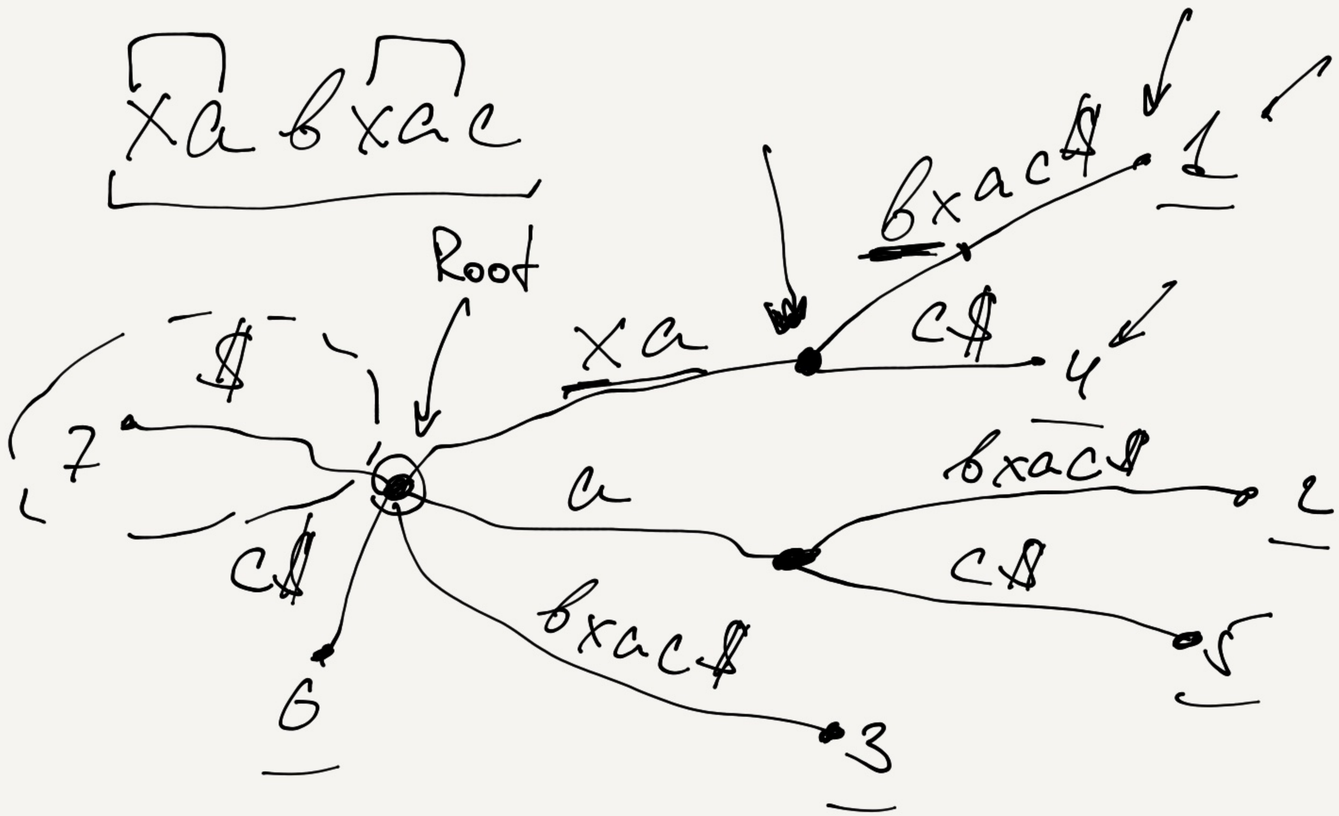


xabx

xa $|T| = n$

$|P| = m$

$O(n)$

$O(m)$

$O(n+m)$

$O(m+k)$

T, $|T| = n$

$P_1, P_2, \dots, P_z$

$\sum_{i=1}^{z} |P_i| = m$

AK: $O(n+m+k)$

CA: $O(n + m_1 + m_2 + \dots + m_z + k_1 + k_2 + \dots + k_z) =$

$= O(n+m+k)$

АК

$\sum_{i=1}^{n} |P_i| = m$

P_1
P_2
$\vdots$
P_2

$O(m)$ – время

$O(m)$ – память

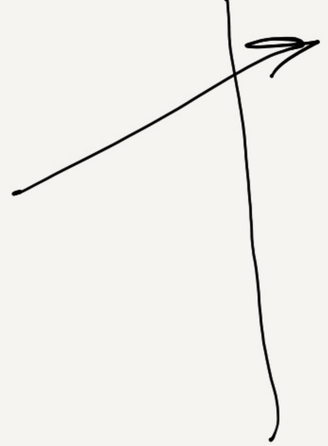
$O(n)$ – поиск

$n >> m$

С.Д.

$O(n)$ – память

$O(m)$ – поиск



$T_1 = a\,b\,c\,b\,c\,c\,b\,c$ (1 2 3 4 5 6 7 8)

$T_2 = b\,a\,a\,b\,c\,a\,b$ (1 2 3 4 5 6 7)

$T_1\$_1\ T_2\$_2$

Root

T_1/T_2

$a\,T_1$ — $a\,b\,c\,a\,b\,\$$ — 2, T_2

T_2 — $b\,c\,\$$ — 6, T_2

T_1 — $b\,c\,c\,b\,c\,\$$ — 1, T_1

$a\,a\,b\,c\,a\,b\,\$$ — 1, T_2

3, T_2 — $T_2\,a\,b\,\$$

$2\,T_1/T_2$

$b\,T_1/T_2$ — $b\,c\,c\,b\,c\,\$$ — 2, T_1

$c\,T_1/T_2$ — $c\,b\,c\,\$$ — 4, T_1

$a\,b\,\$$ — 4, T_2

$\$$ — 7, T_2

c — $b\,c$ — 7, T_1

T_1/T_2 — $c\,b\,c\,\$$ — 5, T_1

T_1 — $\$$ — 6, T_1

$c\,b\,c\,\$$ — 3, T_1

$c\,b\,\$$ — 5, T_2

$\$$ — 8, T_1

$ab = P$

$O(mnk)$

$O(n_1 + n_2)$

$n_1 \approx n_2$

$O(n)$

a	b
ab	bc
abc	c

T_1 T_2

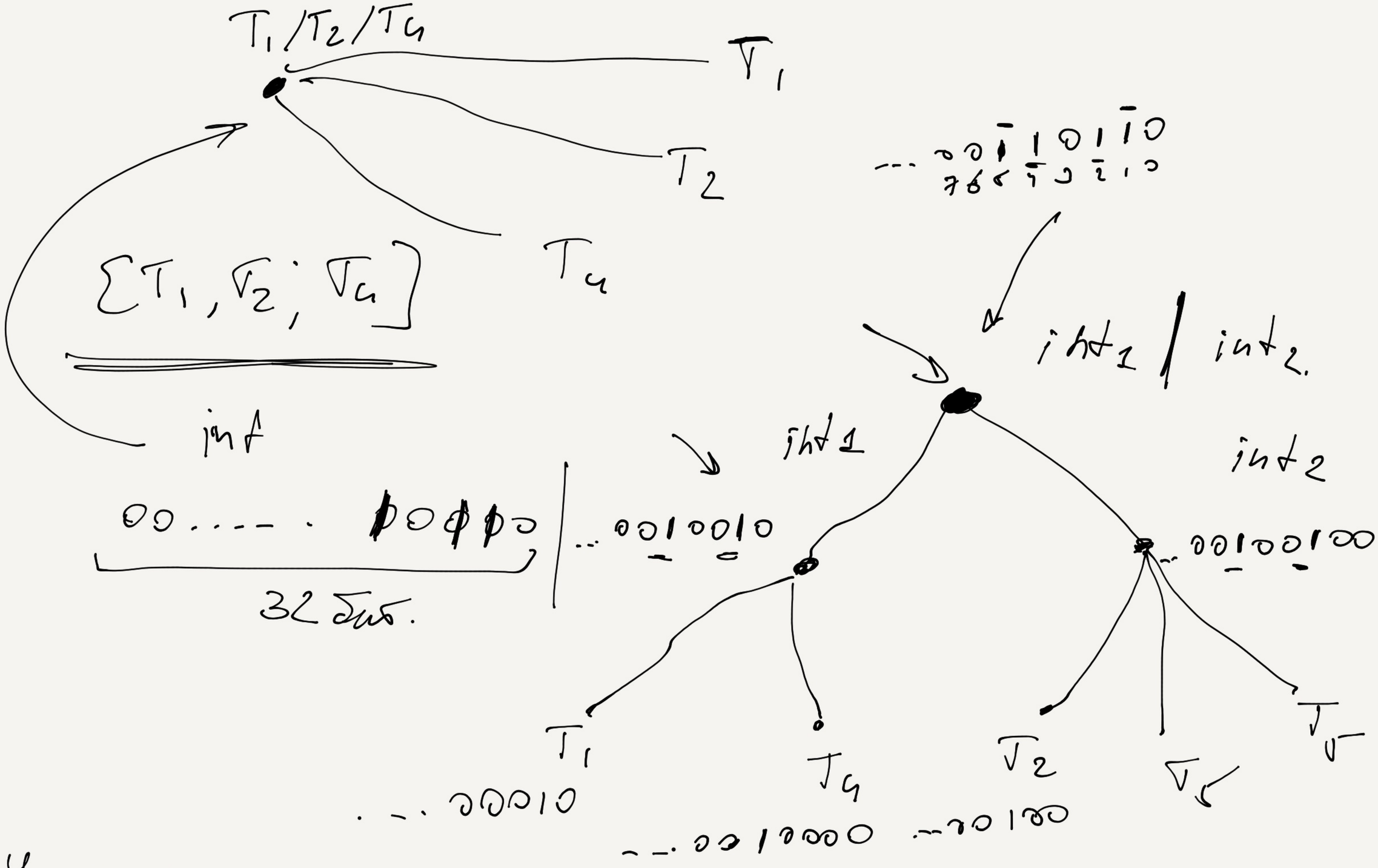
bc — $\$$ — 1, T_2

T_1 T_2 T_3

$\{$ 4, T_2, 1, 6, T_3 $\}$

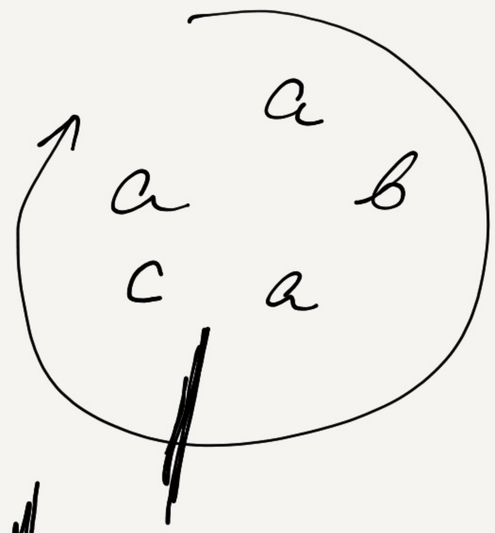
$ce\,b$ — $\$_x$ — e, T_x

$\$_y$ — 6, T_y

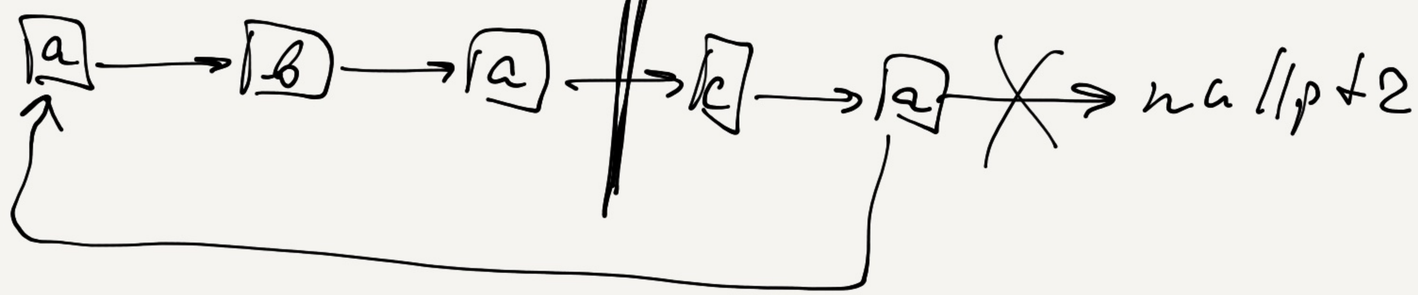


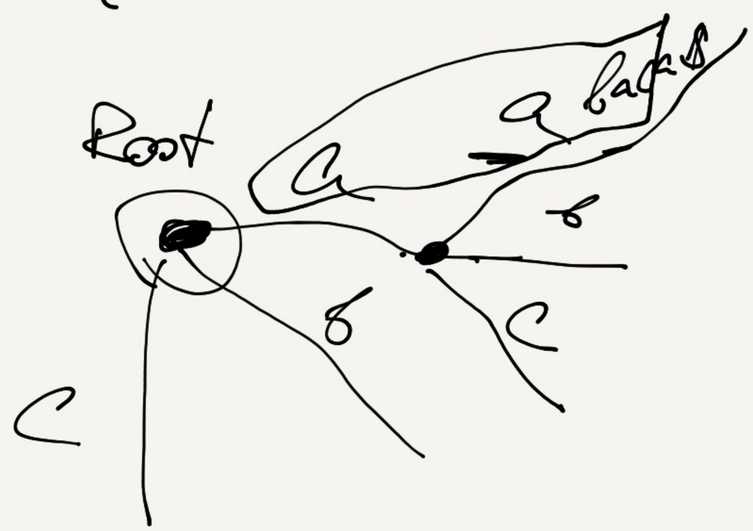
Г. Уоррен мл.
"Алгоритм. Трюки для прогр-ток"

abaca



caaba





abaca

baaca

acaab

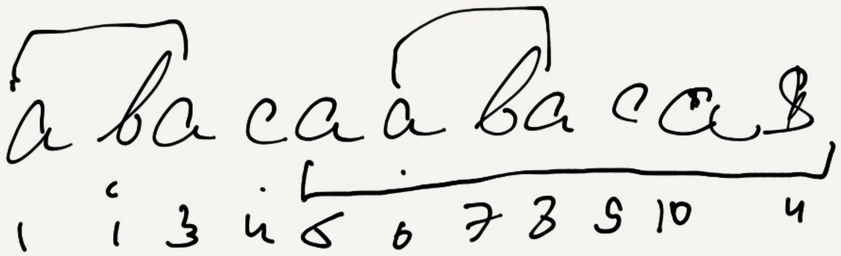
caaba

aabac

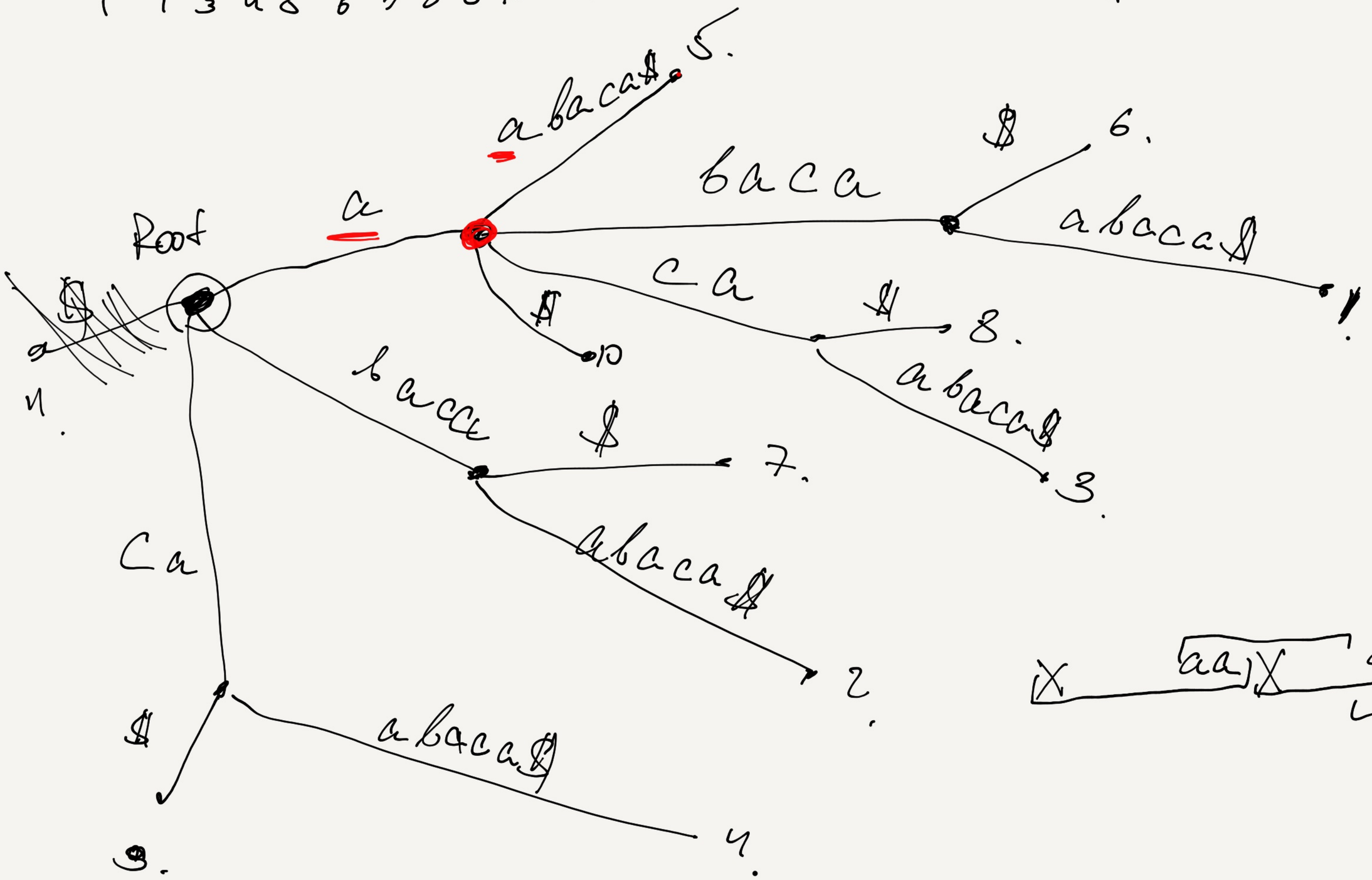
TT$

abacaabac$

ST(TT$)


abacaabacca$
1 2 3 4 5 6 7 8 9 10 11

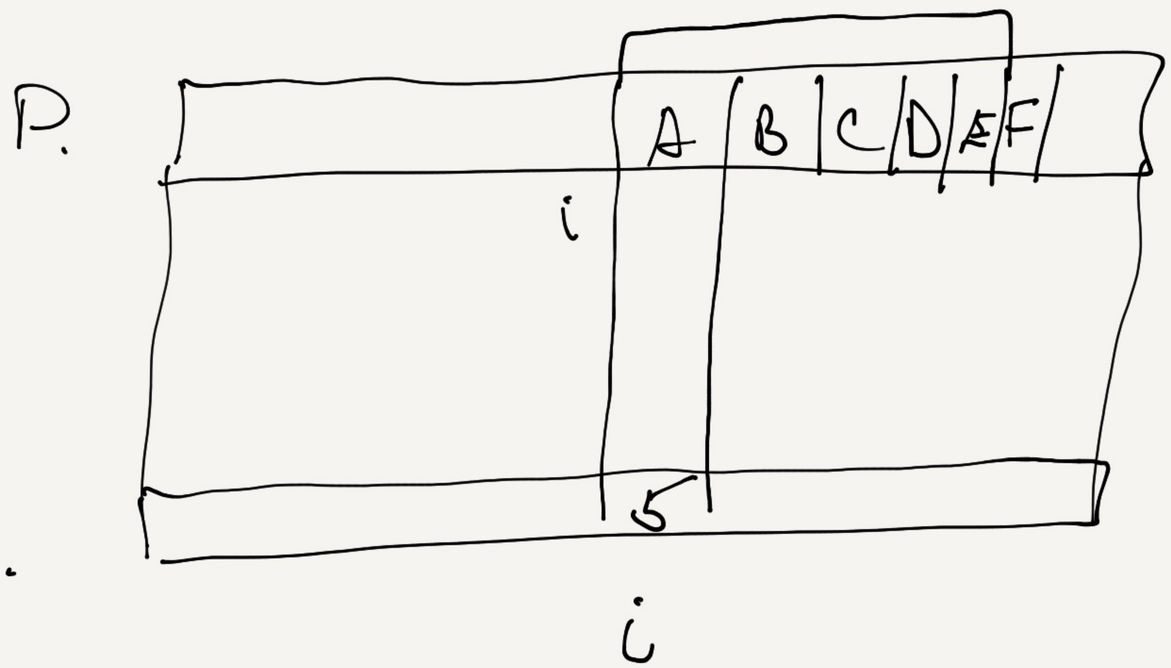

aabaca$

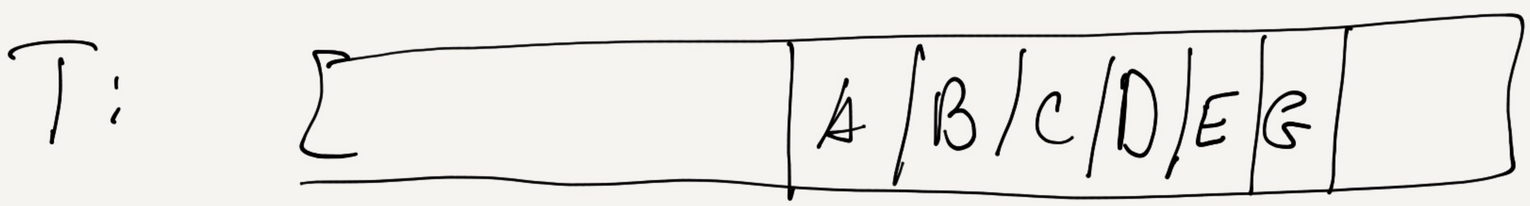

Root
a
abacaA
5.
baca
$
6.
abacaA
ca
A
10
$
8.
abacaA
3.
bacca
$
7.
abacaA
2.
Ca
A
abacaA
4.
$
9.
aa
aaA

$|Text| = n$

$|Pattern| = m$

$m < n$





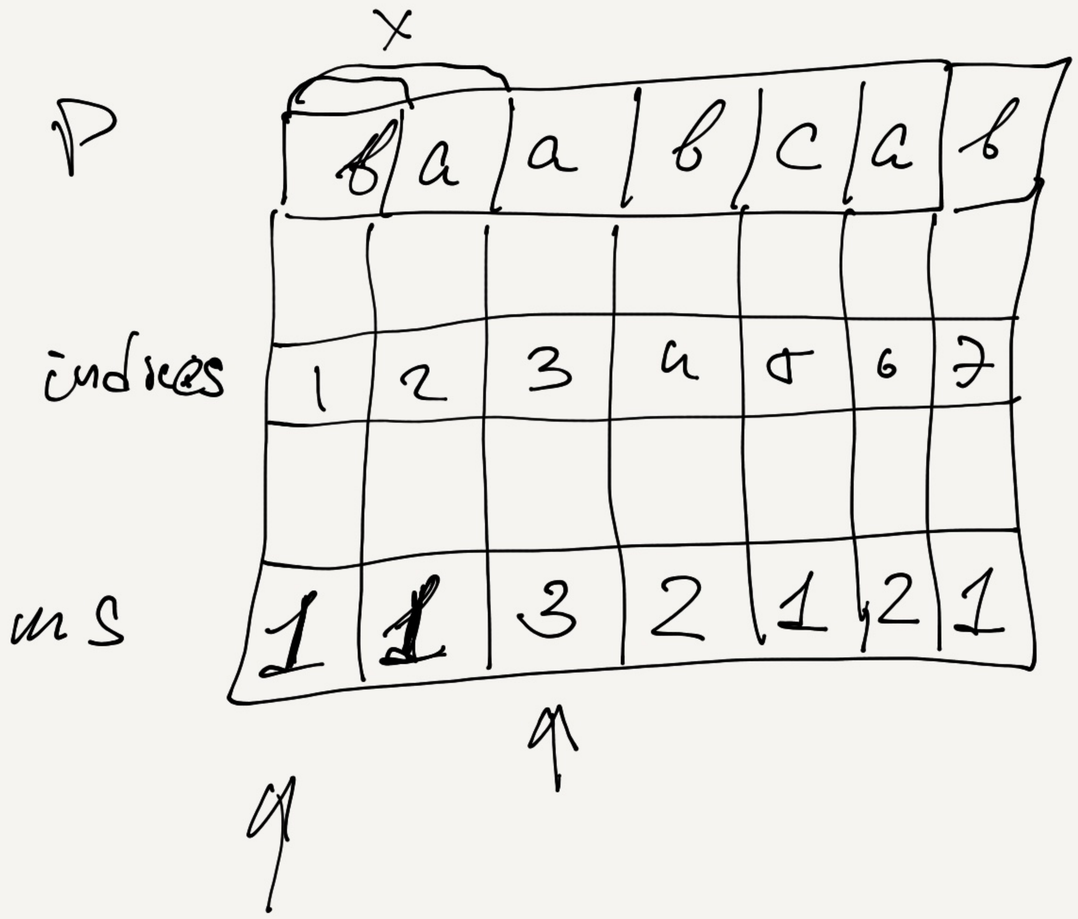
$T = a\,b\,c\,b\,c\,c\,b\,c$

$P = b\,a\,a\,b\,c\,a\,b$

$|T| = n$

$|P| = m$

$n >> m$



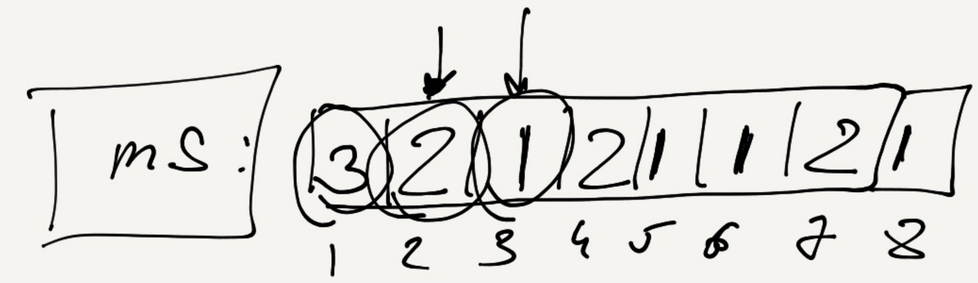
$O(n)$

$\geq$

$O(m)$

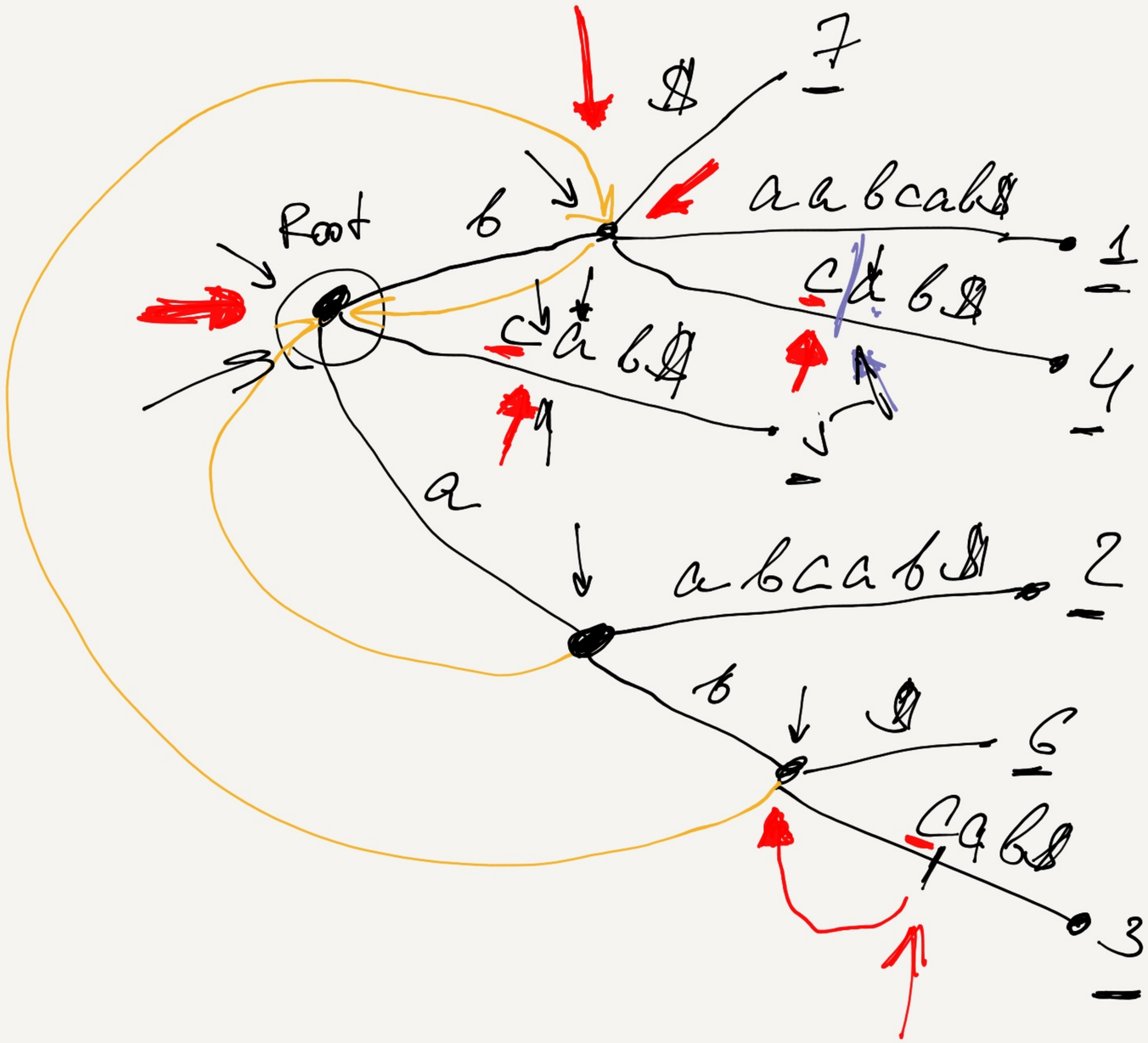
P = b a a b c a b
1 2 3 4 5 6 7

T = a b c b c c b c
1 2 3 4 5 6 7 8



current

max



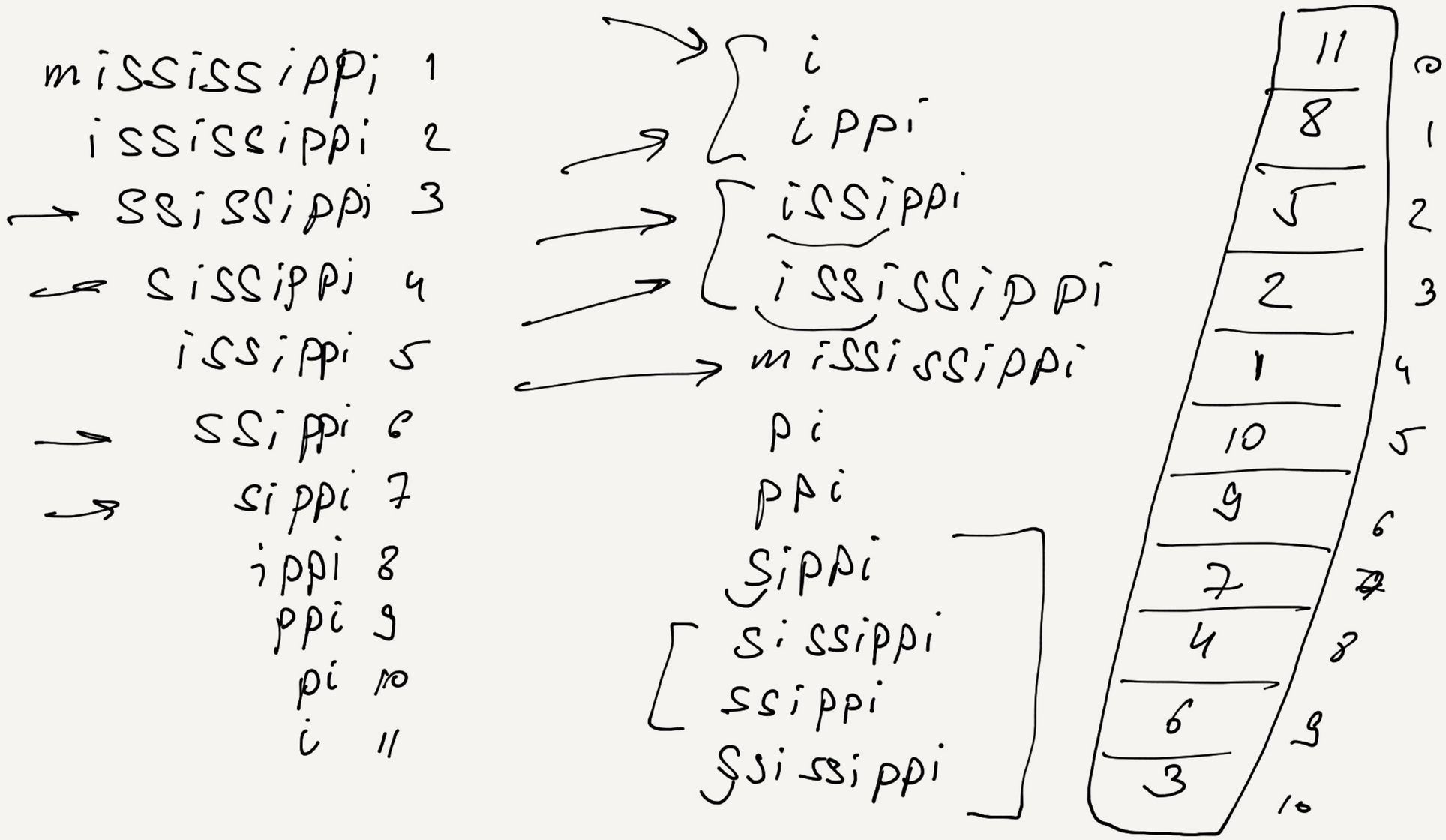
Гасфилд, гл. 7.

i m p s

S. A.

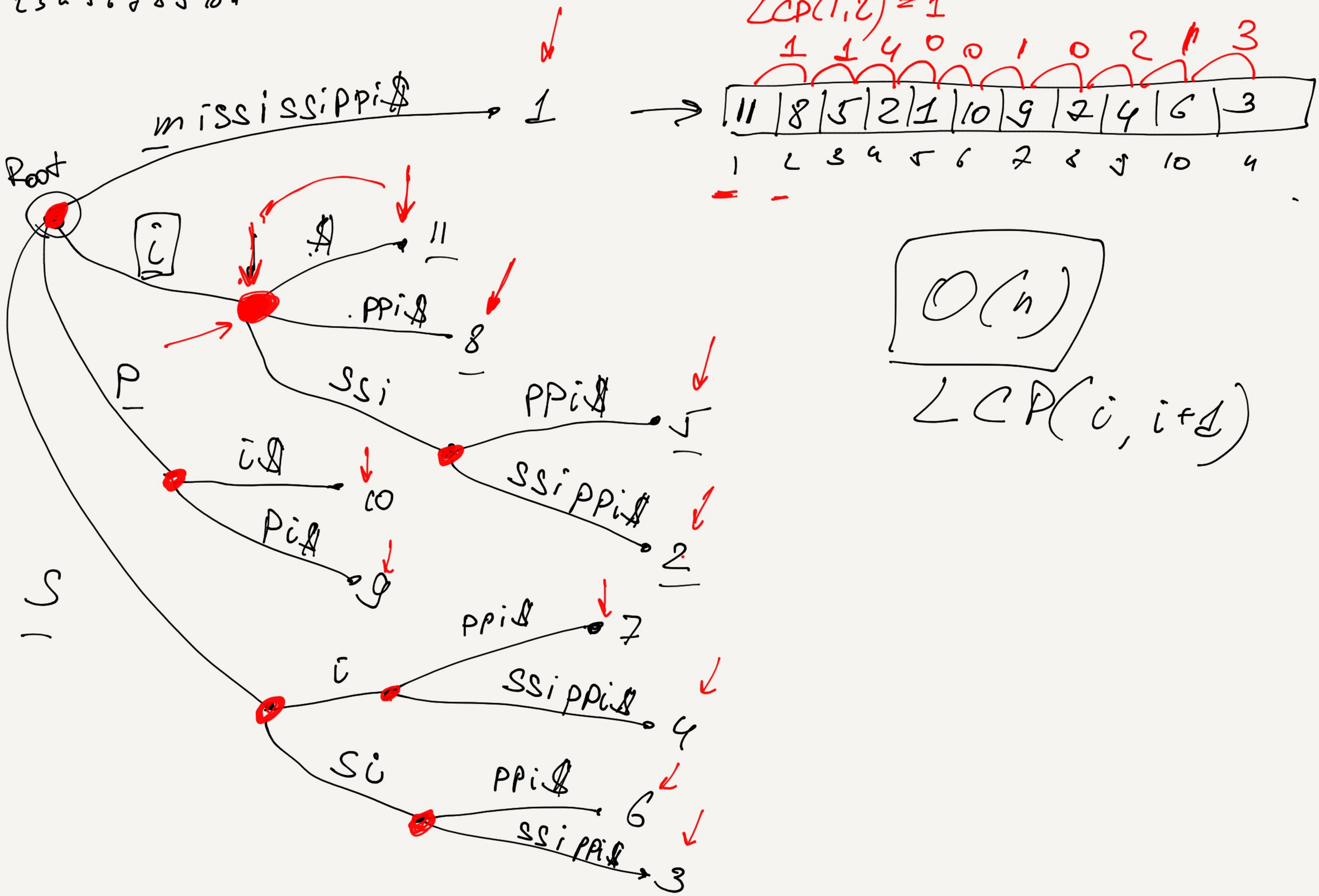
Suffix Arrays

SA



$ < i < m < p < s

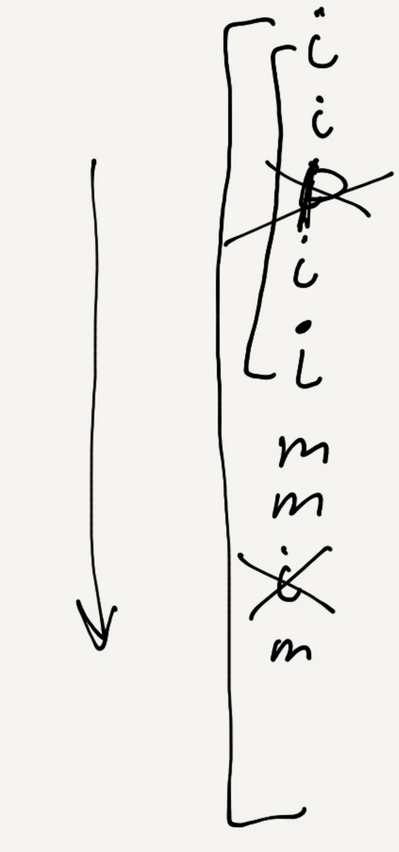
mississippi
1 2 3 4 5 6 7 8 9 10 11



ipsc

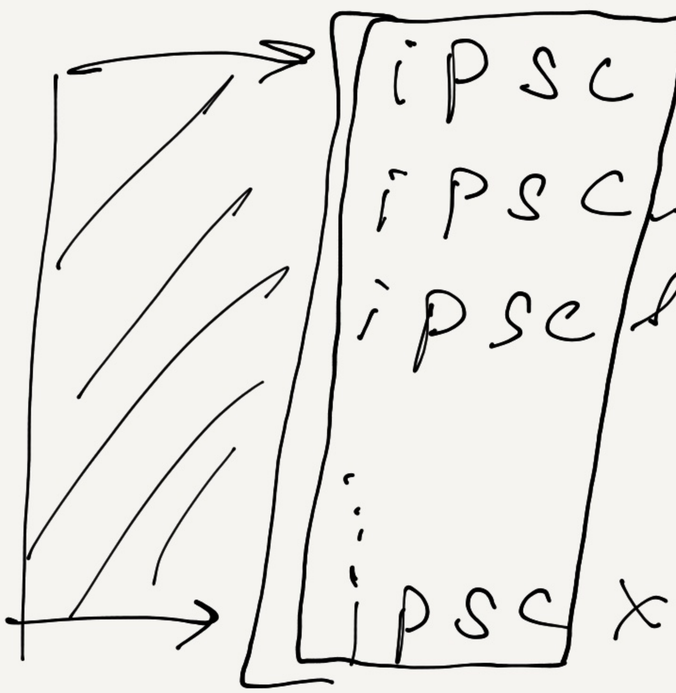
$|T| = n$

$|P| = m$



$O(m)$

ipsa...

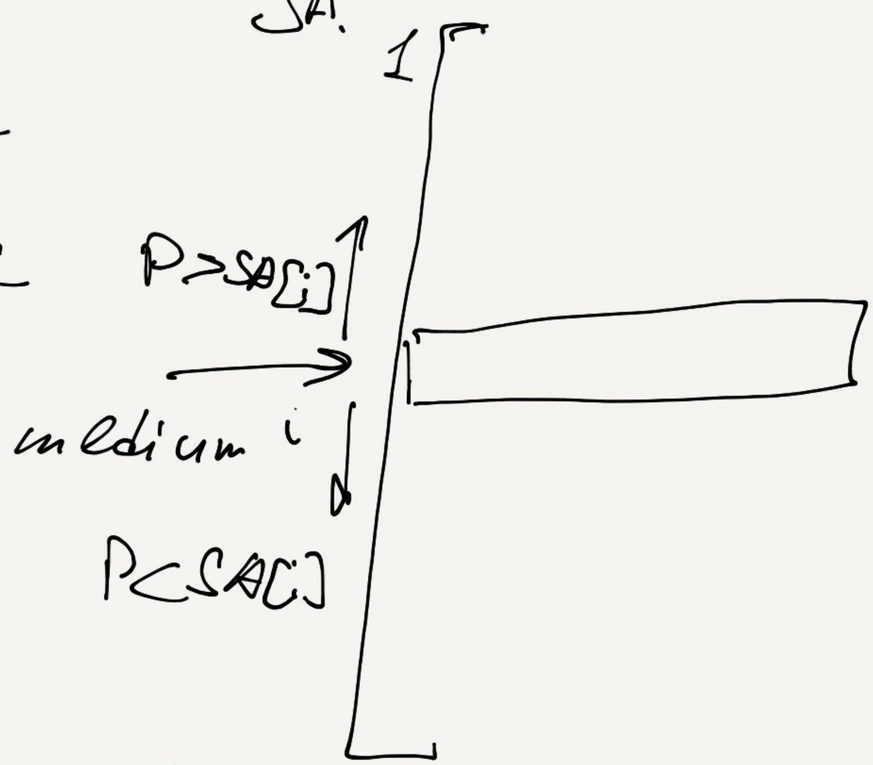


ipsd.

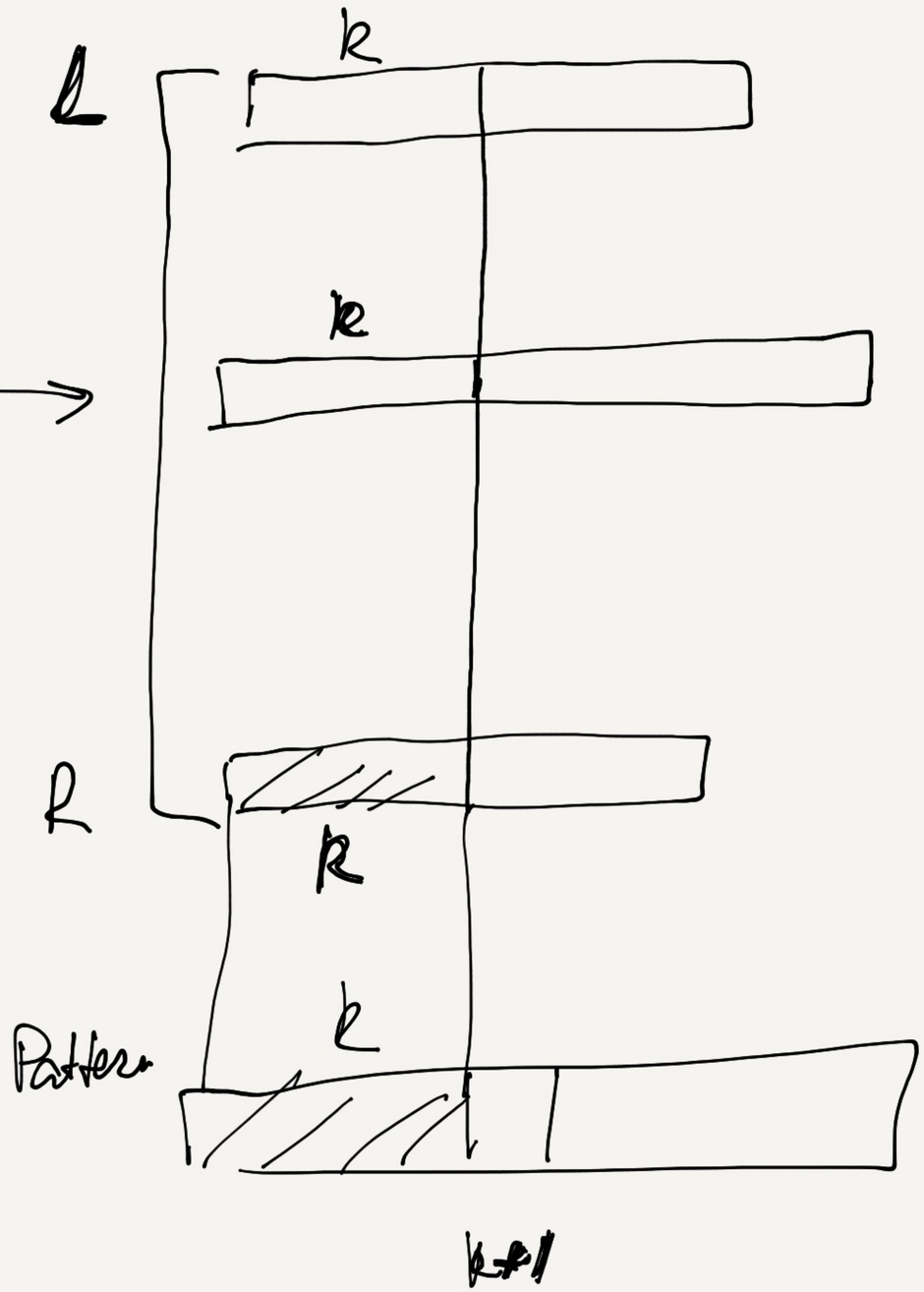
$i = \frac{1+n}{2}$

$O(m \log n)$

SA[i] < P



P



LCP

Longest Common Prefix

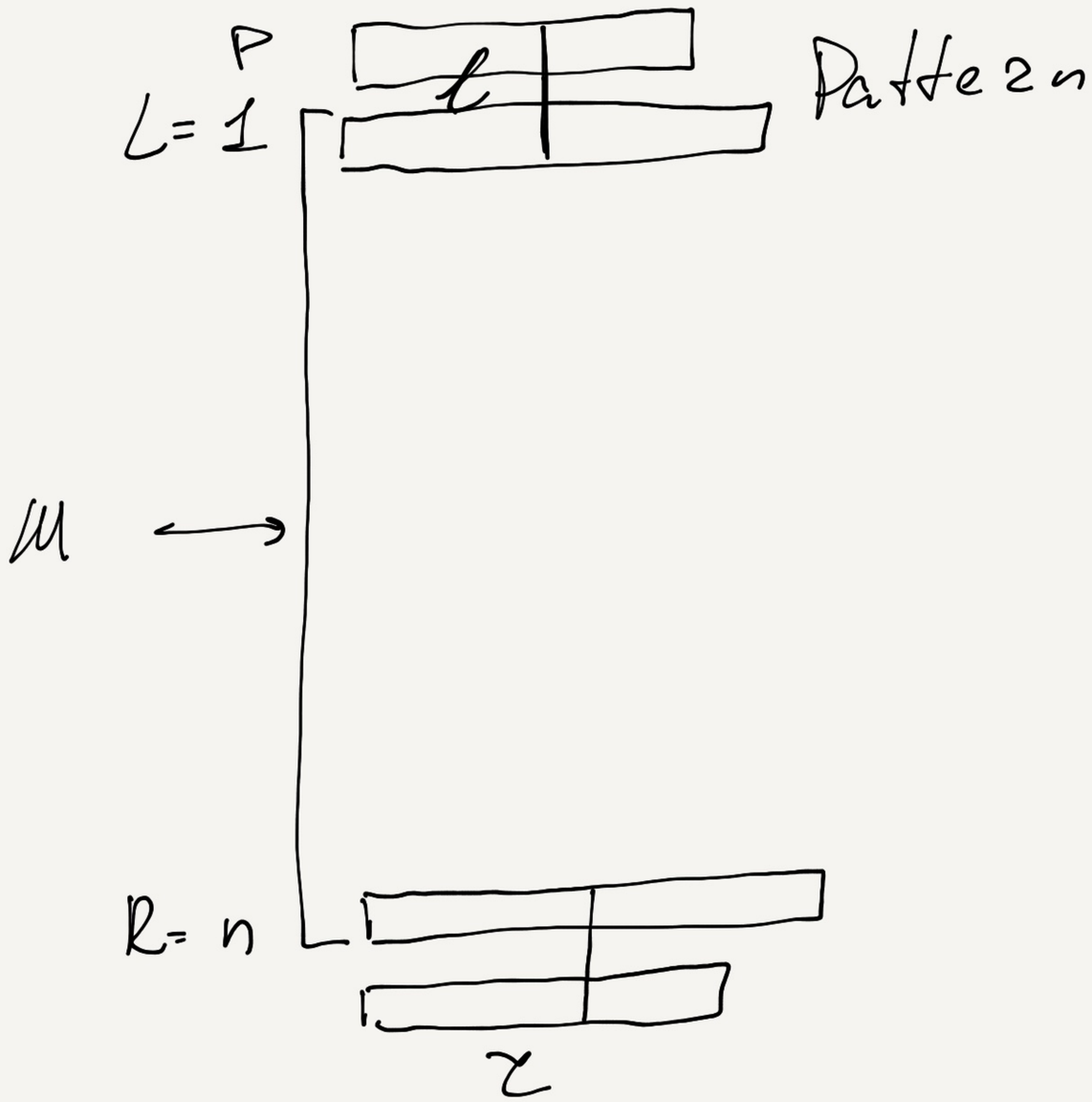
$LCP(i, j) = t$

$LCP(1, 2) = 1.$

↑ q

$LCP(3, 4) = 4$

$LCP(4, 5) = 0$



$LCP'(L, Pattern) = l$

$LCP'(R, Pattern) = r$

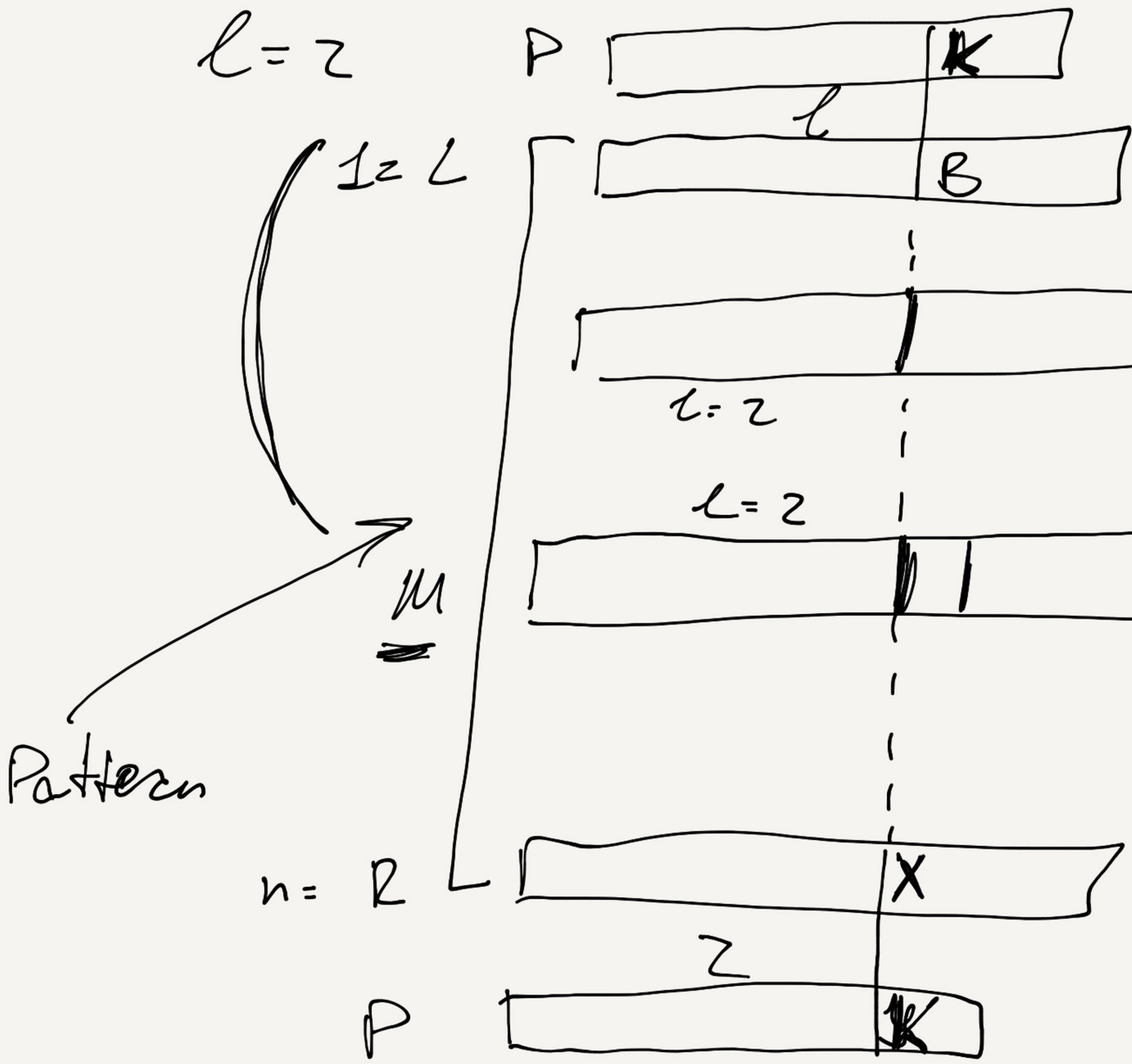
$LCP'(L)$

$LCP'(R)$

1) $l = r$

2) $l > r$

3) $l < r$



B < K < X

M = (L + R) / 2

SA[M][l + 1] ? P[l + 1]

L = M

R = R

SA[M][i] ≥ P[i]

1 ... i - 1.

L = L

R = M

l = i - 1

SA[M][i] < P[i]

aabacd

acabacc

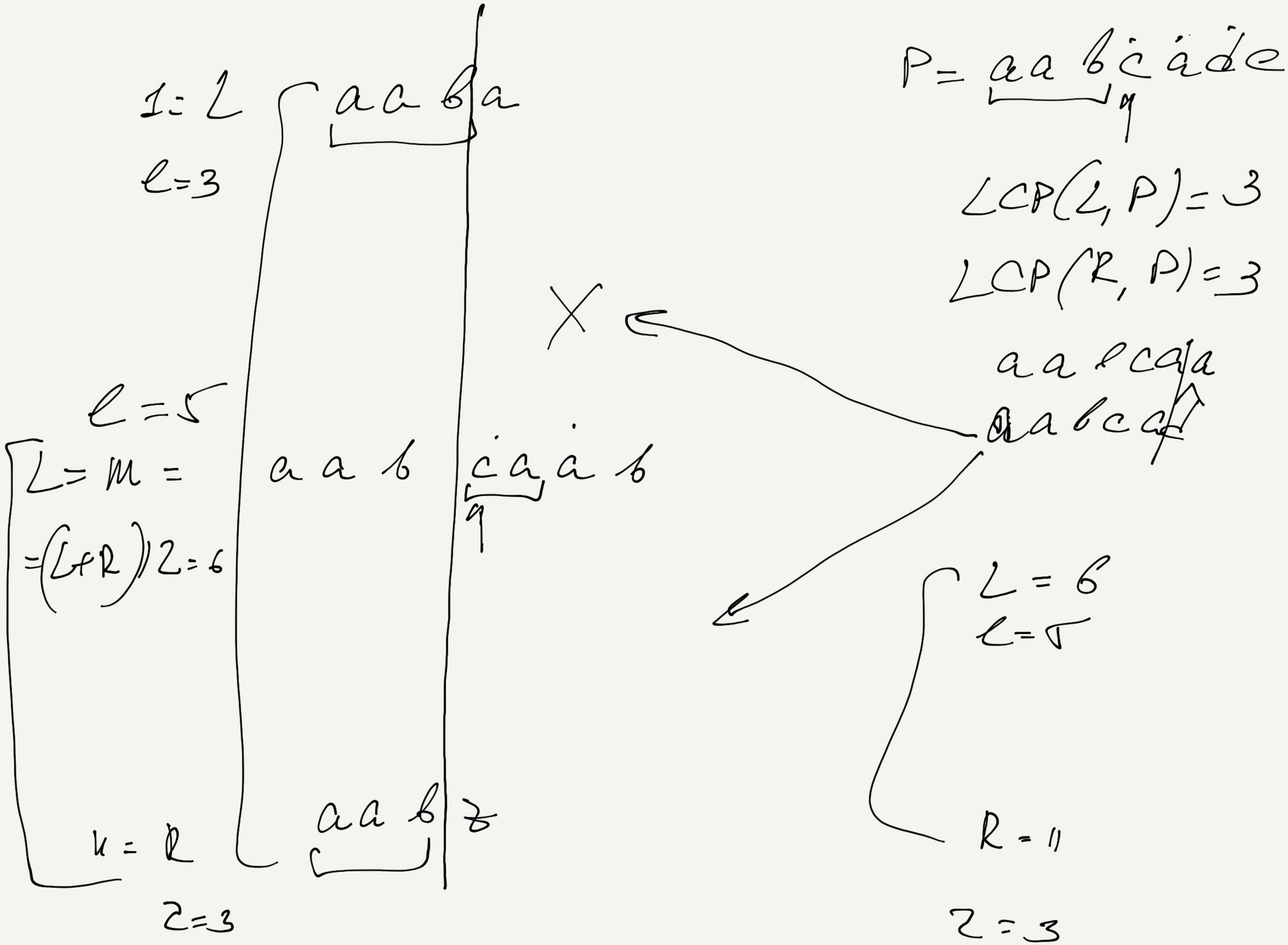
n

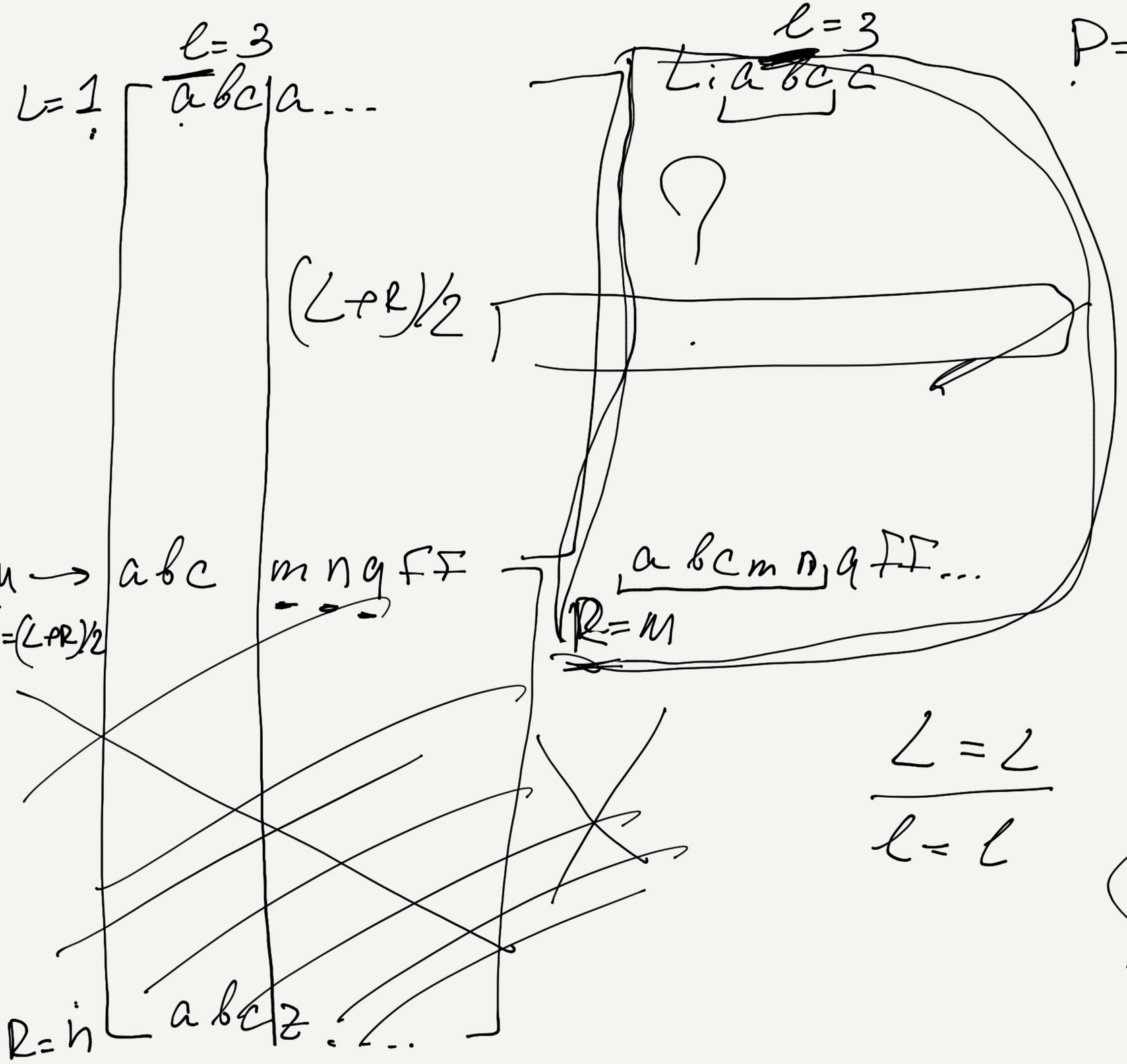
l = 2 = 3

L ~ M

R = R l = i - 1

L = M


1 : 2
aaba
l = 3
X
P = aabcada
LCP(2, P) = 3
LCP(R, P) = 3
aabcaqa
aabcaf
l = 5
L = M = aaba
cqa
aba
= (L + R) / 2 = 6
l = 6
l = 5
R = 11
M = R
aab
z
2 = 3
2 = 3



P=abc mnop

1) $\overset{3}{l} = \overset{3}{l}$

2) $l < z$

3) $l > z$

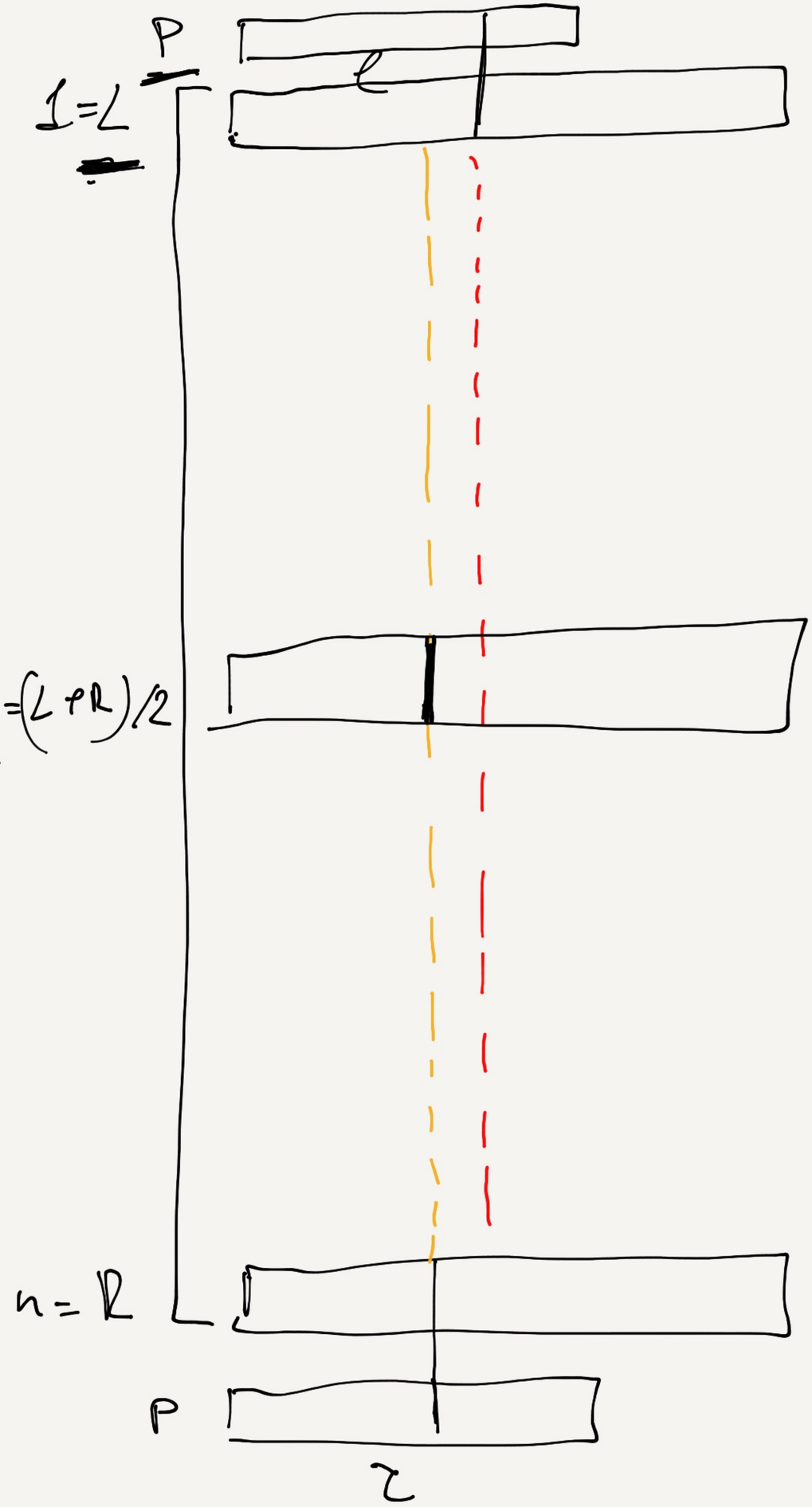
$0 < q$

$P < SA[M]$

$\frac{L = l}{l = l}$

$R = M$

$z = 5$



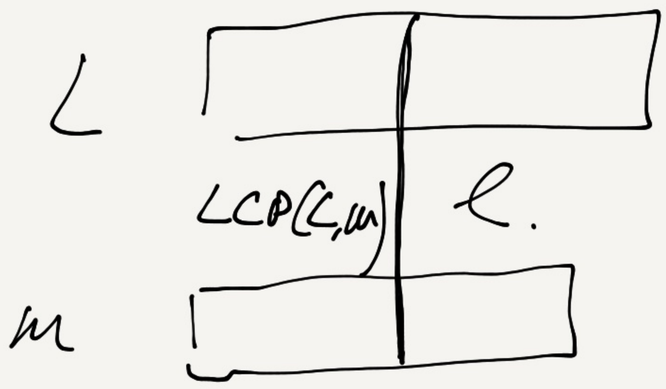
2) $l > 2$

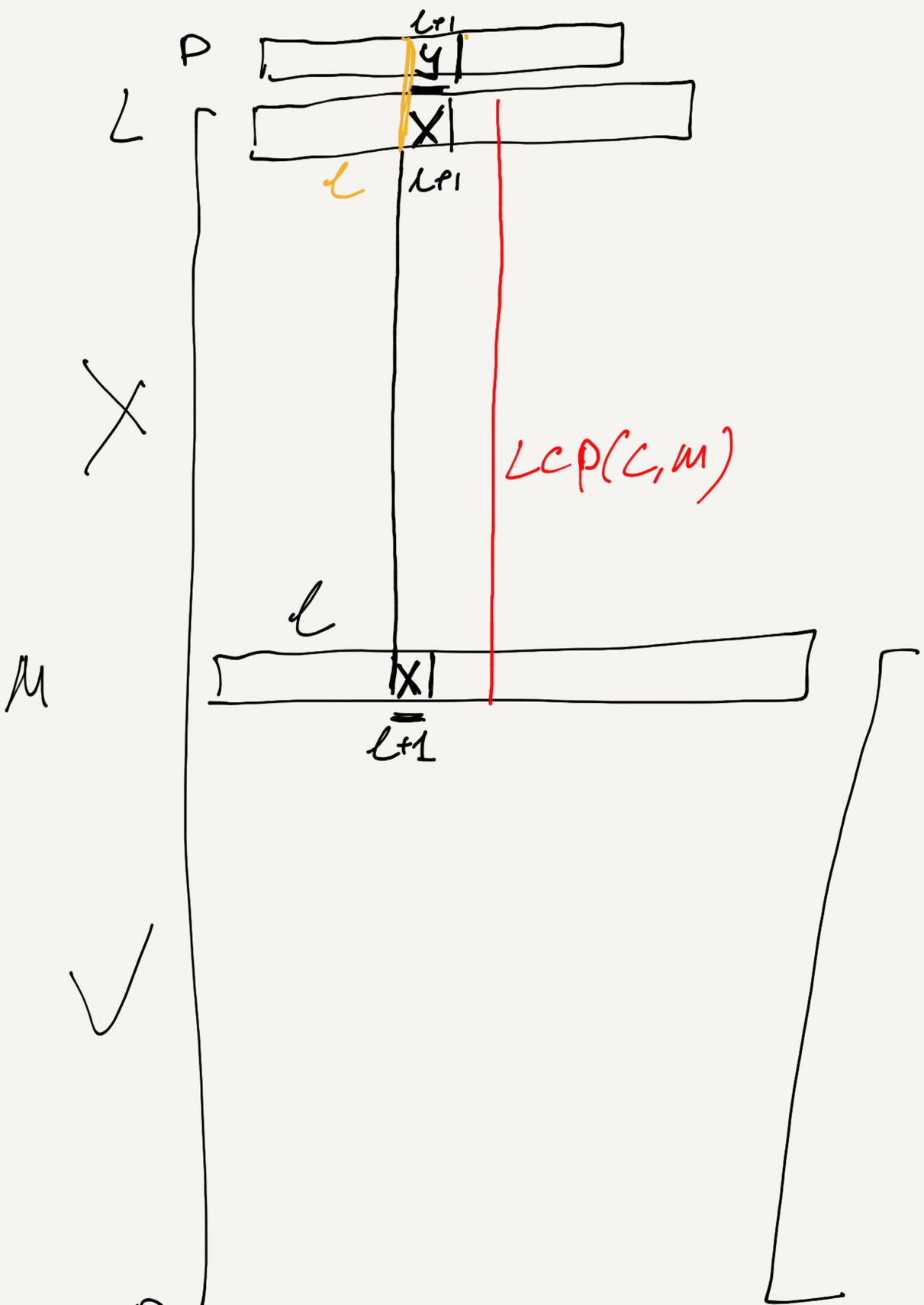
$dp[m][\min(l,r)+1]$

$P[\min(l,r)+1]$

$LCP(L, M)$ l

- $LCP(L, M) > l$
- $LCP(L, M) < l$
- $LCP(L, M) = l$





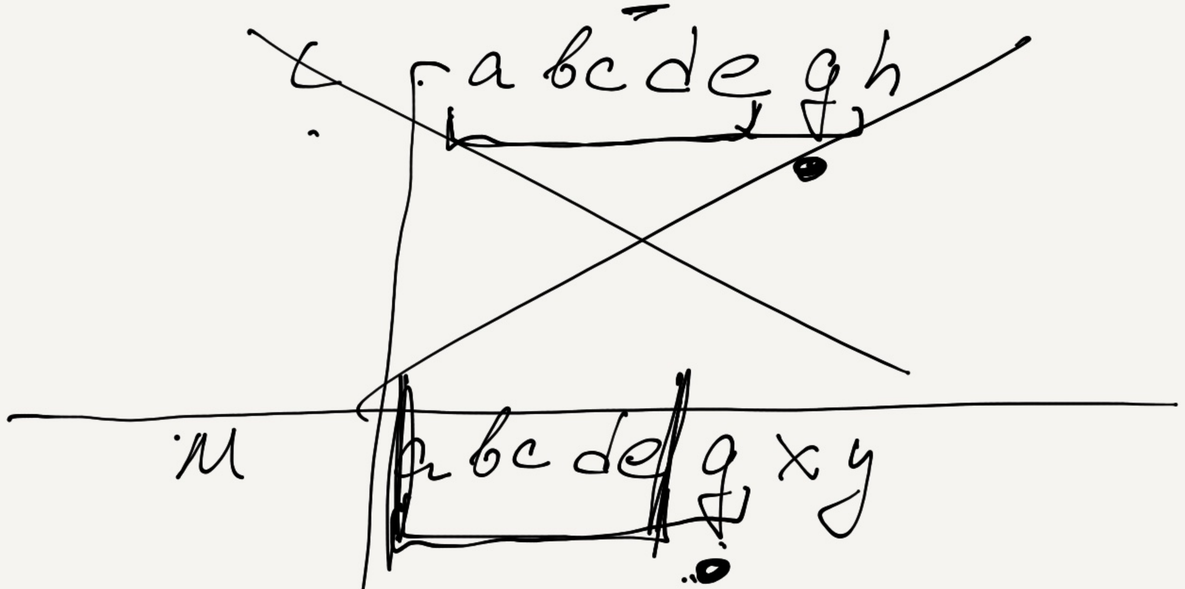
$LCP(L,M) > \ell$

$LCP(L,M) = 6 > 5 = \ell$

$R = R \qquad L = M$

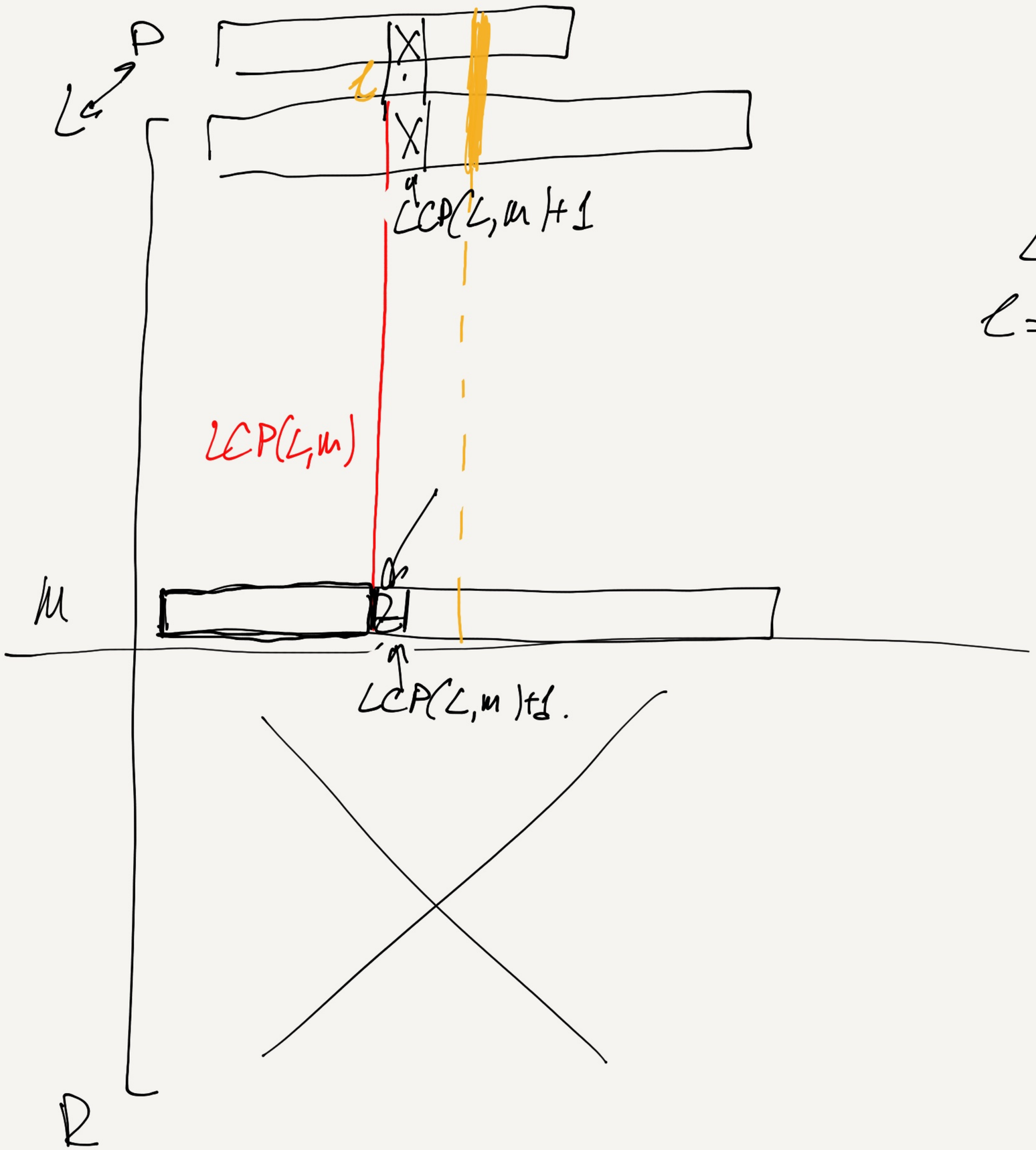
$z = 2 \qquad \ell = \ell$

$\ell = 5$



$z = 3$

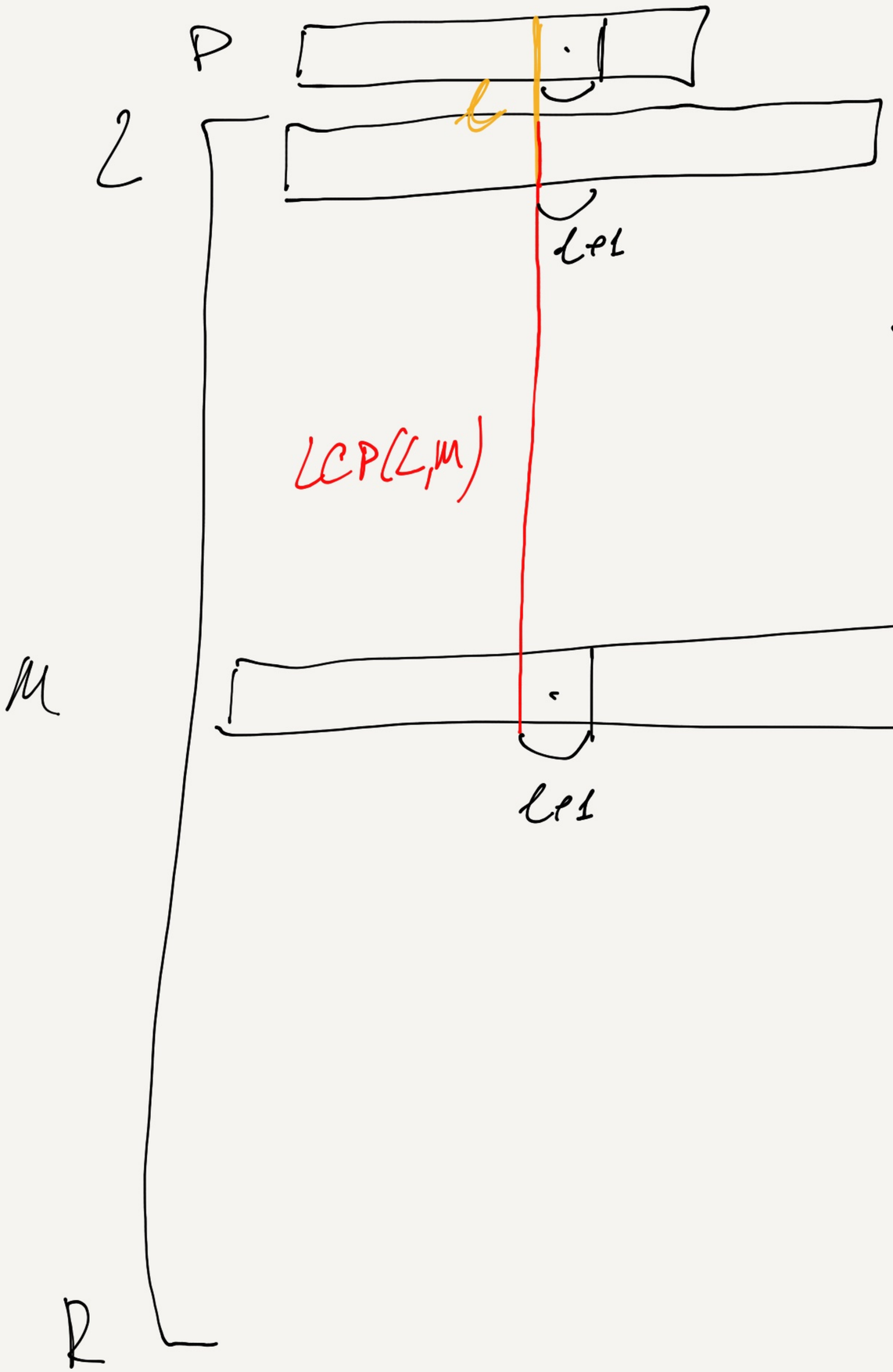
$P = \underline{a\ b\ c\ d\ e}\ m\ n$



$LCP(L,m) < \ell$

$L = L$ $\quad R = m$

$\ell = \ell$ $\quad z = LCP(L,m)$



$LCP(L, M) = e$

$SA[M][l+1] \dots P[l+1]$

$e = 2.$

✓ 1) $\ell = \tau$

$n = m^2$

$\log n = \log m^2 = 2 \log m < m$

$O(\log n + m)$

✓ 2) $\ell > \tau$

- $LCP(L, M) > \ell$
- $LCP(L, M) < \ell$
- $LCP(L, M) = \ell$

$O(m)$

3) $\ell < \tau$

- $LCP(M, R) > \tau$
- $LCP(M, R) < \tau$
- $LCP(M, R) = \tau$

$n = 2^m$

$\log n = \log 2^m = m \log 2 = m$

LCP(i,j)

i < j

L = 1

M

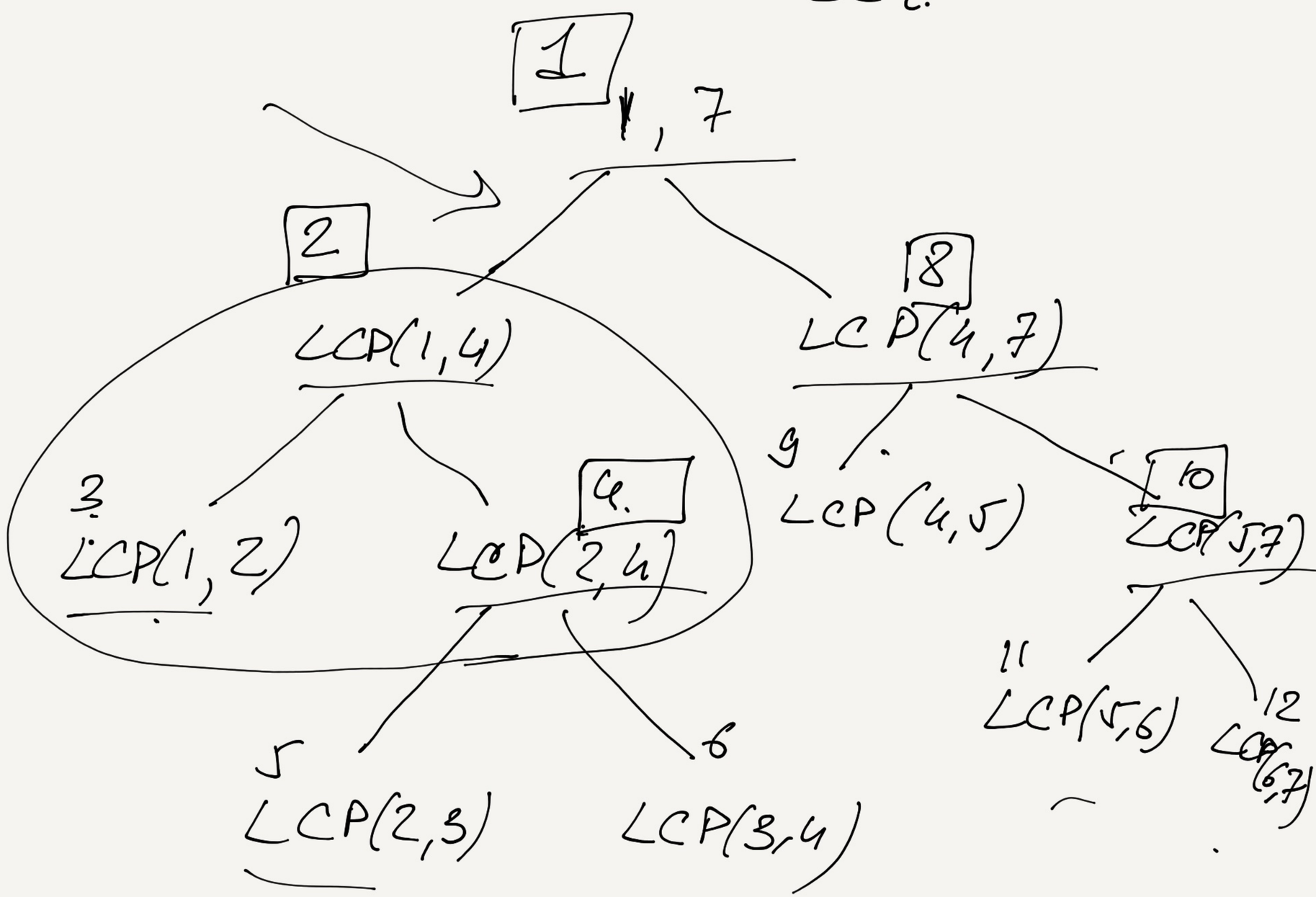
M =

= (L+R)/2

R = n

L > 2

L < 2.



LCP(i, i+1)

n-1

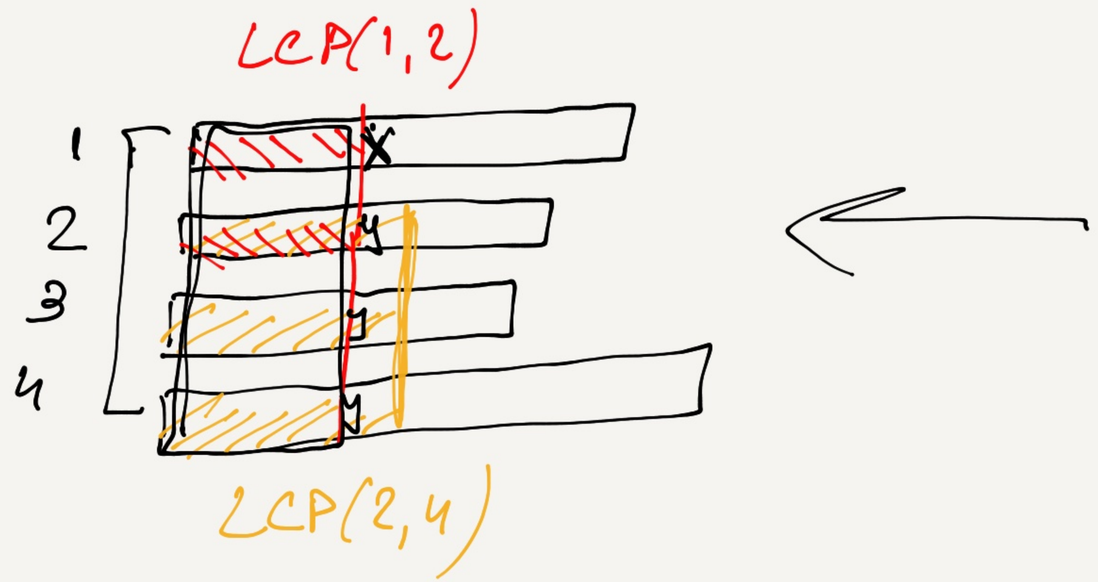
2n

LCP

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

LCP(1, 4)

LCP(1,2) LCP(2,4)



$$LCP(1,4) = \min(LCP(1,2), LCP(2,4))$$

$$LCP(i,j) = \min(LCP(i,i+1), LCP(i+1,i+2), \ldots, LCP(j-1,j))$$

$i < j$

$LCP(i, i+1)$

$O(n)$

$O(n)$

$O(m + \log n)$