

CSE 390a Lecture 7

Regular expressions,
egrep, and sed

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Lecture summary

- regular expression syntax
- commands that use regular expressions
 - egrep (extended grep) - search
 - sed (stream editor) - replace
- links
 - <http://analyser.oli.tudelft.nl/regex/>
 - <http://www.panix.com/~elflord/unix/grep.html>
 - <http://www.robelle.com/smugbook/regexpr.html>

What is a regular expression?

```
"[a-zA-Z_\- ]+@(([a-zA-Z_\- ]+\.)+[a-zA-Z]{2,4})"
```

- **regular expression** ("regex"): a description of a pattern of text
 - can test whether a string matches the expression's pattern
 - can use a regex to search/replace characters in a string
 - regular expressions are extremely powerful but tough to read
 - (the above regular expression matches basic email addresses)
- regular expressions occur in many places:
 - shell commands (grep)
 - many text editors (TextPad) allow regexes in search/replace
 - Java Scanner, String split (CSE 143 grammar solver)

egrep and regexes

command	description
egrep	extended grep; uses regexes in its search patterns; equivalent to grep -E

```
egrep "[0-9]{3}-[0-9]{3}-[0-9]{4}" faculty.html
```

- **grep** uses "basic" regular expressions instead of "extended"
 - extended has some minor differences and additional metacharacters
 - we'll just use extended syntax. See online if you're interested in the details.
- **-i** option before regex signifies a case-insensitive match
 - `egrep -i "mart"` matches "Marty S", "smartie", "WALMART", ...

Basic regexes

```
"abc"
```

- the simplest regexes simply match a particular substring
- this is really a pattern, not a string!
- the above regular expression matches any line containing "abc"
 - YES: "abc", "abcdef", "defabc", ".=.abc.=.", ...
 - NO: "fedcba", "ab c", "AbC", "Bash", ...

Wildcards and anchors

- **.** (a dot) matches any character except `\n`
 - `".oo.y"` matches "Doocy", "goofy", "LooPy", ...
 - use `\.` to literally match a dot `.` character
- **^** matches the beginning of a line; **\$** the end
 - `"^fi$"` matches lines that consist entirely of `fi`
- **\<** demands that pattern is the beginning of a *word*;
\> demands that pattern is the end of a word
 - `"\<for\>"` matches lines that contain the word "for"

- *Exercise* : Find lines in `ideas.txt` that refer to the C language.
- *Exercise* : Find act/scene numbers in `hamlet.txt` .

Special characters

| means OR

- "abc|def|g" matches lines with "abc", "def", or "g"
- precedence of `^(Subject|Date)` vs. `^Subject|Date`:
- There's no AND symbol. Why not?

() are for grouping

- "(Homer|Marge) Simpson" matches lines containing "Homer Simpson" or "Marge Simpson"

\ starts an escape sequence

- many characters must be escaped to match them: `/\$. [] () ^ * + ?`
- `". \. \n"` matches lines containing ". \n"

Quantifiers: * + ?

* means 0 or more occurrences

- "abc*" matches "ab", "abc", "abcc", "abccc", ...
- "a(bc)*" matches "a", "abc", "abcbc", "abcbcbc", ...
- "a_*a" matches "aa", "aba", "a8qa", "a!*_a", ...

+ means 1 or more occurrences

- "a(bc)+" matches "abc", "abcbc", "abcbcbc", ...
- "Go+gle" matches "Google", "Gooogle", "Goooogle", ...

? means 0 or 1 occurrences

- "Martina?" matches lines with "Martin" or "Martina"
- "Dan(ie1)?" matches lines with "Dan" or "Daniel"

- *Exercise*: Find all ^^ or ^_^ type smileys in chat.txt.

More quantifiers

{*min*,*max*} means between *min* and *max* occurrences

- "a(bc){2,4}" matches "abcbc", "abcbcbc", or "abcbcbcbc"

- *min* or *max* may be omitted to specify any number

- "{2,}" means 2 or more
- "{,6}" means up to 6
- "{3}" means exactly 3

Character sets

[] group characters into a character set;
will match any single character from the set

- "[bcd]art" matches strings containing "bart", "cart", and "dart"
- equivalent to "(b|c|d)art" but shorter

- inside [], most modifier keys act as normal characters

- "what[.!*?]" matches "what", "what.", "what!", "what?*" , ...

- *Exercise*: Match letter grades in 143.txt such as A, B+, or D-.

Character ranges

- inside a character set, specify a range of characters with -

- "[a-z]" matches any lowercase letter
- "[a-zA-Z0-9]" matches any lower- or uppercase letter or digit

- an initial ^ inside a character set negates it

- "[^abcd]" matches any character other than a, b, c, or d

- inside a character set, - must be escaped to be matched

- "[+\\-]?[0-9]+" matches optional + or -, followed by ≥ one digit

- *Exercise*: Match phone #s in faculty.html, e.g. (206) 685-2181.

sed

command	description
sed	stream editor; performs regex-based replacements and alterations on input

- Usage:

- `sed -r "s/REGEX/TEXT/g" filename`
 - substitutes (replaces) occurrence(s) of regex with the given text
 - if *filename* is omitted, reads from standard input (console)
 - sed has other uses, but most can be emulated with substitutions

- Example (replaces all occurrences of 143 with 390):

- `sed -r "s/143/390/g" lecturenotes.txt`

more about sed

- sed is line-oriented; processes input a line at a time
- -r option makes regexes work better
 - recognizes (), [], *, + the right way, etc.
- g flag after last / asks for a *global match* (replace all)
- special characters must be escaped to match them literally
 - sed -r "s/http:\\\\https:\\\\g" urls.txt
- sed can use other delimiters besides / ... whatever follows s
 - find /usr | sed -r "s#/usr/bin#/home/billy#g"

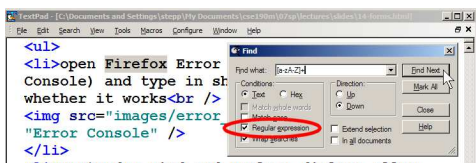
Back-references

- every span of text captured by () is given an internal number
 - you can use *\number* to use the captured text in the replacement
 - \0 is the overall pattern
 - \1 is the first parenthetical capture
 - ...
- Back-references can also be used in egrep pattern matching
 - Match "A" surrounded by the same character: "(.)A\1"
- Example: swap last names with first names
 - sed -r "s/([^\s]+), ([^\s]+)/\2 \1/g" names.txt
- Exercise : Reformat phone numbers with 685-2181 format to (206) 685.2181 format.

Other tools

- find supports regexes through its -regex argument


```
find . -regex ".*CSE 14[23].*"
```
- Many editors understand regexes in their Find/Replace feature



Exercise

- Write a shell script that reads a list of file names from files.txt and finds any occurrences of MM/DD dates and converts them into MM/DD/YYYY dates.
 - Example:


```
04/17
```
 - would be changed to:


```
04/17/2011
```

Yay Regular Expressions!



Courtesy XKCD