regular expressions

Fernando Diaz

a lot of data exists as text

news articles

social media

email

messaging

regular expression: a language for writing strings that define the patterns to match in text.

A.L. East is best in baseball!
Aargh! Great Hockey Coverage!! (Devils)
Atlanta Hockey Hell!!
Baseball Stats
Baseball spreads?
College Hockey All-Star Roster
ESPN cares less about hockey
European/Russian Hockey team addresses?
Hockey Equip. Recommendations?
Hockey coverage
Hockey on TV in the Bay area, NOT!
Hockeytipset 93 avgjort
Info - world hockey championships
Isles / Hockey Ramblings
Joe Robbie Stadium "NOT FOR BASEBALL"
Looking for: Strategic Boardgame for Baseball
NCAA Hockey Final
Need software for baseball stats
Official Rules of Baseball ISBN
Please join my hockey playoff pool.
Remarks by President Clinton to NCAA Division I Champion Hockey Team
Sad day for hockey
Selfish hockey fans..
Some baseball trivia
The Bob Dylan Baseball Abstract
Truly a sad day for hockey
UMass Big East hockey underway
Where can I find baseball statistics ??
baseball in Spanish
hockey playoff pool: LAST CHANCE!
stats for hockey pool
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W

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`[Hh]ockey`

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`[Hh].*`

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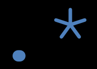


```
ca[rt]s?
```

```
ca[rt]s?
```

match a single character `c` in the first position `ca[rt]s?`

match a single character `a` in the second position `ca[rt]s?`

match a single character “`r` or `t`“ in the third position

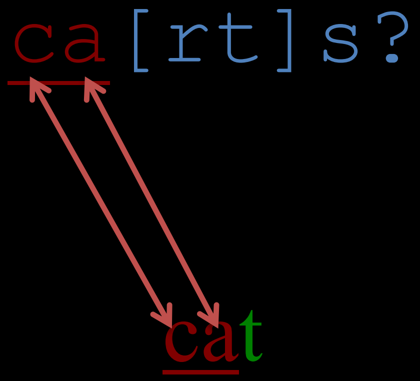
```
ca[rt]s?
```

match zero or one character `s` in the fourth position

```
ca[rt]s?
```

art
car
cat
carts
cars
cas

literals: characters matched exactly as written.



ca[rt]s?

cat

special characters: literals reserved for pattern matching; must be escaped if matching these characters.

.	\.
^	\^
$	\$
*	*
+	\+
?	\?
\	\\\\
[	\[
(	\(
)	\)

special characters: literals reserved for pattern matching; must be escaped if matching these characters.

```
\[at
```

[at

.   match any character once

.at	b.t	z.r.
cat	bat	zero
hat	bot	zzrz
~~at~~	~~bxxt~~	~~zaaro~~

^ match character at the beginning of the line

^cat	^.t	^fr.
cat	at	fry
category	itinerary	free
~~seat~~	~~vbt~~	~~afraid~~

`$` match character at the end of the line

`cat$`	`.t$`	`^fr.$`
cat	at	fry
~~category~~	~~itinerary~~	~~free~~
scat	vbt	~~afraid~~

* match character zero or more times

`c.*t`	`e*t$`	`^fre*$`
cat	et	free
caasdat	t	fr
ct	~~ea~~	~~afree~~

+ match character one or more times

`c.+t`	`e+t$`	`^fre+$`
cat	et	free
caasdat	~~t~~	~~fr~~
~~et~~	~~ea~~	~~afree~~

* and + operators are greedy

given a string and a pattern, a regular expression will match as much of the string as possible while satisfying the pattern.

`c.+t`

caatdat

~~caatdat~~

`?` match character zero or one times

`c.?t`	`e?t$`	`^fre?$`
cat	et	~~free~~
~~caasdat~~	t	fr
ct	~~ea~~	~~afree~~

`{m}` match character exactly `m` times

`c.{2}t`	`e{3}t$`	`^fre{1}$`
coat	eeet	~~free~~
~~caasdat~~	~~t~~	fre
~~et~~	~~ea~~	~~afree~~

`[a]` matches any character in the set `a`

`c[oa]t`	`[ea]+t$`	`f[re]{3}`
cot	et	free
cat	eaet	feer
~~coat~~	~~t~~	~~frare~~

`[^a]` matches any character not in the set `a`

`c[^oa]t`	`[^ea]+t`
~~cot~~	~~et~~
~~cat~~	it
cet	out

[a-b] matches any character in the range a-b*

c[a-z]t	[0-9]+t$	F[A-Z]{3}
cot	0t	FOUR
cat	213t	FREE
~~coat~~	~~aet~~	~~Free~~

*defined by ASCII codes

`A|B` matches either pattern `A` or `B`

`c[oa]t|^wo*l`

cot

wool

wol

~~catwol~~

cat

`dog|cat`

cat

dog

~~squirrel~~

`(A)` groups a regular expression

`(dog|cat)+`	`b(ea|oa)t`
dog	beat
cat	boat
dogcatdogcatcat	~~bat~~

built-in character sets

\s	[\t\n\e\f\v]
\S	[^ \t\n\e\f\v]
\d	[0-9]
\D	[^0-9]
\w	[a-zA-Z0-9_]
\W	[^a-zA-Z0-9_]

*may not work on Windows machines

tools for regular expression matching

grep: command line tool for detecting regular expressions in lines of text

egrep: grep with extended regular expression syntax

```
$ echo “hello world” | egrep “world”
```

```
world
```

```
$ echo “hello world” | egrep “w.*d”
```

```
w.*d
```

```
$ echo “hello world” | egrep “d.*w”
```

d.*w

common flags

`egrep -c`	number of matching lines
`egrep -v`	lines not matching the pattern
`egrep -i`	ignore case
`egrep -An`	print `n` lines after each matching line
`egrep -Bn`	print `n` lines before each matching line
`egrep -f PATH`	read patterns from `PATH` (one pattern per line)

tools for regular expression processing

sed: command line tool for substituting regular expressions in lines of text

```
$ echo “hello wood” | sed -E “s/wood/world/g”
```

replace `wood` with `world`.

```
$ echo “hello wood” | sed -E “s/o/0/g”
```

replace `o` with `0`.

```
$ echo “hello wood” | sed -E “s/(oo|ll)/\1\1/g”
```

repeat `oo` or `ll` twice.

exercises

1. define a regular expression for zip codes.
2. define a regular expression for US phone numbers.
3. define a regular expression for email addresses from US universities.

exercises

download and uncompress the “20 newsgroups” dataset (20news-19997.tar.gz),

http://qwone.com/~jason/20Newsgroups/

1. list the subject lines for all messages in the package.
2. count the number of mentions of “baseball” per newsgroup.
3. count the number of mentions of “hockey” per newsgroup.