LCS [Longest Common Subsequence]

Q Given 2 strings A & B, find their LCS!

A (N) B (M)

A: a b g d b a

B: x a g x b c a a

g b

a b a

a g b a → ANS: 4

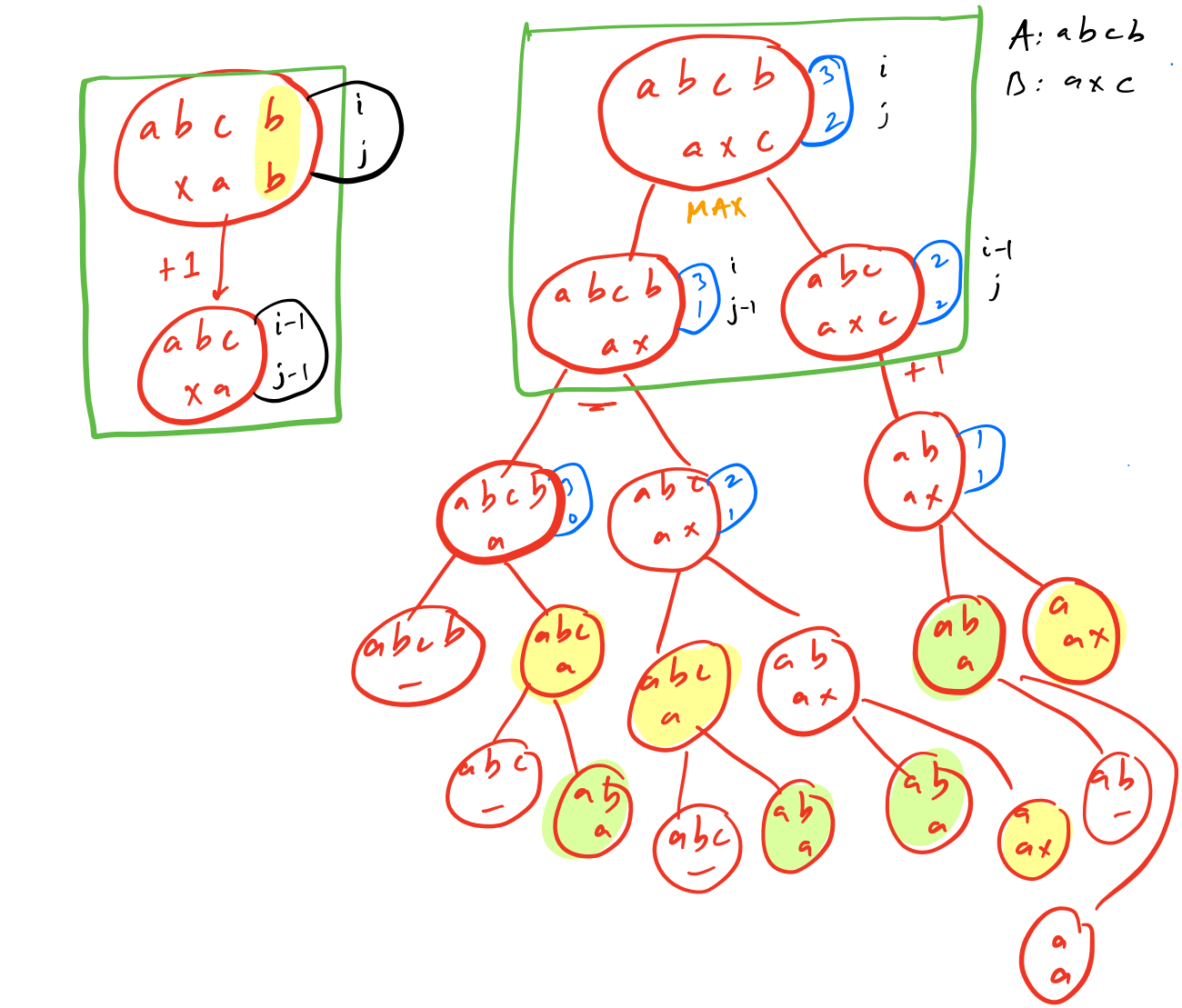
1) BF

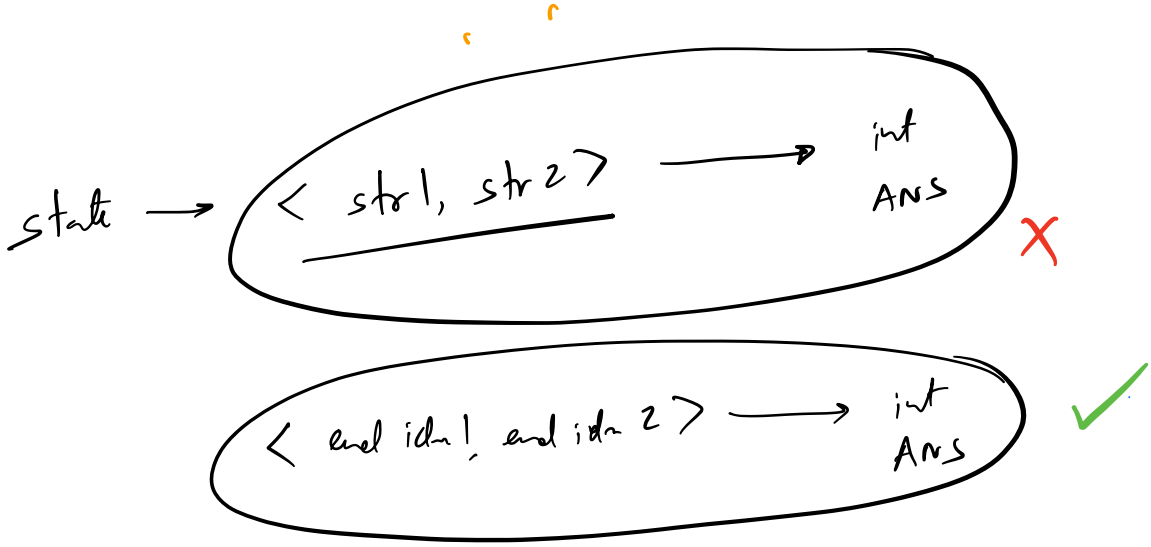
Gen of subseq of A → 2^N

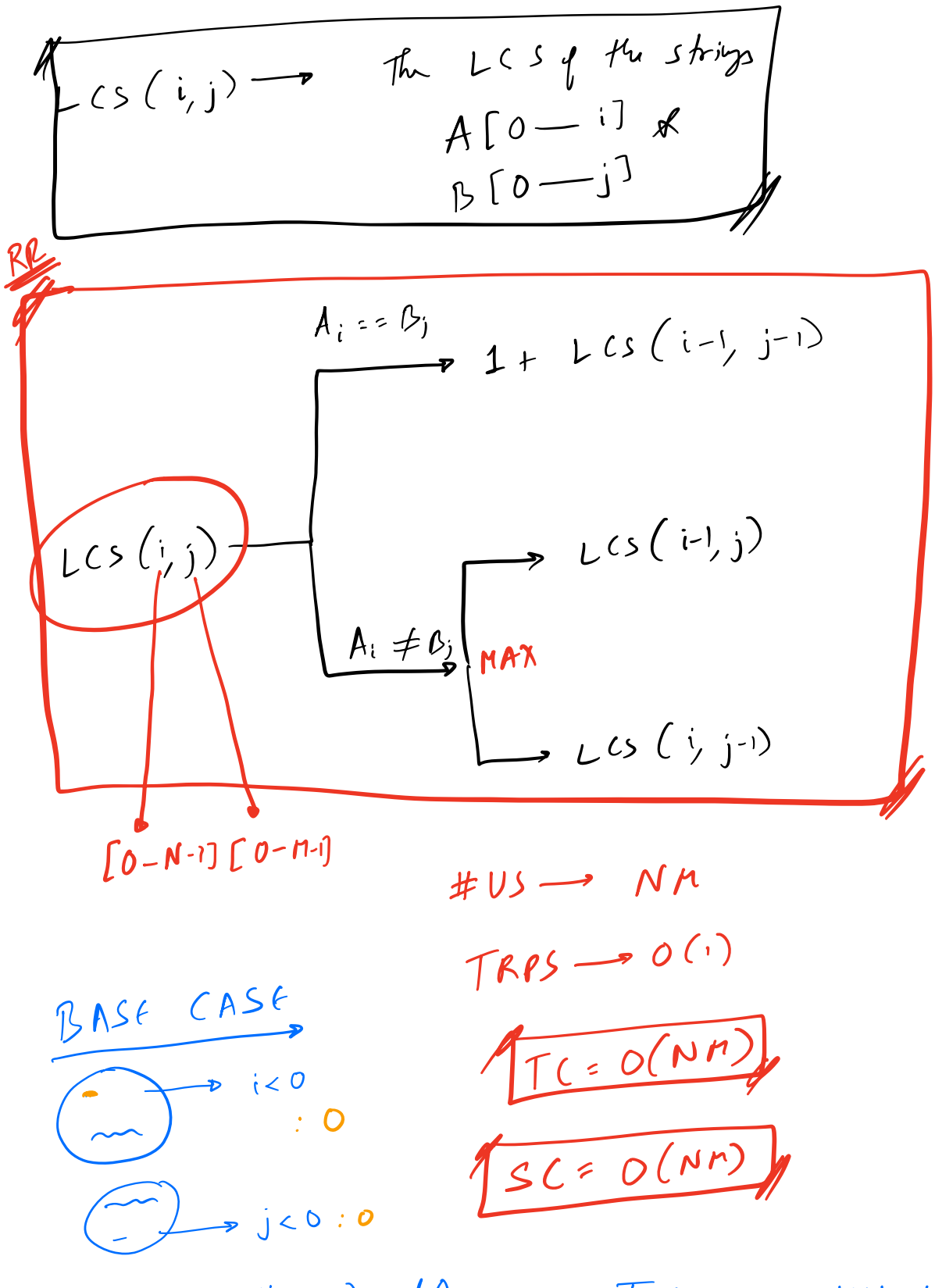
Gen of subseq of B → 2^M

TC is HIGH!

2, 1


A: abcb
B: axc
MAX
+1
=
+1


state
< str1, str2 >
int
ANS
< end idx1, end idx2 >
int
ANS



#US → NM

TRPS → O(1)

TC = O(NM)

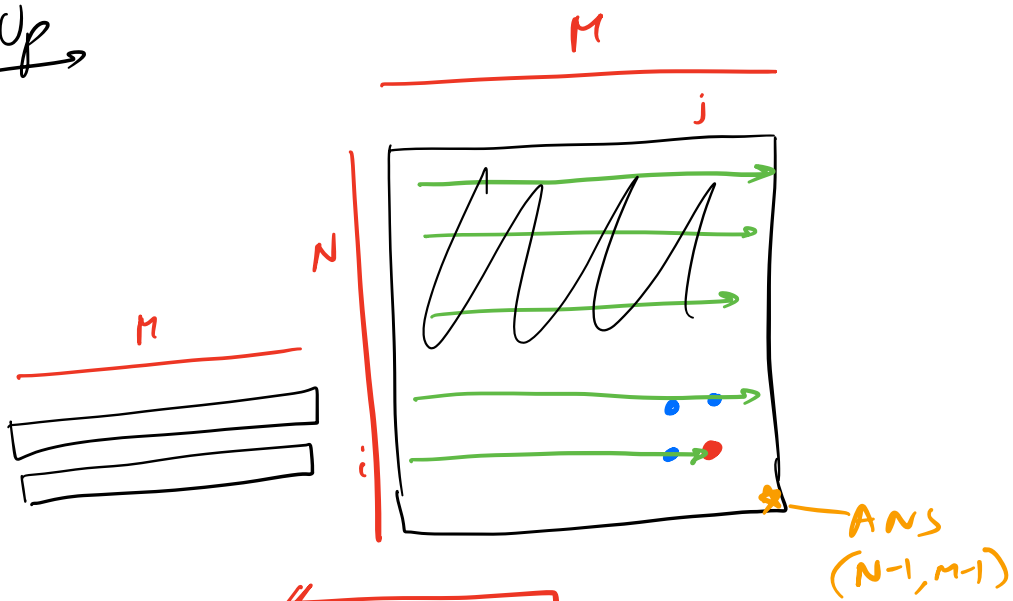
SC = O(NM)

BASE CASE

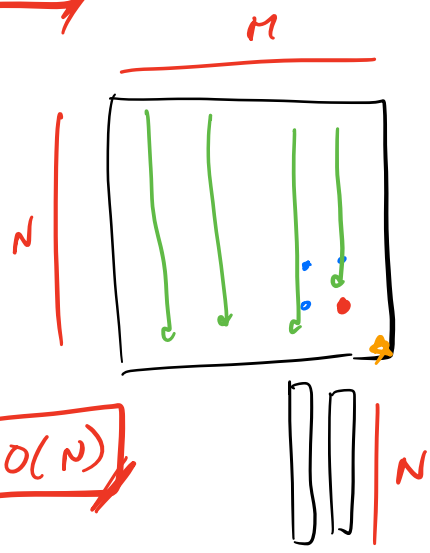
if (i<0 || j<0) ret 0;

TopDown → HW !

Bottom Up →



SC = O(M)



SC = O(MIN(N, M))

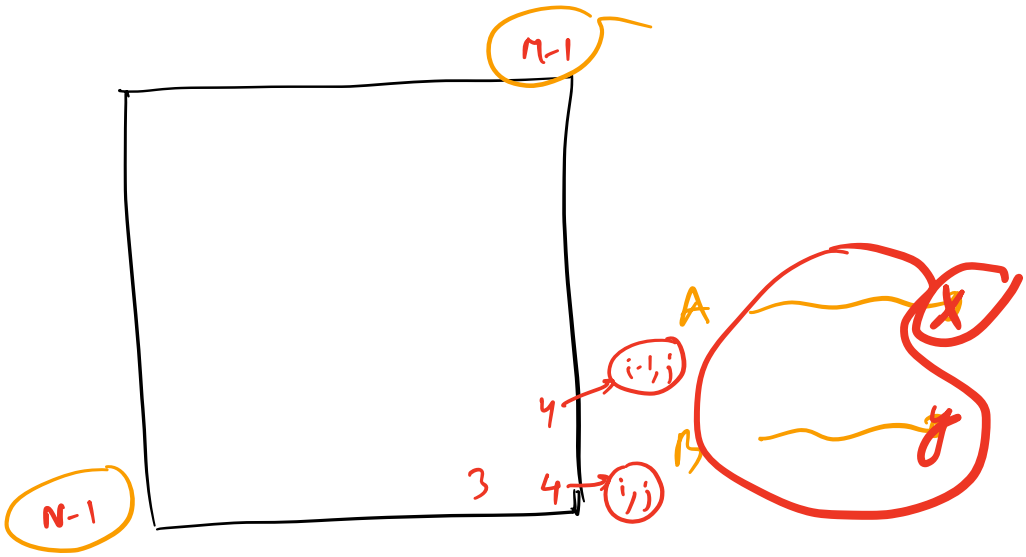
SC = O(N)

LCS(A, B) = LCS(B, A)

```
if ( B.len() > A.len())
    swap (A, B)
```

→ Solve —

→ SC = O(MIN(N, M))



i = N-1 , j = M-1

loop

```
if( A[i] == B[j] ) {
    LCS += A[i];
    i--; j--;
}
else {
    if( dp[i][j] == dp[i-1][j] )
        i--;
    else
        j--;
}
```

Reverse(LCS) !

EDIT DISTANCE

Given 2 strings A (N) & B (M)

Goal: Convert A → B

Allowed 3 types of ops on A.

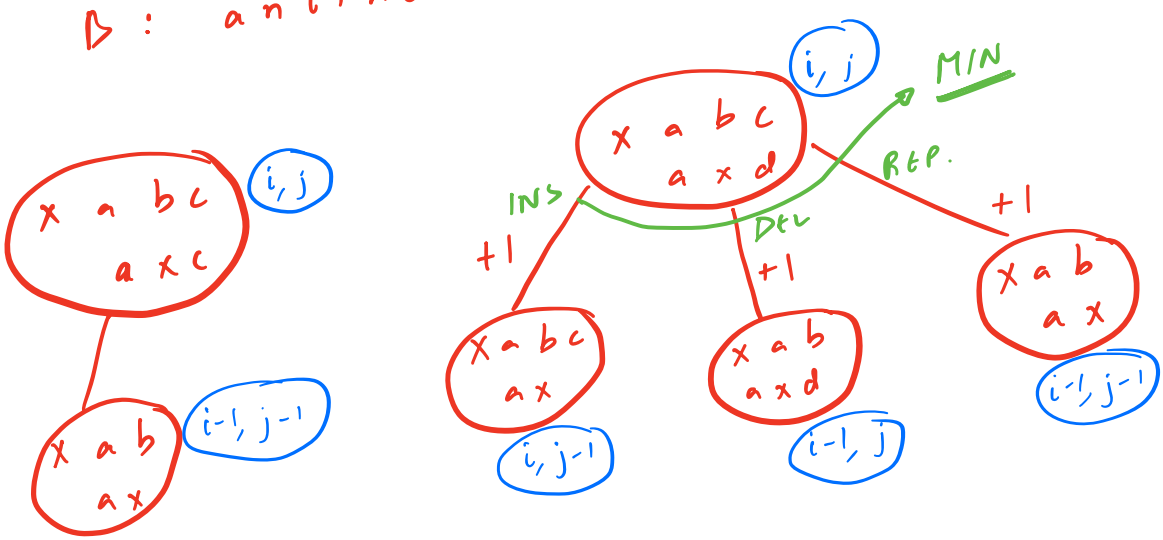
1. Insert a char!
2. Del a char!
3. Replace a char!

Find the MIN ops to do so!

A: anshuman

B: antihuman

ED: 2

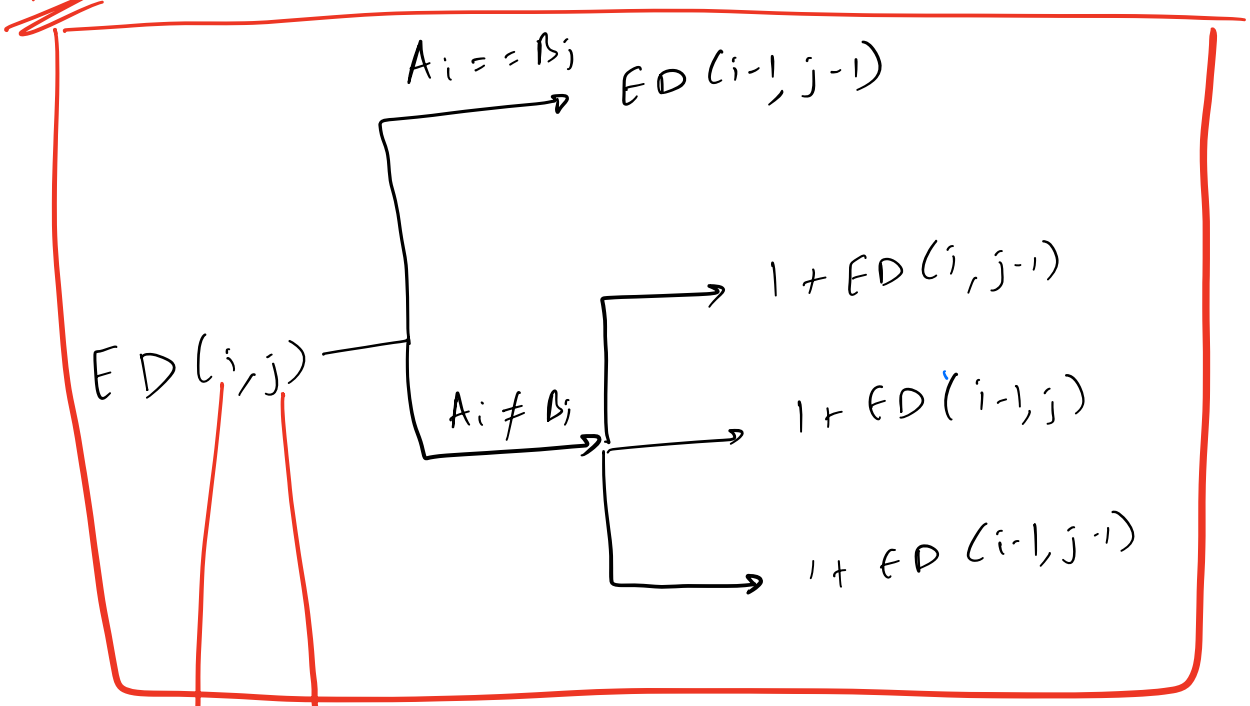


ED(i, j) → Edit Distance b/w the strings

A[0 — i] &

B[0 — j]

RR



[0-N-1] [0-M-1]

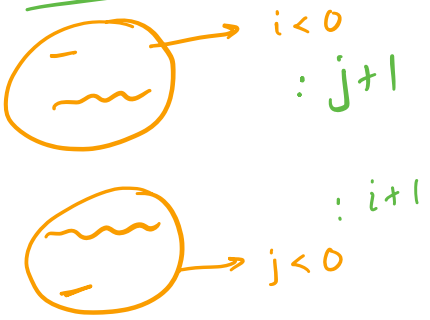
#US → NM

TRPS → O(1)

TC = O(NM)

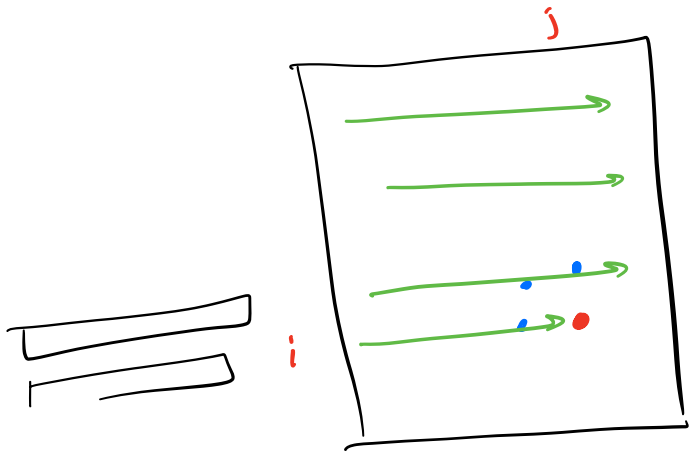
SC = O(NM)

BASE CASE



Top-down → HW

Bottom Up



SWAP(A, P)

TC = O(NM)

SC = O(MIN(N, M))

Q Given a string (s) & a pattern (P).

$S_i \in \{a - z\}$

$P_i \in \{a - z, ?, *\}$

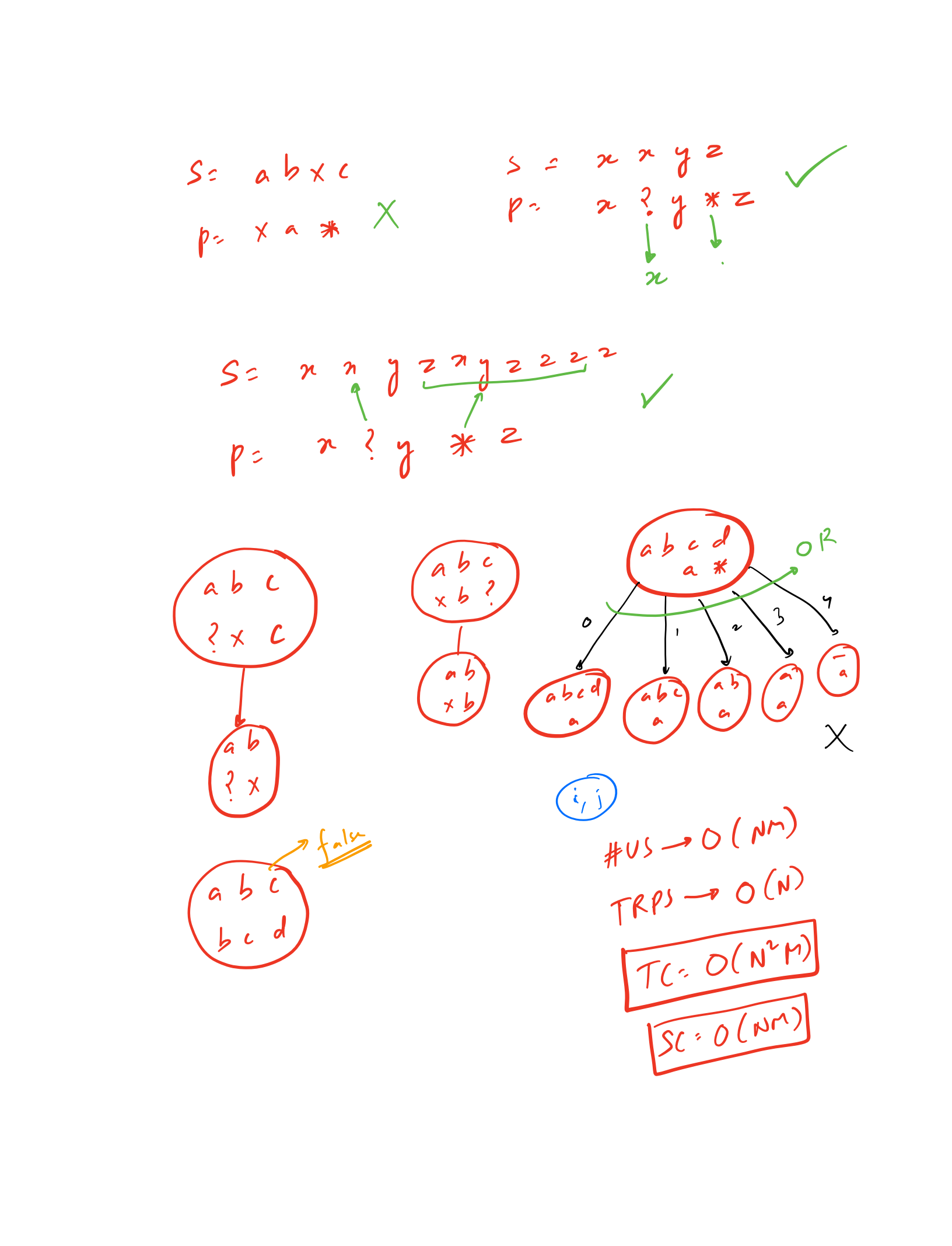
? → match any single char

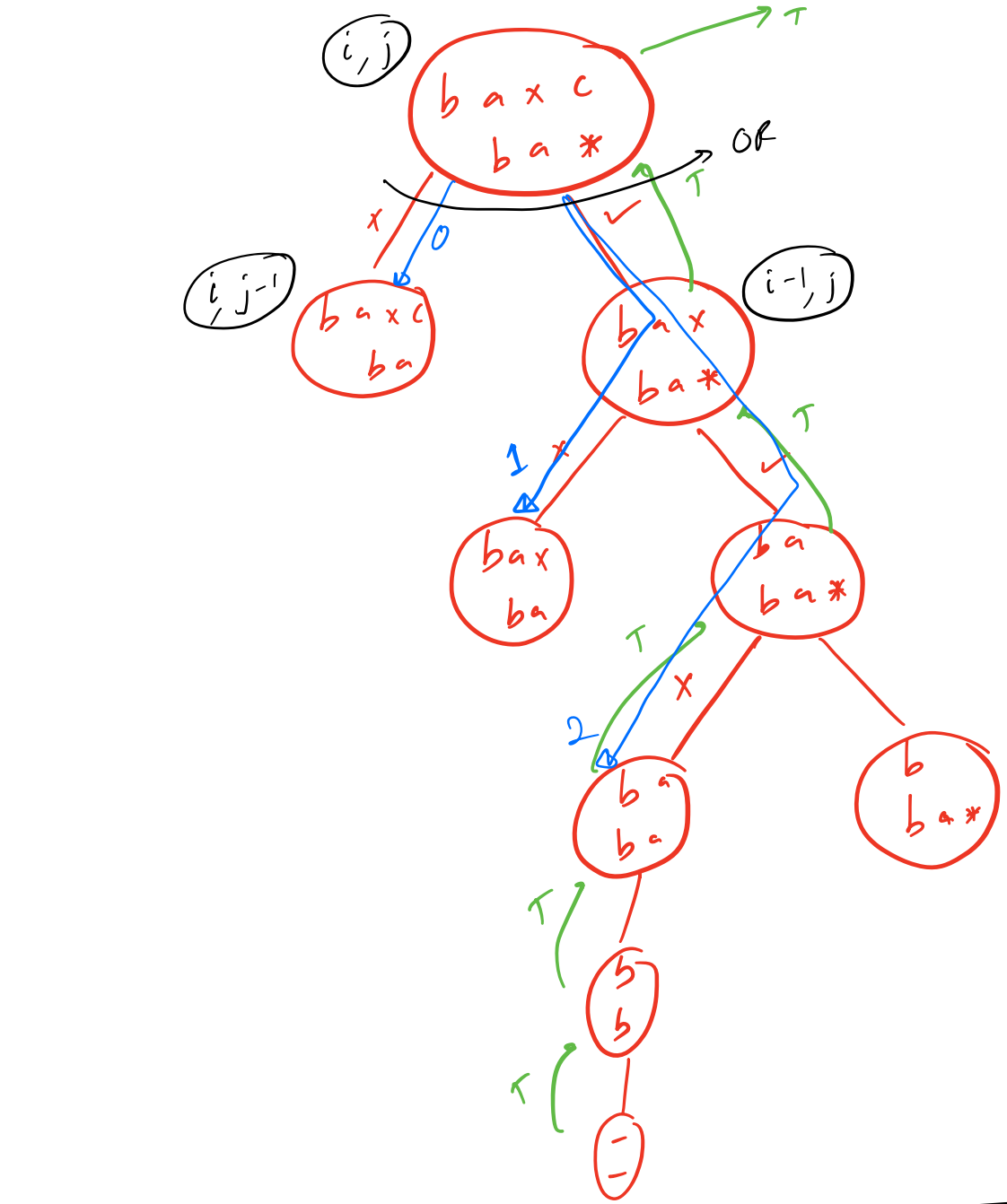
* → match 0 or more chars

Tell if P matches the S.

S = abc
P = abc ✓

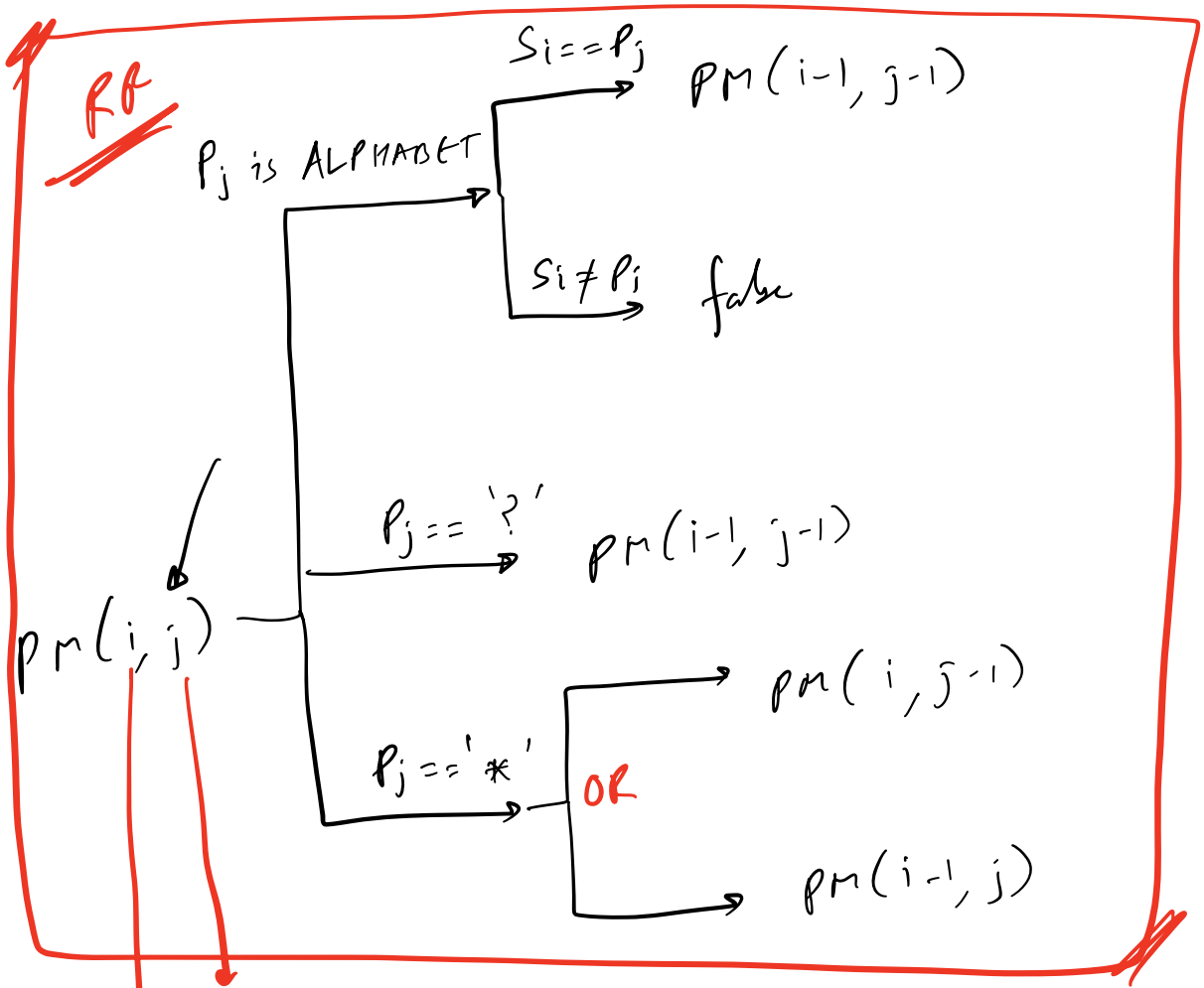
S = abc
P = d ✗


S: a b x c
p: x a *
S: x x y z
p: x ? y * z
S: x x y z x y z z z z
p: x ? y * z
a b c
? x c
a b
? x
a b c
x b ?
a b
x b
a b c d
a *
OR
0
1
2
3
4
a b c d
a
a b c
a
a b
a
a
a
a
X
i, j
#US → O(NM)
TRPS → O(N)
TC: O(N²M)
SC: O(NM)
a b c
b c d
false



PM(i, j) → is true if s[0 — i] matches p[0 — j]

false otherwise



[0-N1] [0-M]

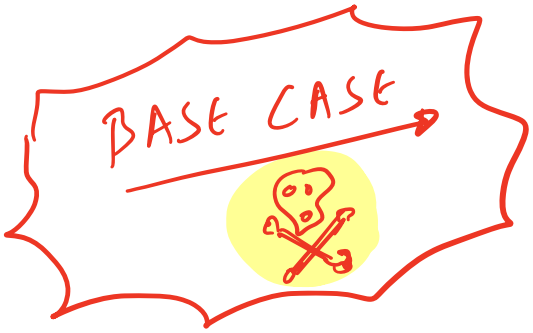
US → N M

TRPS → O(1)

Top Down

↓

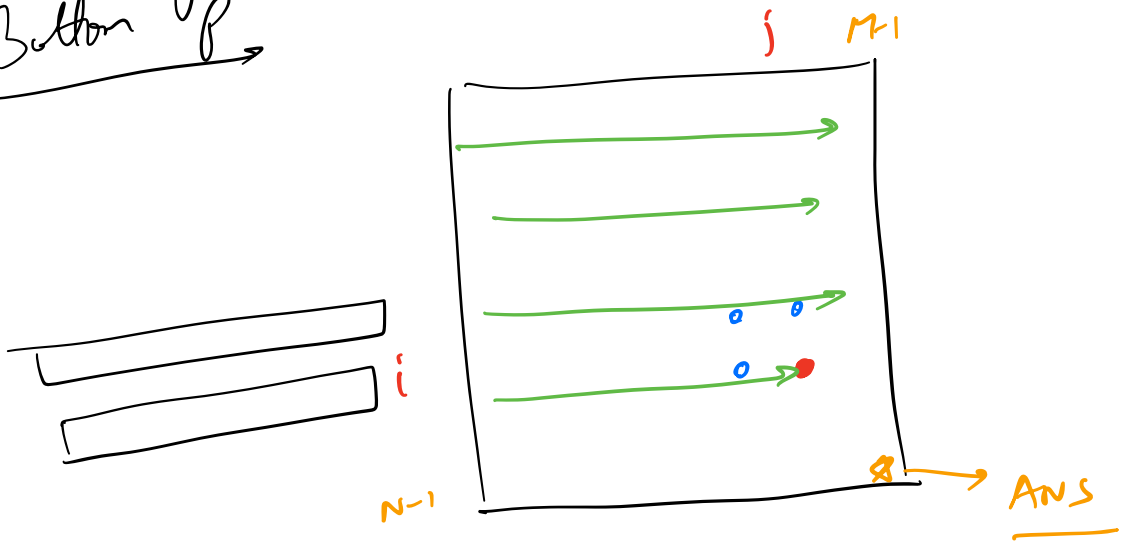
HW



TC = O(NM)

SC = O(NM)

Bottom Up



TC = O(NM)

SC = O(MIN(N,M))