

Regular Expressions

$r ::=$ Constant string

$r_1 \cdot r_2$

r^*

$r_1 \mid r_2$

Bottom

$O(|w| \cdot \text{poly}(|r|))$

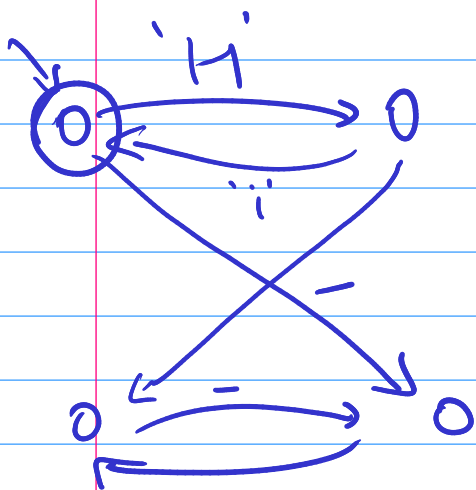
~~$O(|w| \cdot 2^{|r|})$~~

r_1 and r_2 not r

"Hi"*

looking for $H = \text{True}$

fail = False



$\neg \text{fail}$ for c in w :

if $\neg H \wedge c \neq 'H'$ or

$\neg \neg H \wedge c \neq 'i'$:

fail

$\neg H = \text{fail} = \text{True}$

$\neg H$

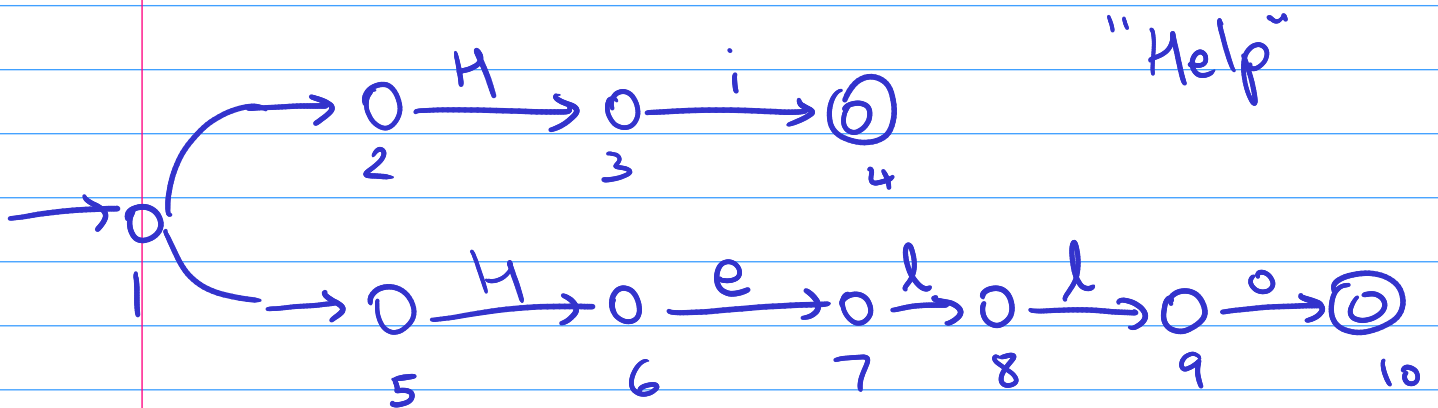
$\neg \neg H$

ans = $\neg H \wedge \neg \text{fail}$

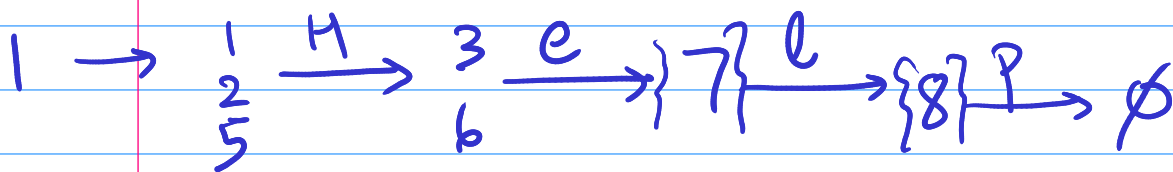
"Hello"

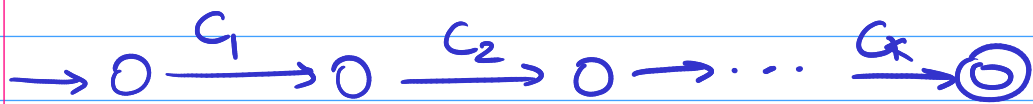


"Hi" | "Hello"

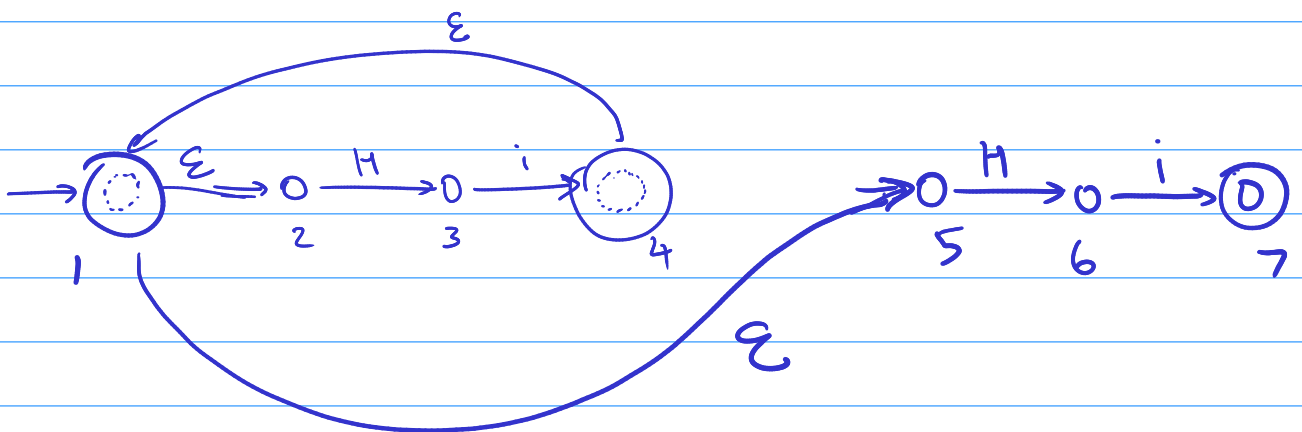


"Help"

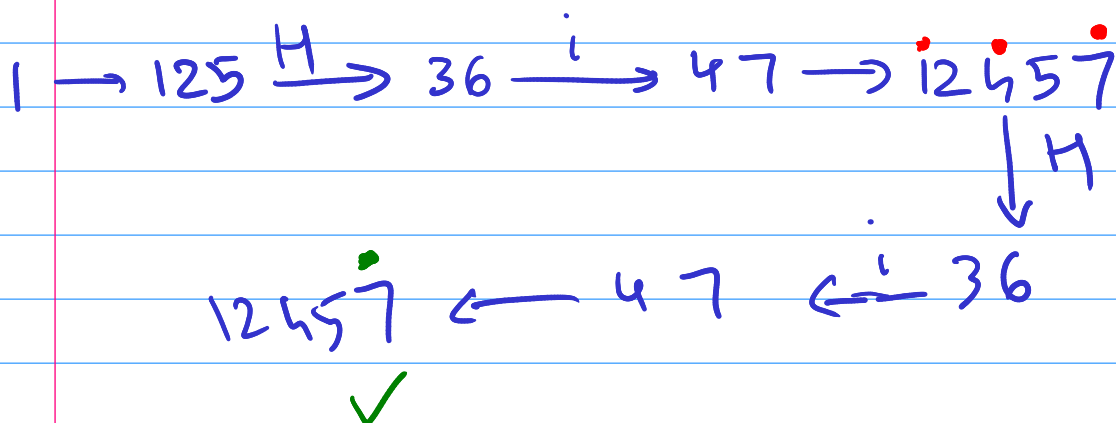


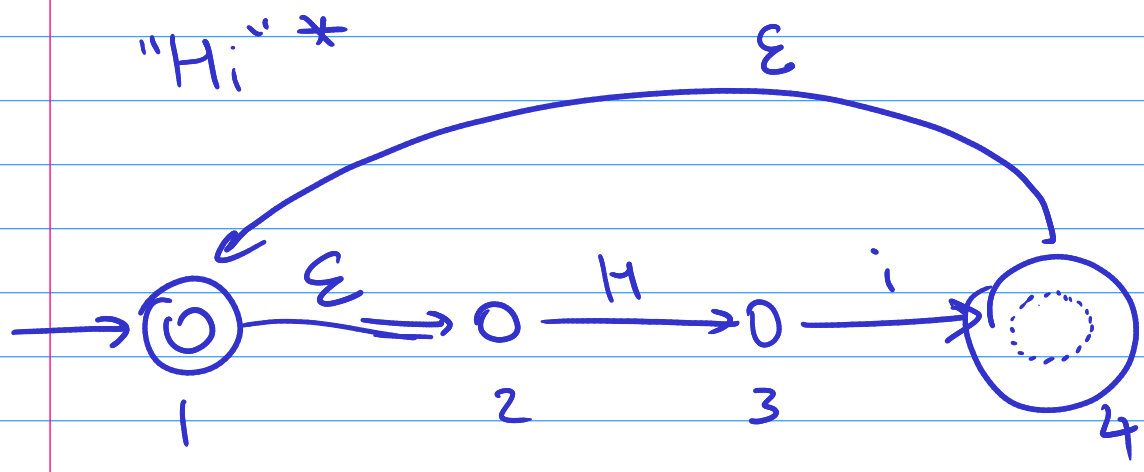
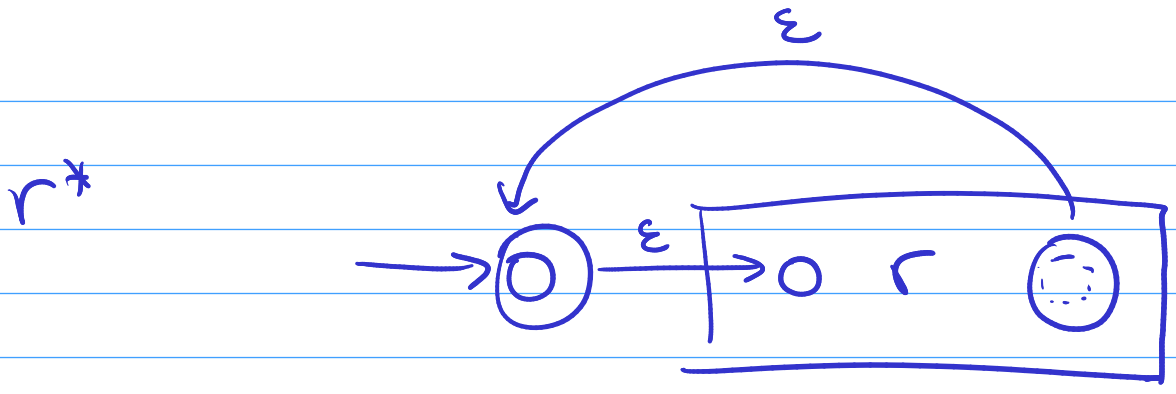


"H_i" * "H_i"

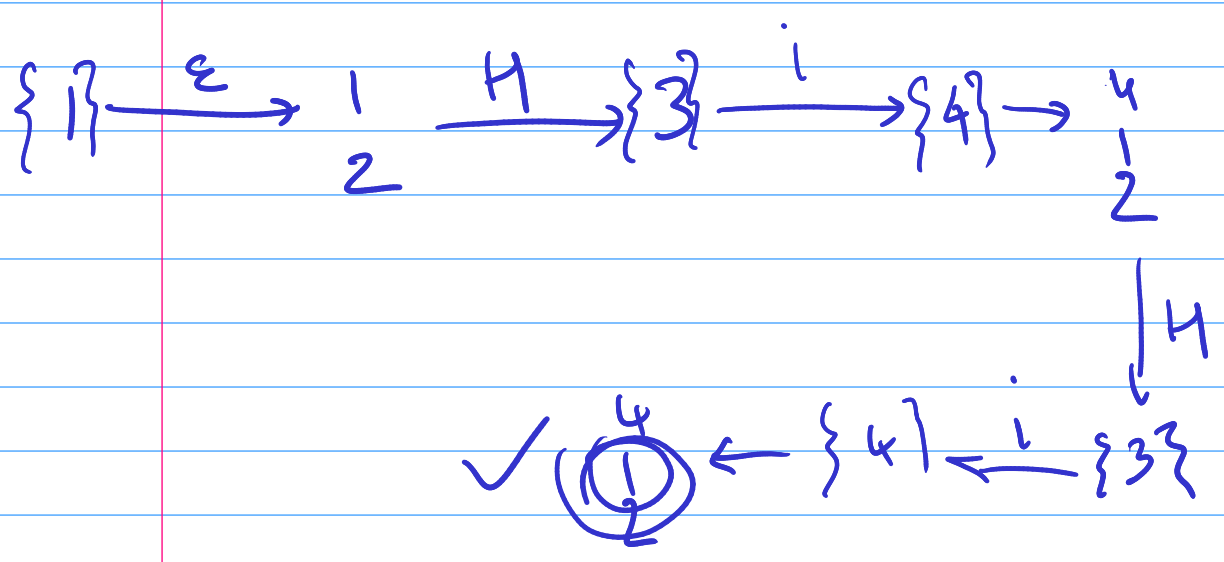


H_i H_i

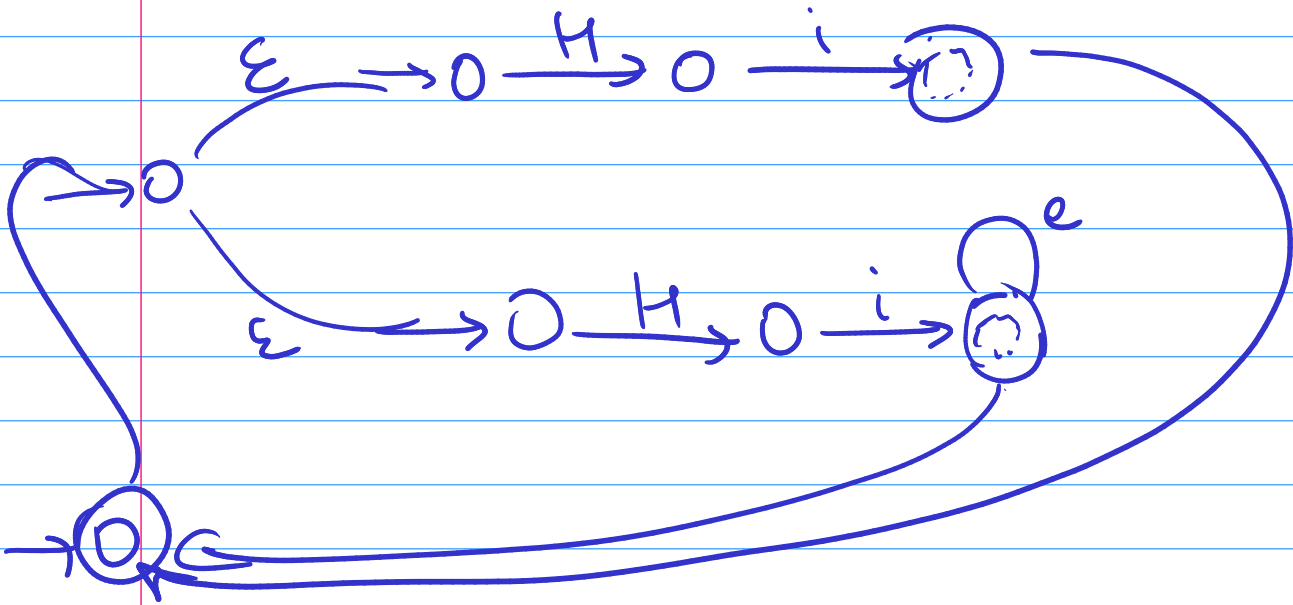




HiHi



$$(H_i \mid H_i e^*)^*$$



ϵ /Forking : Non determinism

Destroying redundant tokens : Powerset construction

NFA \rightarrow DFA

Bounded number of tokens

Types

$$3 + 5 \Rightarrow^* 8$$

$$(\text{if } 3 \leq 5 \text{ then } 3 \text{ else } 5) + 8 \Rightarrow^* 11$$

$$3 + \text{true} \Rightarrow^* ? \text{ Runtime error}$$

$$\text{if } 3 \text{ then } 4 \text{ else } 5 \Rightarrow^* ? \text{ Runtime error}$$

Language L_1 (Untyped expressions)

$e ::= 0 \mid 1 \mid 2 \mid \dots \mid \underbrace{\text{true} \mid \text{false}}_{\text{Booleans}}$

$c \in \text{Int}$

$\mid e_1 + e_2 \mid e_1 - e_2 \mid e_1 \leq e_2$

$\mid e_1 \text{ and } e_2 \mid e_1 \text{ or } e_2 \mid \text{not } e_1$

$\mid \text{if } e_1 \text{ then } e_2 \text{ else } e_3$

Language L_2 (Separate Ints & Bools)

Arithmetic Exprs

$a ::= 0 \mid 1 \mid 2 \mid \dots$
 $\underbrace{\hspace{10em}}$
 $c \in \text{Int}$

$\mid a_1 \pm a_2$

$\mid \text{if } b \text{ then } a_1 \text{ else } a_2$

Boolean Exprs

$b ::= \text{true} \mid \text{false}$

$\mid a_1 \leq a_2$

$\mid b_1 \text{ and } b_2 \mid b_1 \text{ or } b_2$

$\mid \text{not } b_1$

$\mid \text{if } b_1 \text{ then } b_2$
 $\text{else } b_3$

~~$(b_1 \text{ and } b_2)$ or~~
 ~~$(\text{not } b_1 \text{ and } b_3)$~~