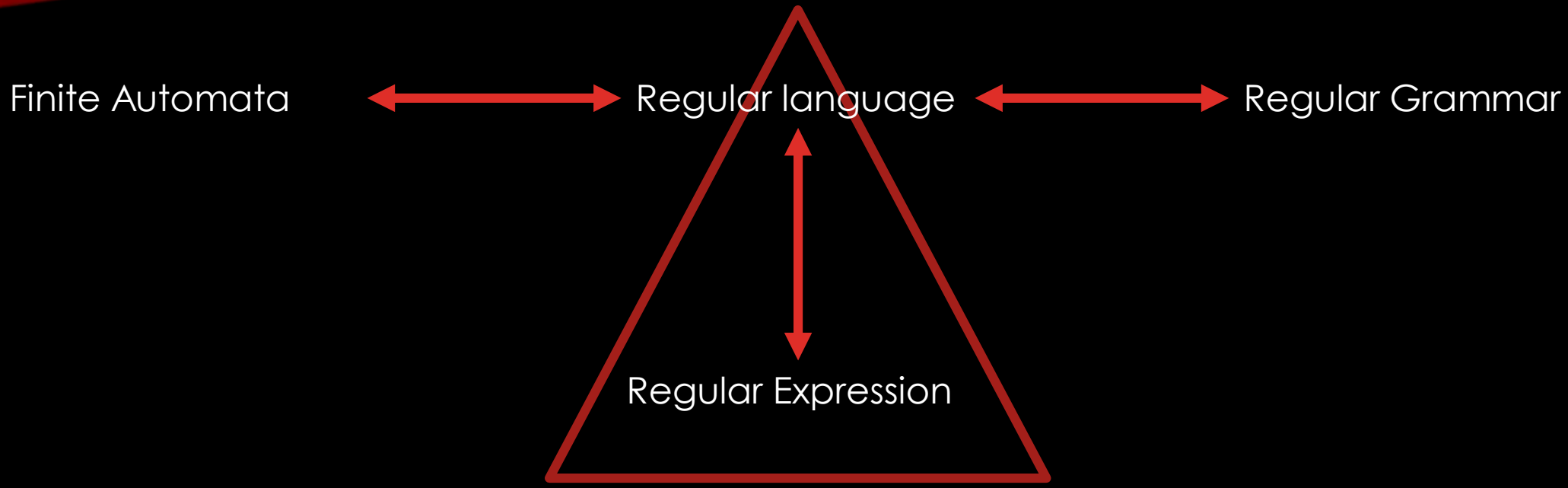
REGULAR EXPRESSIONS



In theoretical computer science and formal language theory, a regular language is a formal language that can be expressed using a regular expression, regular grammar, and Finite automata

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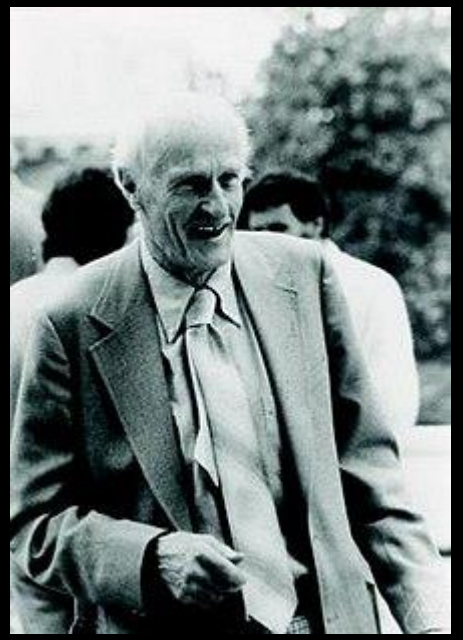
HISTORY OF REGULAR EXPRESSIONS

- Regular expressions originated in 1951, when mathematician Stephen Cole Kleene described regular languages using his mathematical notation called *regular sets*. These arose in theoretical computer science, in the subfields of automata theory (models of computation) and the description and classification of formal languages. Other early implementations of pattern matching include the SNOBOL language, which did not use regular expressions, but instead its own pattern matching constructs.
- Source: Wikipedia



Stephen Cole Kleene
1909-1994

DEFINING REGULAR EXPRESSIONS

Any terminal symbol i.e symbols ∈ Σ including ε and Ø are regular expressions. Regular expression is said to be valid if and only if it can be derived from the primitive regular expression by a finite number of application of either just one, or the combination of the following rules

Kleen Closure
[a*]
=
ε,a,aa,aaa,….. ∞

Positive Closure
[a+]
=
a,aa,aaa,….. ∞

Concatenation
[a.b]
=>
[abc.cdc]=
abccdc

Union [a+b]
=
a,b
(either a, or b)

FREQUENTLY USED OPERATONS IN REGULAR EXPRESSIONS

Using "R=a" as a regular expression, for the following examples,

R+ Union R* = R*

Explanation:

Since R* = the string ε,a,aa,aaa,..... ∞

And, R+ = a,aa,aaa,..... ∞,

By performing union operation the resulting expression will be ε,a,aa,aaa,..... ∞

R+ Intersection R* = R+

Explanation:

Since R* = the string ε,a,aa,aaa,..... ∞

And, R+ = a,aa,aaa,..... ∞,

By performing union operation the resulting expression will be a,aa,aaa,..... ∞

R+ Concatinate R* = R+

Explanation:

Since R* = the string ε,a,aa,aaa,..... ∞

And, R+ = a,aa,aaa,..... ∞,

To do concatenation, we need to do Cartesian product between these two expressions, and the first product of ε and a is a.

FREQUENTLY USED OPERATONS IN REGULAR EXPRESSIONS

Using "R=a" as a regular expression, for the following examples,

$(R^*)^* = R^*$

Explanation:

$R^* = \varepsilon, a, aa, aaa, .. \infty$

$(R^*)^* = \{\varepsilon, a, aa, .. \infty\}^*$

, above here in any case ε string can be obtained by the expression

$(R+)^* = R^*$

Explanation:

$R+ = a, aa, aaa, .. \infty$

$(R+)^* = \{\varepsilon, a, aa, .. \infty\}$

, using the * operation, ε string can be obtained by the expression

$(R^*)+ = R^*$

Explanation:

$R^* = \varepsilon, a, aa, aaa, .. \infty$

$(R^*)+ = \{\varepsilon, a, aa, .. \infty\}$

, above here in any case ε string can be obtained by the expression

$((R^*)+)^* = R^*$

Hack: for all operations, if the statement contains a *, ε can be obtained.

WRITING REGULAR EXPRESSIONS FOR REGULAR LANGUAGES

EXAMPLES, Σ = {a,b}

Starts with ab

ab(a+b)*

Start and ends with a

a+a(a+b)*a

| w | <=3

ε+(a+b) +(a+b)^2 +(a+b)^3

Can also be written as

(a+b+ ε)^3

| w | a =2

b*ab*ab*

28th symbol from right end is a

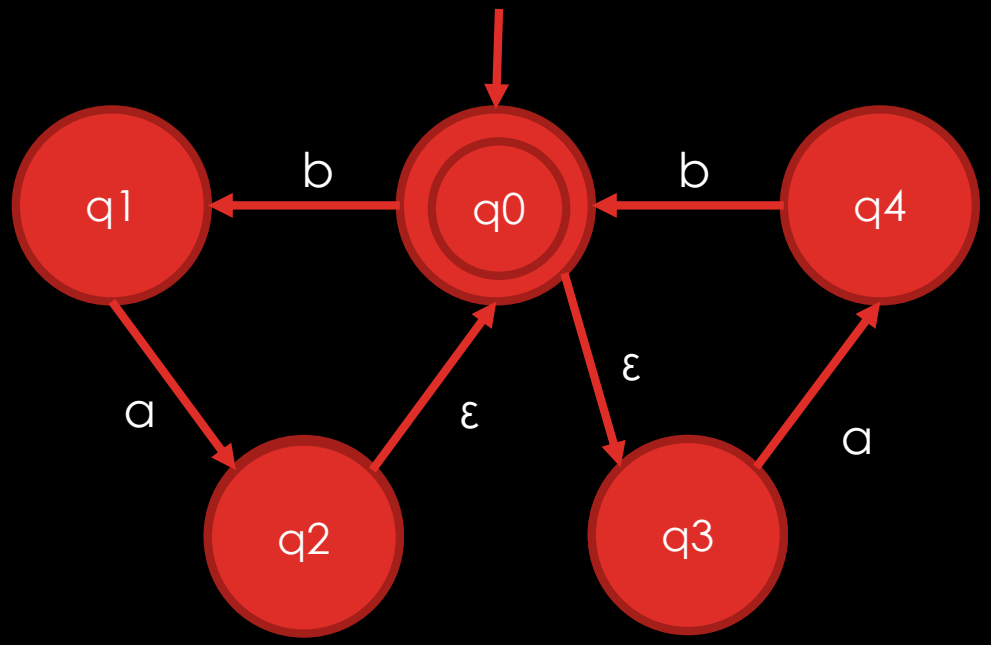
(a+b)*a(a+b)^27

| w | b =2(mod 3)

a*ba*ba*(a*ba*ba*ba*)*

CONVERTING FINITE AUTOMATA INTO REGULAR EXPRESSIONS

EXAMPLE, Σ = {a,b}

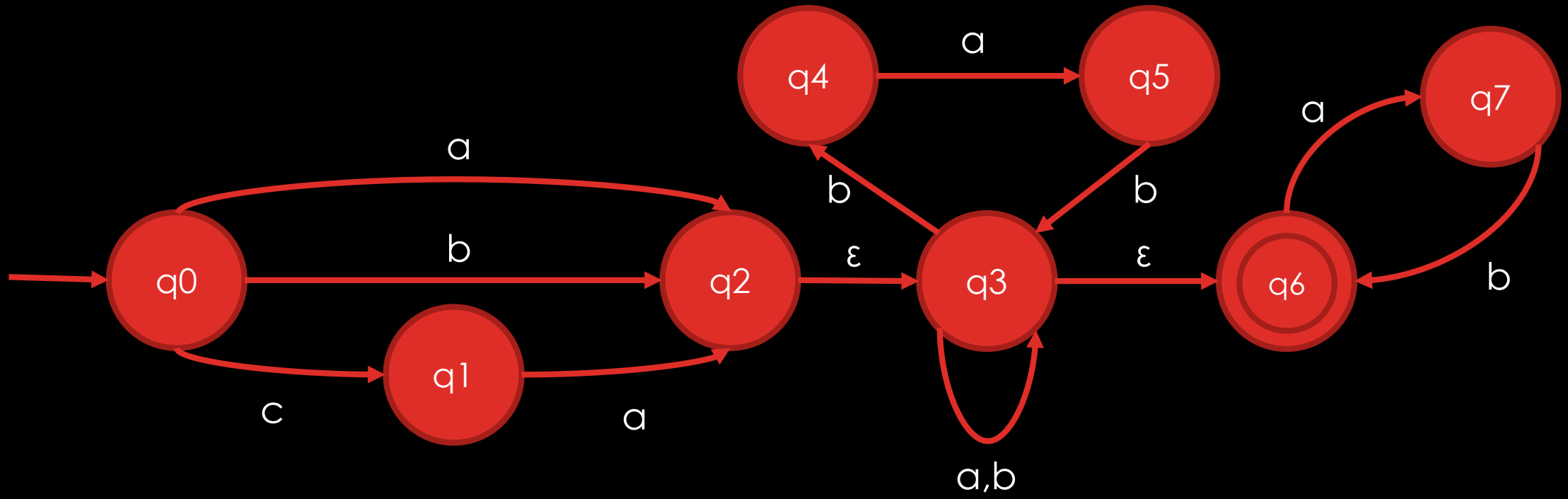


((baε)*+(εab)*)*(ba+ab)*

CONVERTING REGULAR EXPRESSIONS INTO FINITE AUTOMATA

EXAMPLE, Σ = {a,b}

(a+b+ca)((bab)*+(a+b)*)*(ab)*



APPLICATIONS OF REGULAR EXPRESSION

SEARCH ENGINES

regular expressions are useful in a wide variety of text processing tasks, and more generally string processing, where the data need not be textual. Common applications include data validation, data scraping (especially web scraping), data wrangling, simple parsing, the production of syntax highlighting systems, and many other tasks.

While regular expressions would be useful on Internet search engines, processing them across the entire database could consume excessive computer resources depending on the complexity and design of the regex. Although in many cases system administrators can run regular-expression-based queries internally, most search engines do not offer regex support to the public.

Notable exceptions:

Google Code Search,

Exalead.

SUMMARY

In this presentation, we discussed the

- Definition
- Properties
- Frequently used operations
- Relation with Finite Automata
- And the Applications of REGULAR EXPRESSION.

THANK YOU,

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