Princípios da Computação

The Unix shell 3

Regular expressions

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What is a regular expression?

- A regular expression (*regex*) is a pattern that describes a set of strings that match the pattern.

- Typically used to find expressions in text.

  - Example: search for **cat**

  - Matches: **cat**, **cat**s, con**cat**enate, advo**cat**e

How do you build a regular expression?

- A regular expression pattern makes use of:

  - (static) characters and,

  - wildcard characters to represent unknown/variable data.

- You have already used wildcards with the `ls` command: *e.g.* ∗ and **?**

Types of regular expressions

- Different applications use different types of regular expressions.

- A *regular expression engine* is the software that interprets regular expression patterns.

Unix regular expression engines

- Basic Regular Expression (BRE)

  - Fast, good for most of the tasks.

- Extended Regular Expression (ERE)

  - Advanced pattern symbols, not so fast (?).

grep

- We will use the grep utility to search for regular expressions.

  - The **grep** supports BRE.

  - The **egrep** supports ERE.

    - … or, use the **grep** with the **–E** option.

BRE patterns

Plain text

- String of regular characters that represents the text to be searched.

- CaSe SeNsItIvE!!!!!!

- Examples:

  - **book** -> **book**shelf, **book**s

  - **one** -> **one**, Stall**one**

Plain text

- The grep command displays the lines where it finds a match to the regular expression.

```
$ echo 'I have three cats!' | grep at
I have three cats!
$ echo 'I have three dogs!' | grep at
$ echo 'I'm chatting with my friends.' | grep at
I'm chatting with my friends.
$
```

Anchor characters: start of line

- Start at the beginning of the line: **^**

  - Defines a pattern starting at the beginning of the line.

```
$ echo 'Number 13' | grep ^1
$ echo '13 is the number' | grep ^1
13 is the number
$
```

Anchor characters: end of line

- Pattern at the end of the line: **$**

  - Defines a pattern at the end of the line.

```
$ echo 'Number 13' | grep 3$
Number 13
$ echo '13 is the number' | grep 3$
$
```

Any single character

- Single character: **.**

  - Matches any single character except a newline character.

  - If there is no character in the place of the dot, then the pattern fails.

-

Any single character

```
$ echo 'The drone is flying.' | grep 'ro.e'
The drone is flying.
$ echo 'I need a piece of rope!' | grep 'ro.e'
I need a piece of rope!
$ echo 'There are zero elements.' | grep 'ro.e'
There are zero elements.
$ echo 'There is John McEnroe.' | grep 'ro.e'
$
```

Does not match pattern:
r + o + *any-single-char* + e

Character classes

- Single character from a group (class) of characters: **[ ]**

  - Matches a single character from the group defined inside square brackets.

  - The brackets should contain any character you want to include in the class.

Character classes

```
$ echo 'Cat is an animal.' | grep '[BbCc]at'
Cat is an animal.
$ echo 'A bat can fly.' | grep '[BbCc]at'
A bat can fly.
$ echo 'My hat is on the chair.' | grep '[BbCc]at'
$ echo 'Combat boots' | grep '[BbCc]at'
Combat boots
$
```

Character classes - negating a class

- The caret **^** negates the character class: **[^]**

```
$ echo 'A bat can fly.' | grep '[^CcBb]at'
$ echo 'My hat is on the chair.' | grep '[^CcBb]at'
My hat is on the chair.
$
```

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Character classes - ranges

- The dash **–** defines a range: **[–]**

- The range includes all characters that extend between both ends.

```
$ echo 'A bat can fly.' | grep '[c–mC–M]at'
$ echo 'Hat trick!' | grep '[c–mC–M]at'
Hat trick!
$
```

Special character classes

- There are pre-defined character classes:

`[[:alpha:]]` Matches any alphabetical character, either upper or lower case

`[[:alnum:]]` Matches any alphanumeric character 0–9, A–Z, or a–z

`[[:blank:]]` Matches a space or Tab character

`[[:digit:]]` Matches a numerical digit from 0 through 9

`[[:lower:]]` Matches any lowercase alphabetical character a–z

`[[:print:]]` Matches any printable character

`[[:punct:]]` Matches a punctuation character

`[[:space:]]` Matches any whitespace character: space, Tab, NL, FF, VT, CR

`[[:upper:]]` Matches any uppercase alphabetical character A–Z

Special character classes

```
$ echo 'R2-D2 is a droid.' | grep '[[:upper:]][[:digit:]]-'
R2-D2 is a droid.
$ echo 'C-3PO is a droid.' | grep '[[:upper:]][[:digit:]]-'
$ echo 'R5-D5 was a jedi.' | grep '[[:upper:]][[:digit:]]-'
R5-D5 was a jedi.
$
```

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Repeating character

- The asterisk ∗ after a character means the character must appear zero or more times in the text.

```
$ echo 'neighbour (UK)' | grep 'bou*r'
neighbour (UK)
$ echo 'neighbor (US)' | grep 'bou*r'
neighbor (US)
$ echo 'neighbouuur (oops)' | grep 'bou*r'
neighbouuur (oops)
$
```

ERE patterns

Using ERE regular expressions

- To use ERE regular expressions, you need to:

    - use the **egrep** utility, or

    - add the **−E** option to the **grep** utility.

Non-repeating character

- The question mark **?** after a character means the character must appear zero or one time in the text.

```
$ echo 'neighbour (UK)' | egrep 'bou?r'
neighbour (UK)
$ echo 'neighbor (US)' | grep –E 'bou?r'
neighbor (US)
$ echo 'neighbouuur (oops)' | grep –E 'bou?r'
$
```

Repeating character

- The plus sign **+** after a character means the character must appear one or more times in the text.

```
$ echo 'neighbour (UK)' | egrep 'bou+r'
neighbour (UK)
$ echo 'neighbor (US)' | grep -E 'bou+r'
$ echo 'neighbouuur (oops)' | grep -E 'bou+r'
neighbouuur (oops)
$
```

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Intervals

- You can specify how many times a character appears in a pattern by setting the limits (min and max) inside curly braces **{}** — the *interval*.

  - {*n*} : the regular expression appears exactly *n* times.

  - {*m,n*} : the regular expression appears at least *m* times, and no more than *n* times.

Intervals

```
$ echo 'neighbour (UK)' | egrep 'bou{0,2}r'
neighbour (UK)
$ echo 'neighbor (US)' | grep -E 'bou{0,2}r'
neighbor (US)
$ echo 'neighbouuur (oops)' | grep -E 'bou{0,2}r'
$
```

```
$ echo 'Phone: 900 234 876' | grep -E '[0-9]{3} [0-9]{3} [0-9]{3}'
Phone: 900 234 876
$
```

Alternative patterns

- The pipe **|** allows to specify two or more alternatives, making the regex engine to use a logical OR.

```
$ echo 'I like cats.' | grep -E 'cat|dog'
I like cats.
$ echo 'I love dogs.' | grep -E 'cat|dog'
I love dogs.
$
```

Grouping expressions

- Parenthesis **()** allow to group an expression that is treated as a character.

```
$ echo "I don't like Mondays." | egrep '(Mon|Fri)day'
I don't like Mondays.
$ echo "I'll see you Thursday." | egrep '(Mon|Fri)day'
$ echo "Finally it's Friday\!" | egrep '(Mon|Fri)day'
Finally it's Friday!
$
```

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