Introduction to Regular Expressions

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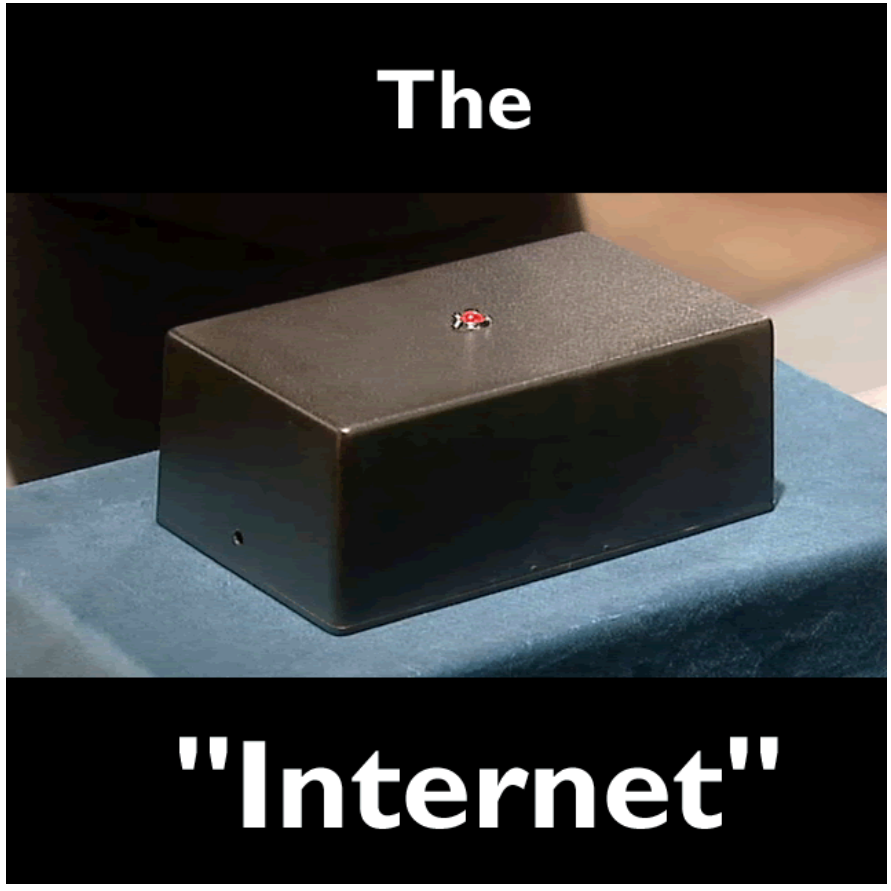
Finite Automata

- Imagine a mysterious black box



Finite Automata

It comprises:

- some form of input
  - seemingly wireless (it is worth watching *The IT Crowd* ☺)
- a reset button; and
- a light labelled 'accept'

Finite Automata

How does it work?

Finite Automata

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- More importantly, we have been diligent and recorded the accepted sequence

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- How far can we go?

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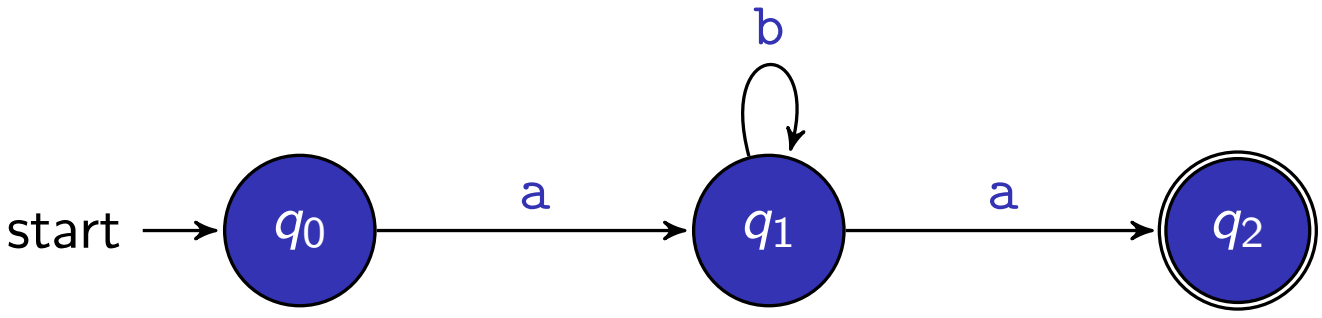

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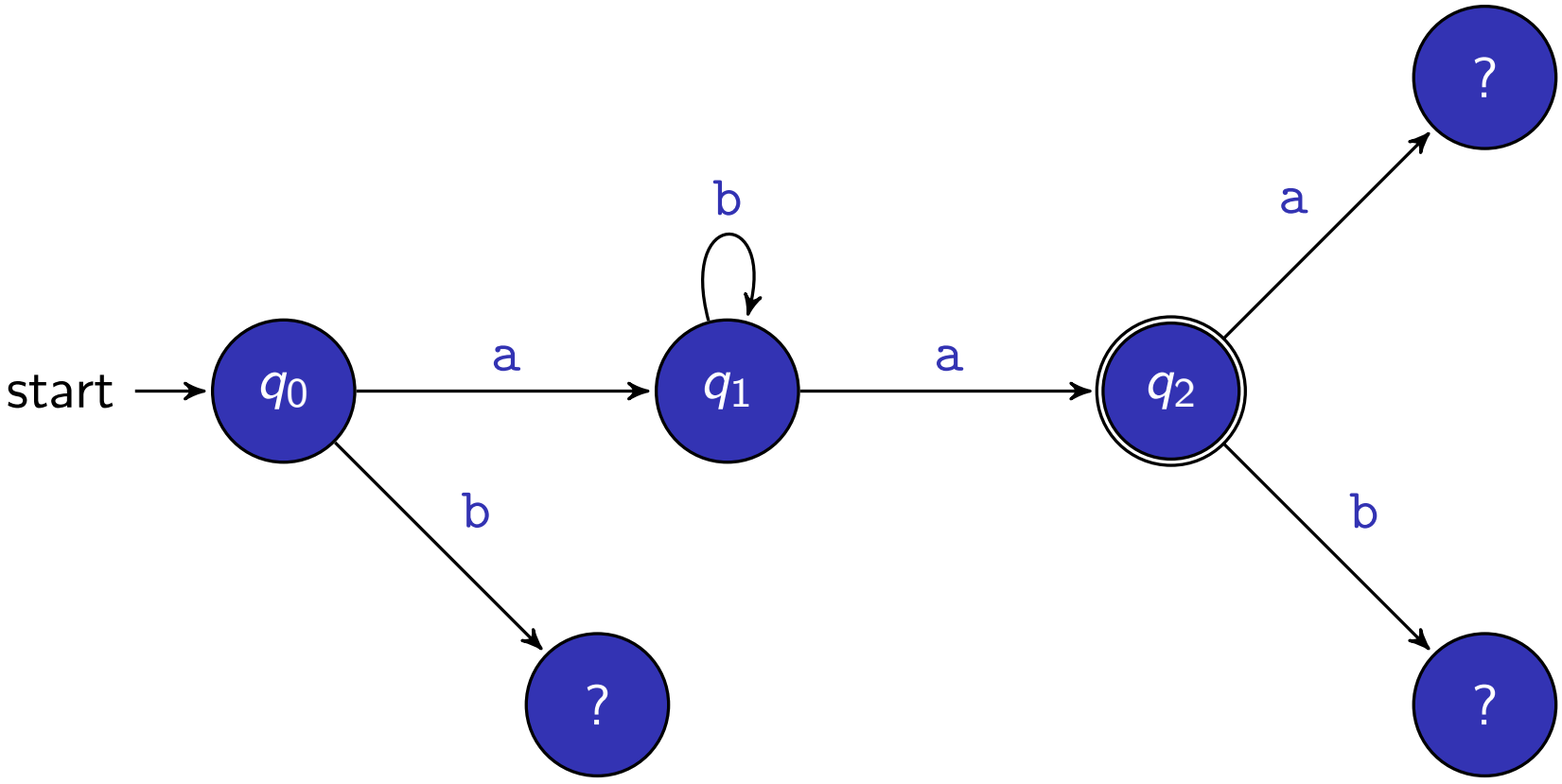

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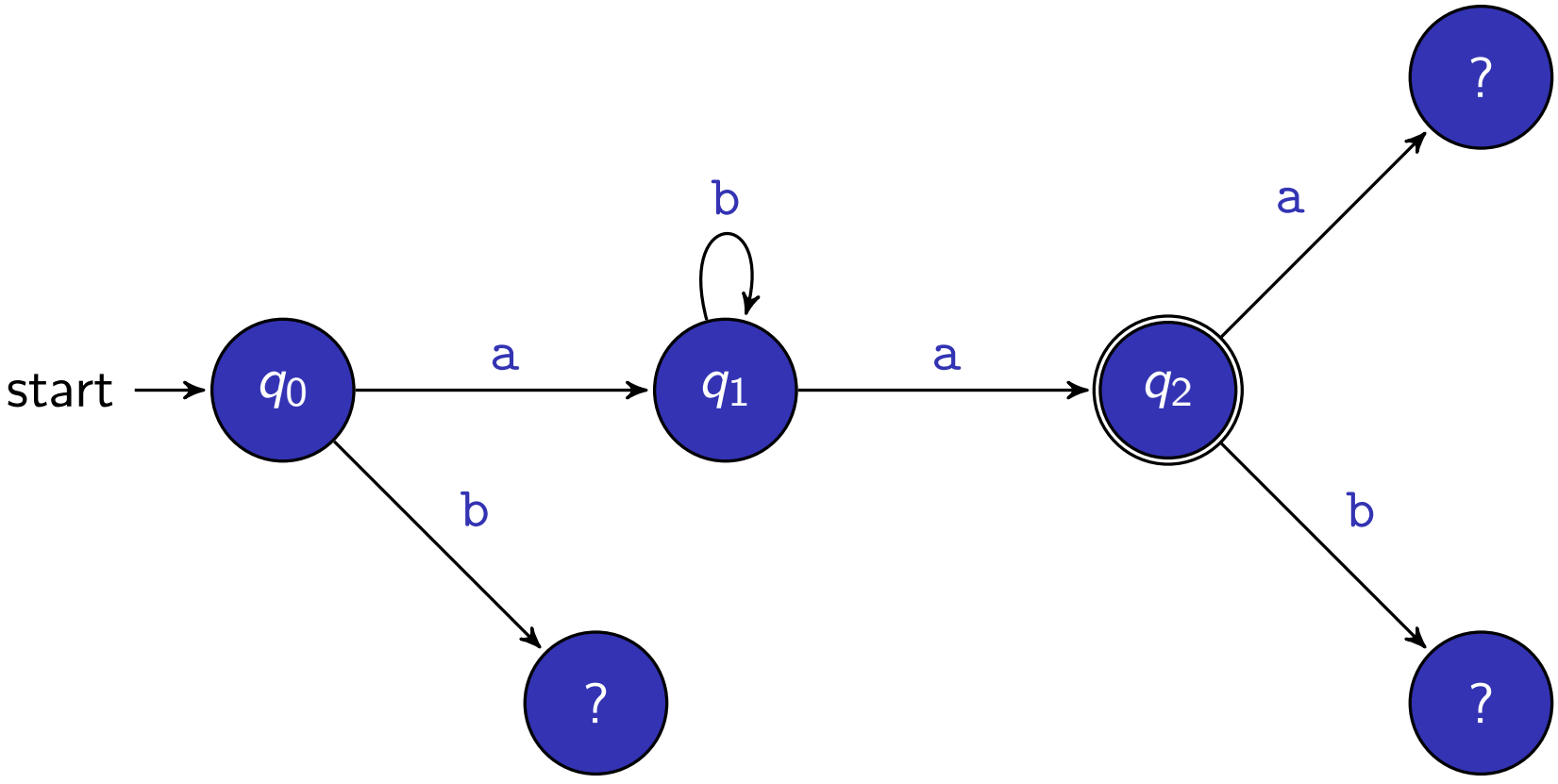

This set of states is not even uniquely correct

Finite Automata

- The title gives it away - this is a finite automaton (FA), or finite-state machine
- Model of computation, like Turing machines and λ-calculus, but less powerful
- State machines are everywhere, e.g. vending machines, combination locks and, of course, regular expressions!

Enter Chomsky

- The set of all symbol combinations, or strings/words, accepted by a FA (e.g. `abba`) form a *regular* language
- The two are practically inseparable concepts, with the latter often being defined in terms of the former
- The title refers to a hierarchical classification of formal languages and their grammars in terms of their expressiveness and recognition

Enter Regular Expressions (finally)

- Succinct notation for expressing regular languages
- Regular expressions are readily understood by humans, e.g. when describing text patterns
- There are algorithms for transforming regular expressions to minimal (optimal) FAs which can be efficiently implemented on a computer

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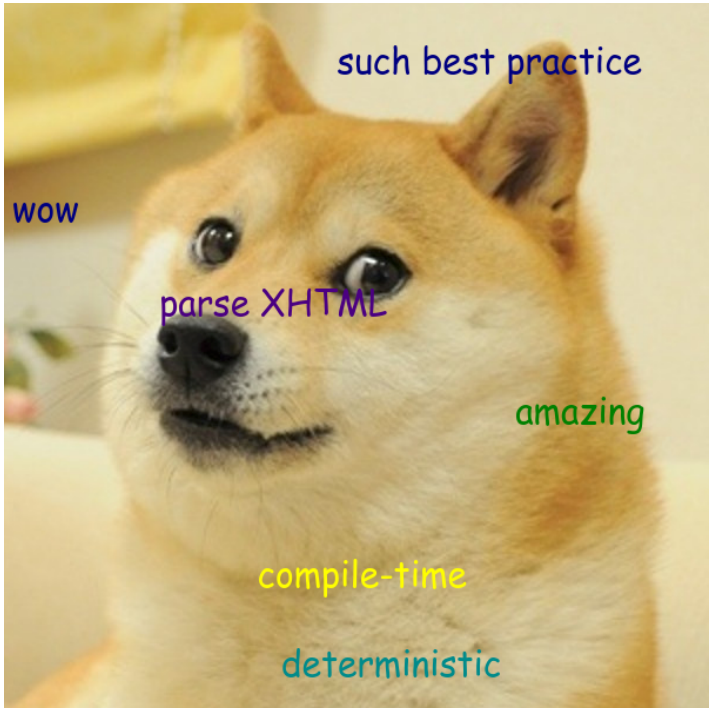

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- Formal language theory,
  compiler design, etc.

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- Most modern implementations vastly extend this standard definition—varied notation

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- $\Rightarrow$ `ba(na)+`

Moar Quantification

- `?` - “zero or one occurences”
  - e.g. `win(ner)?`
- `{n}` - “n many occurences”
  - e.g. `ba(na){2}`
- `{n, }` - “at least n many occurences”
- `{n, m}` - “between n and m occurences”

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- In `sed`, `Perl`, `ECMAScript` and others, regexes are contained or delimited by forward slashes
  - e.g. `s/speling/spelling/g`

Standards

- "The good thing about standards is there are so many to choose from."
- POSIX distinguishes between basic and extended regular expressions
- In practice it boils down to the engine you are working with
  - If `grep` does not work, try `egrep`

Moar Syntax

- `.` - (ostensibly) matches any character
- `[ ]` - matches any one contained atom
  - Complement with hat `[^ ]`
  - Define ranges with hyphen, e.g. `[a-z]` or `[^a-z]`
- `^` - matches start of string
- `$` - matches end of string

Character Classes

https://en.wikipedia.org/wiki/Regular_expression#Character_classes

References


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