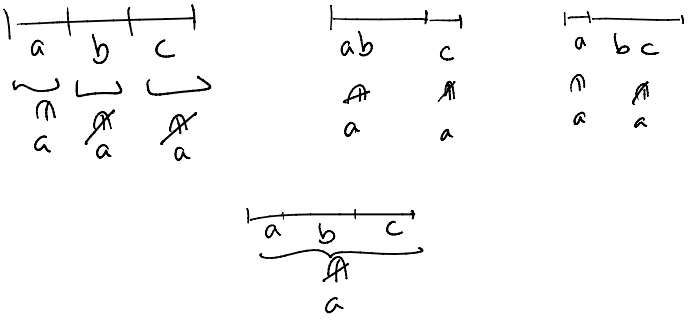
Lecture 17

Thursday, October 21, 2021 2:03 PM

Claim : $r^* = \text{""} + (r \cdot r^*)$

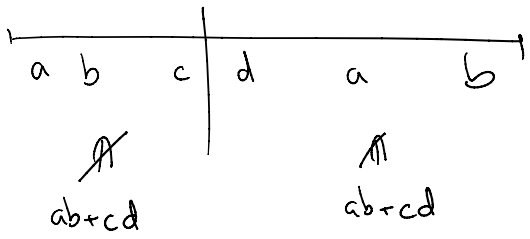
matches "abc" a*

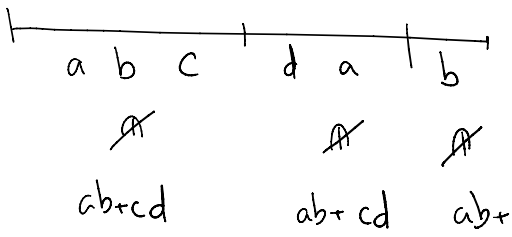


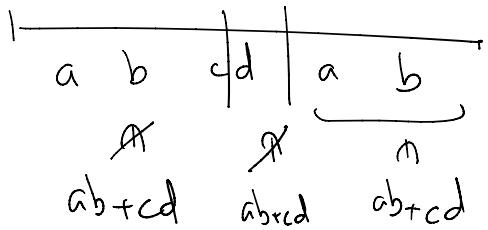
matches "abcdab" ("ab" + "cd")*

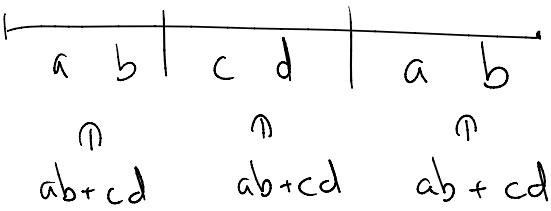
a b c d a b

Can I break this string into pieces so that each piece matches ("ab" + "cd") ?





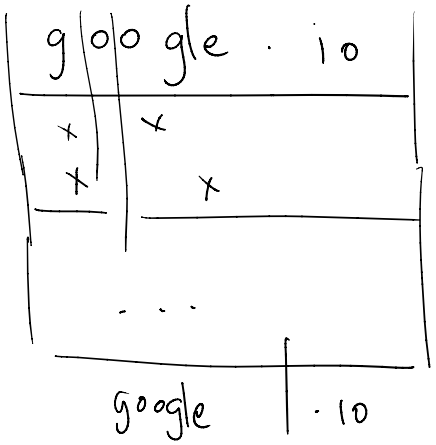




Pattern = "google" • ("·com" + "·edu")

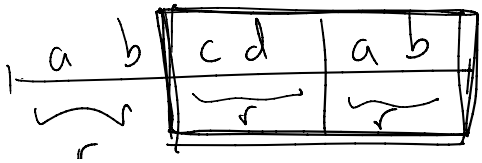
google | · com

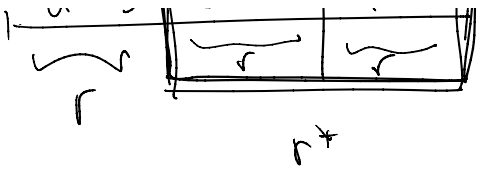
Pattern = ("google" + "apple") • ("·com" + "·io")



The string "ab cd ab" matches $(ab + cd)^*$

" "



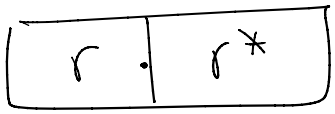


We want to say: $r^* = r \cdot r^*$

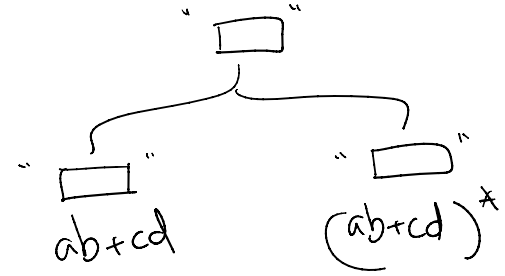
Part 1: " " matches r^* $(ab+cd)^*$

Vacuous claim

Part 2: Question: Does " " match $r \cdot r^*$? (r = $(ab+cd)$)



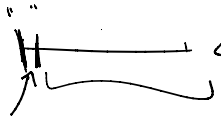
" " $(ab+cd) \cdot (ab+cd)^*$



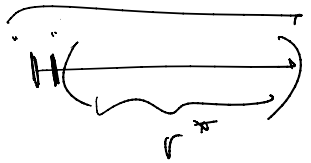
We want to say: $r^* = r \cdot r^*$

But we can only say: $r^* =$ " " $+ r \cdot r^*$

Concat ("ab", Union("de", "fg"))



$r^* = \varepsilon + r \cdot r^*$



$fib(5) = fib(4) + fib(3)$

$= fib(3) + fib(2) + fib(2) + fib(1)$

$= fib(2) + fib(1) + fib(1) + fib(0)$

$+ fib(1) + fib(0) + fib(1)$

$= fib(1) + fib(0) + fib(1) + fib(1) + fib(0)$

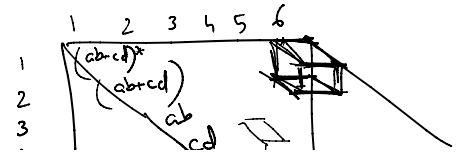
$+ f_1 + f_0 + f_1$

$$fib(n) = \begin{cases} fib(n-1) + fib(n-2) & \text{if } n > 1 \\ 1 & \text{if } n = 1 \\ 0 & \text{if } n = 0 \end{cases}$$

$fib(n) \quad O(\varphi^n)$

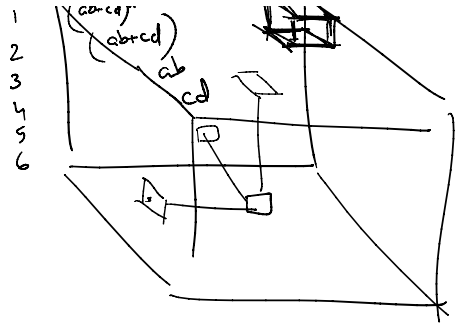
$w =$ "ab cd ab" match $(ab + cd)^*$?

1 2 3 4 5 6



$(ab+cd)^*$

$ab + cd$



ab + cd
ab
cd

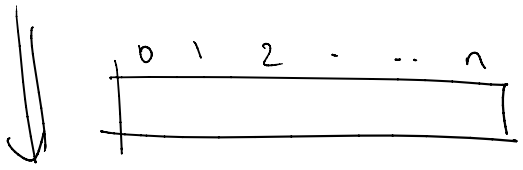
Table (i j r) =

Does $w_i w_{i+1} w_{i+2} \dots w_j$ match r ?

$O(n^2 |r| \cdot n) = O(n^3 |r|)$ time

- $n^2 |r|$: cells in table
- n: time to fill each cell

$fib(n) = fib(n-1) + fib(n-2)$



$fib(n) = fib(n-1) + fib(n-2)$ unless table already filled

Given a regular expression r
& string w (of length n),
you can determine whether
w matches r in

one left to right pass over the string,
each character processed in
$O(|r|^2)$ time
& with only $O(|r|)$ memory.

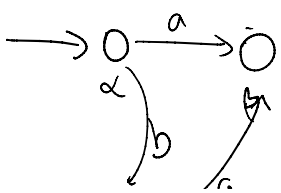
● : _____

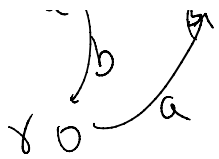
for each a in w:

    if a = "a" then
        ● = _____
    else if a = "b" then
        ● = _____
    ⋮

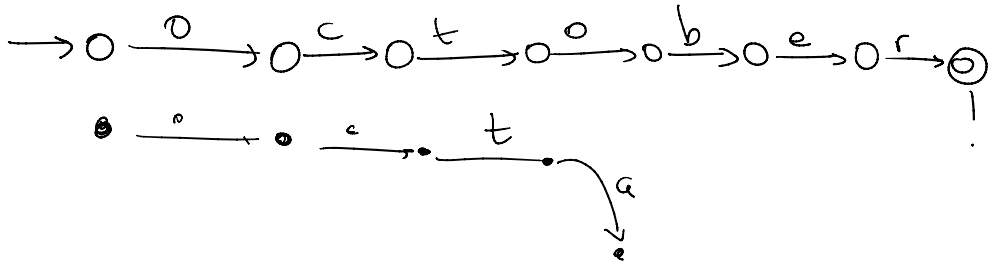
if f(●) then true else false

Constant memory algorithms

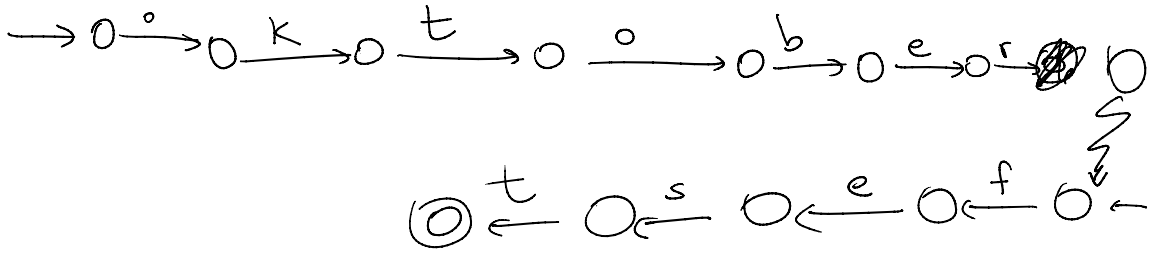




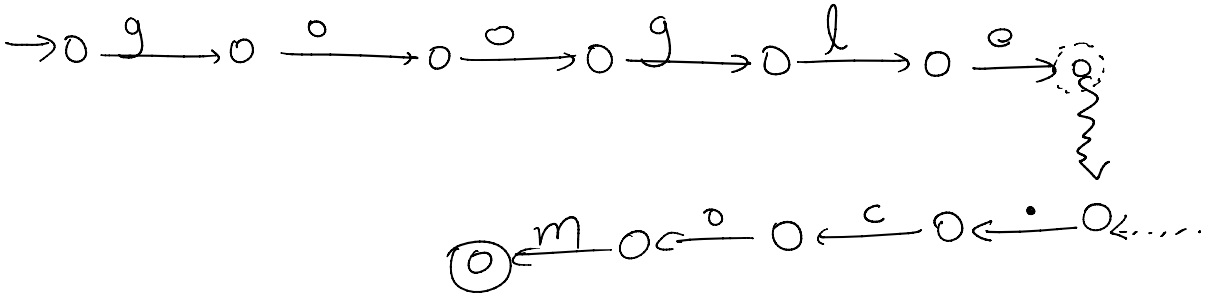
How to match Constant "october"

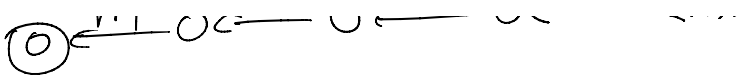


Concat (Constant "oktober", Constant "fest")

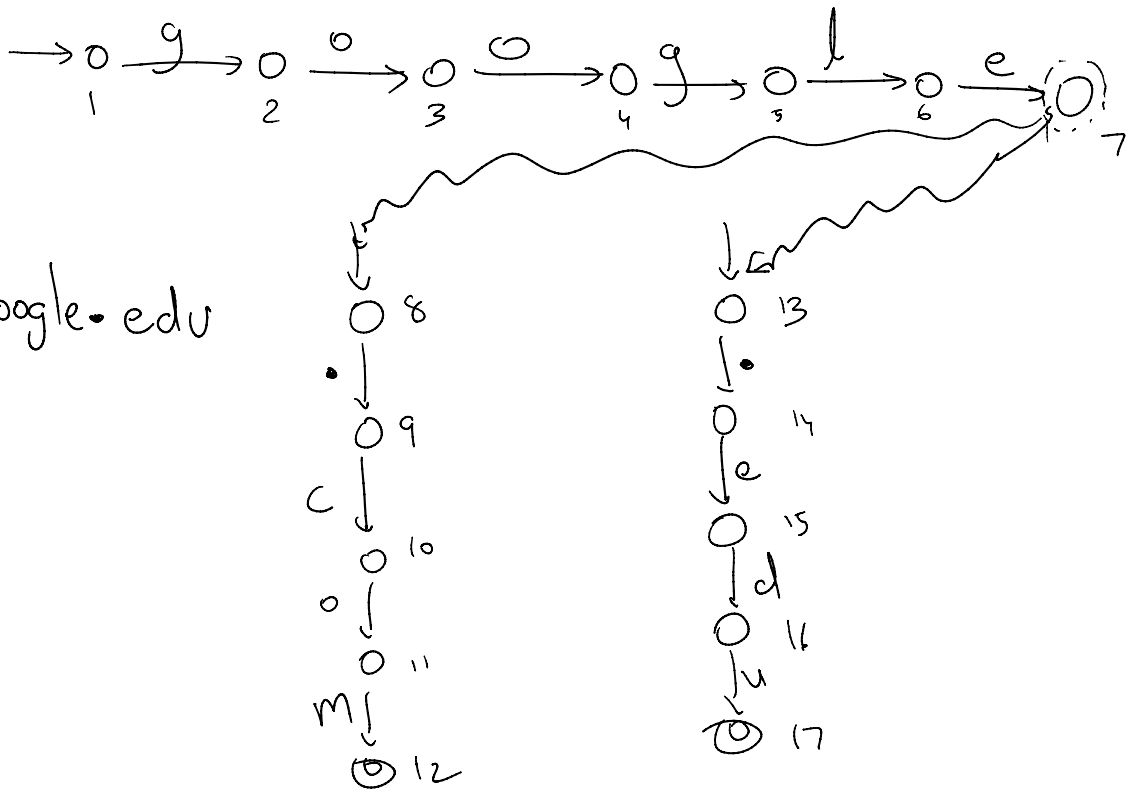


Concat ("google", ".com")





Concat ("google", ".com" + ".edu")



google.edu

tokens @ [3]

tokens @ [4]

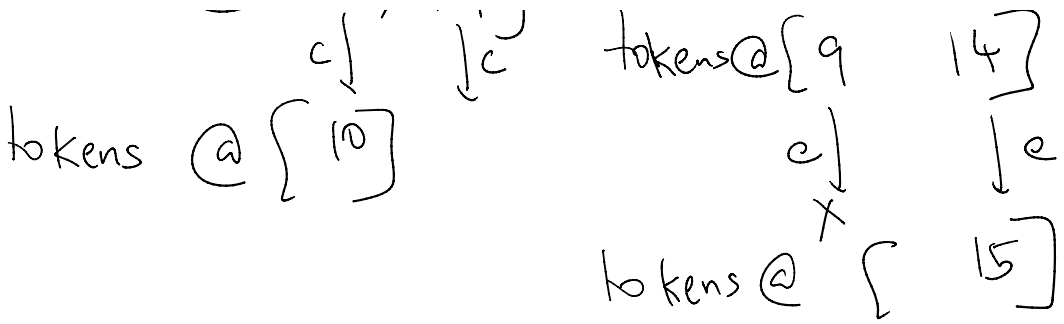
tokens @ [5]

tokens @ [9, 14]

token @ [6]

tokens @ [8, 13]

tokens @ [9 14]



Person always ends sentences with 5!!!!!

Helb! World!!!!!

$$(a+c+b)^* \cdot b \cdot (d+a)^*$$