Chapter 8, Strings:

- General introduction; string sorting (last week Friday)
- Tries (Monday)
- Regular expression (**Today**)

Today:

- What regular expressions are
- How to use regular expressions practically
- Why regular expressions are important theoretically


WHENEVER I LEARN A NEW SKILL I CONCOCT ELABORATE FANTASY SCENARIOS WHERE IT LETS ME SAVE THE DAY.
OH NO! THE KILLER MUST HAVE FOLLOWED HER ON VACATION!
BUT TO FIND THEM WE'D HAVE TO SEARCH THROUGH 200 MB OF EMAILS LOOKING FOR SOMETHING FORMATTED LIKE AN ADDRESS!
IT'S HOPELESS!
EVERYBODY STAND BACK.
I KNOW REGULAR EXPRESSIONS.
GERU
TAP
TAP

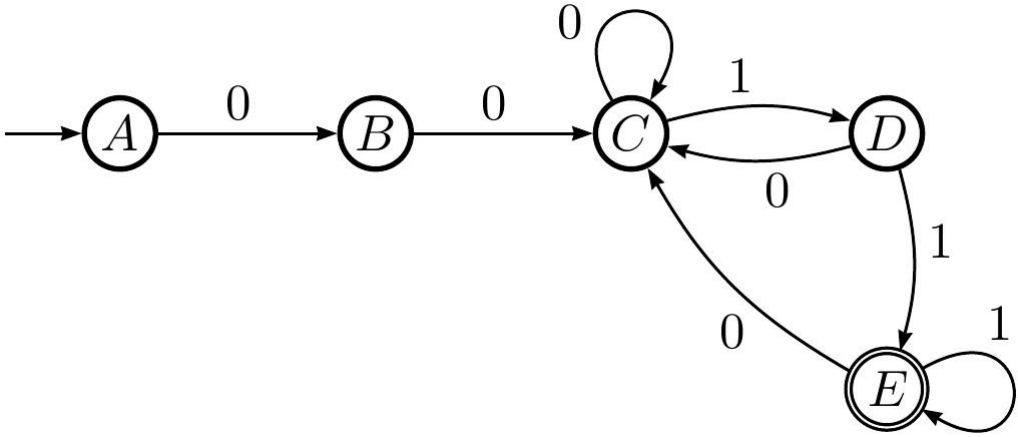
- An **alphabet** is a set of symbols, Σ.
- A **string** over an alphabet is a sequence of symbols from that alphabet. $\Sigma*$ is the set of all strings over alphabet Σ.
- A **language** over an alphabet is a set of strings, that is, a subset of $\Sigma*$.

- **Regular expressions** constitute a system for specifying languages; a regular expression denotes a language.

base cases	$\emptyset$	the empty set of strings
	ε	the set containing the empty string, $\{""\}$
	a	the set containing only the string with only a, for some $a \in \Sigma$, $\{"a"\}$
recursive cases	rs	the set of strings made from concatening strings from r and s, $\{x + y \mid x \in r \wedge y \in s\}$, for some regular expressions r and s
	$r\|s$	the set of strings from r or s, $r \cup s$ for some regular expressions r and s
	$r*$	the set of strings made from concatenating 0 or more strings from r for some regular expression r

Abbreviation	**Meaning**	**Equivalence**
`[abc]`	One occurrence of any of these symbols	`(a|b|c)`
`[a-c]`	One occurrence of any symbol in this range	`(a|b|c)`
$r?$	Optionally an occurrence of a string defined by r	$(r\|\varepsilon)$
r^5	5 occurrences of a string defined by r	$rrrrr$
$r^{3,5}$	Between 3 and 5 occurrences of a string defined by r	$(rrr\|rrrr\|rrrrr)$
$r+$	One or more occurrences of a string defined by r	$rr*$

- *DNA sequences:* `(A|C|G|T)*`.
- *Identifiers:* `((’|`ε`)[A-Za-z][A-Za-z0-9_])|_`.
- *Phone numbers:* `[2-9][0-9]`^{2} – `[2-9][0-9]`^{2} – `[0-9]`^{4}.
- *Dates:* `((1[0-2])|[1-9])/(30|31|([12][0-9])|[1-9])/[1-9][0-9]`^{0,3}. |
- *US Postal Addresses:* `[0-9]+ [NSEW]`^{0,2} `[A-Z][a-z]* (St|Ave|Rd|Ln|Dr|Blvd),([A-Z][a-z]*)*, [A-Z]`^{2}`[0-9]`^{5}.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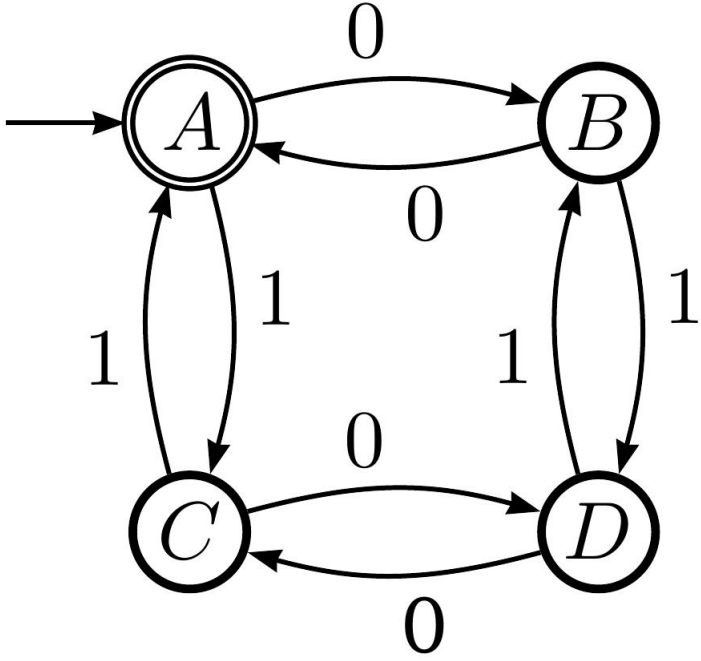
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