod p$ POSSIBLE:

$(h[l] - h[l]) \cdot p-2$

$a \cdot a^{p-2} \equiv 1 \pmod p$ $(h[l] - h[l])$

mod p

if you want to divide by x,

multiply by $x^{p-2} \bmod p$

Hashing

$x^{100} = ?$ Let's say we know $x^{50} = 4$

$\therefore x^{100} = 16$. Now what if $x^{50} = ?$

$x^{25} = ?$ $x^{12} = 4$

$x^{12} \cdot x^{12} \cdot x = x^{25}$

$O(\log b)$ $a^b \bmod p$

$a^{\frac{b}{2}}$ multiplied by a if $b \% 2 == 1$

Use or compare something more easily

$A \cdot B \bmod C \equiv 1$

B is inv mod of A

Suffix Arrays

" " < a

5	avichal	a|******
0	vichal	avichal
3	ichal	chal...
4	chal	hal...
2	hal	ichal...
6	al	l...
1	l	vichal...

0 1 2 3 4 5 6

avichal * * * * * * *

sa[i][k] rank of substring starting at i length 2^k

length 1

compare (a, b)
return s[a] < s[b]

compare (a, b) length 2
if (s[a] == s[b])
return s[a+1] < s[b+1]
else return s[a] < s[b]

for any power of 2

compare (a, b, k) length 2^k

if (s[a ... a+2^{k-1}] == s[b ... b+2^{k-1}])
look at 2nd half [a+2^{k-1} ... a+2^k]

if length of suffix array is not power of two, add * * * to balance

(-1 considered)