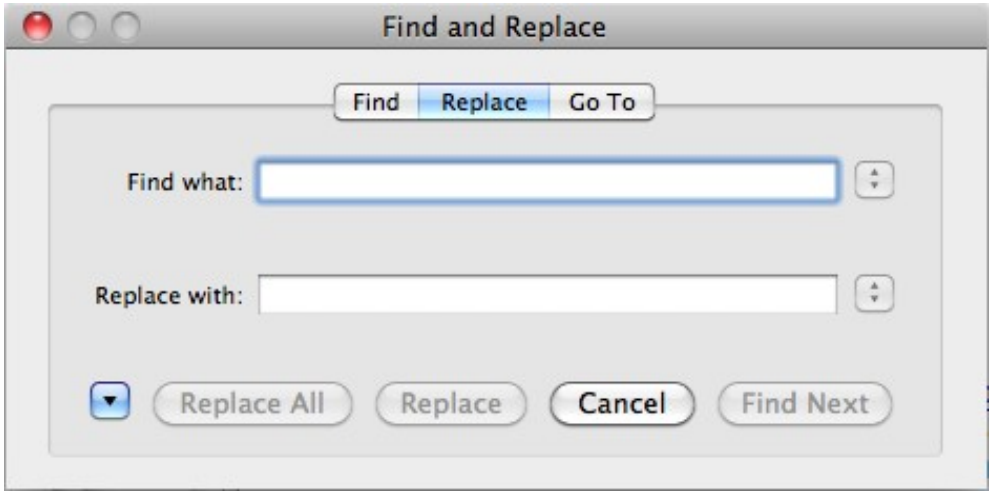
Regular Expressions

Devin J. Pohly <djpohly@cse.psu.edu>

Regular expressions

- Often shortened to "regexp" or "regex"
- Regular expressions are a language for matching patterns
  - Super-powerful find and replace tool
  - Can be used on the CLI, in shell scripts, as a text editor feature, or as part of a program



What are they good for?

- Searching for specifically formatted text
  - Email address
  - Phone number
  - Anything that follows a pattern
- Validating input
  - Same idea
- Powerful find-and-replace
  - E.g. change "*X* and *Y*" to "*Y* and *X*" for any *X*, *Y*

Regex “flavors”

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- Many languages support regular expressions
  - Perl
  - JavaScript
  - Python
  - PHP
  - Java, Ruby, .NET, etc.
- Today we will be learn standard Unix “extended regular expressions”

On the command line

- The `grep` command is a regex filter
  - That's what the "re" in the middle stands for
  - We have seen `fgrep`, which looks for literal strings
- Today we will use `egrep`
  - E for "extended" regular expressions
  - Very close to other languages' flavors

grep command syntax

- To find matches in files:

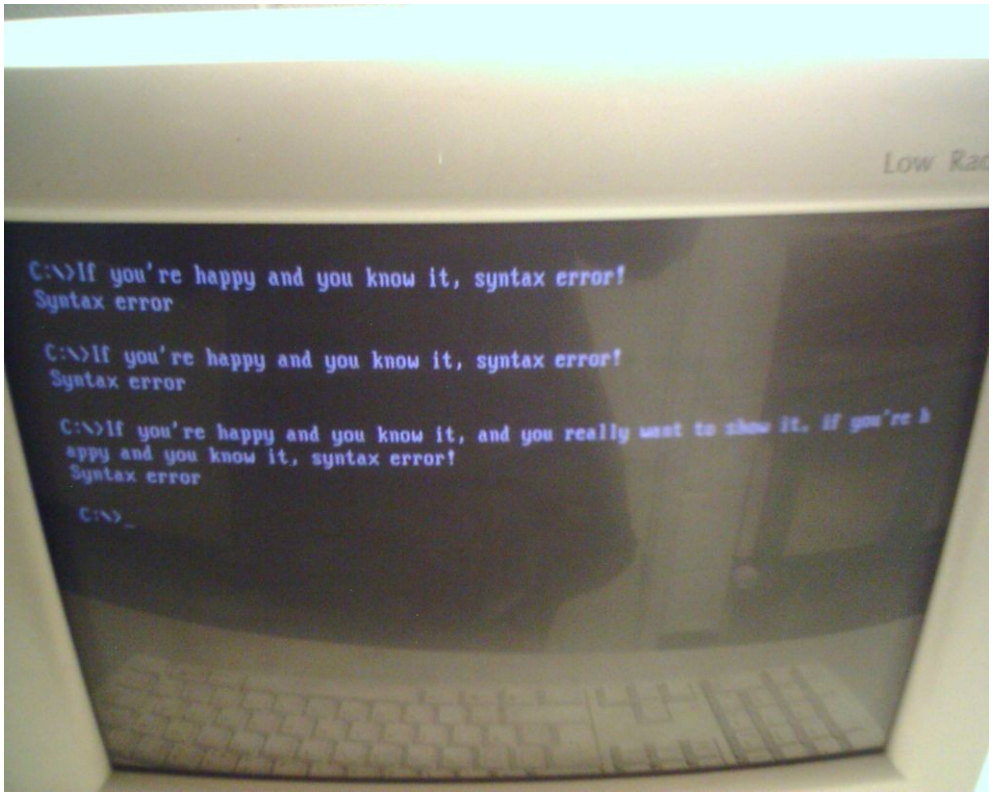
  `egrep regex file(s)`

- To filter standard input:

  `egrep regex`

  - where *regex* is a regular expression, and *file(s)* are the files to search

- Options (aka "flags"):
  - `-i`: ignore case
  - `-v`: find *non*-matching lines
  - `-r`: search entire directories
  - `man grep` for more

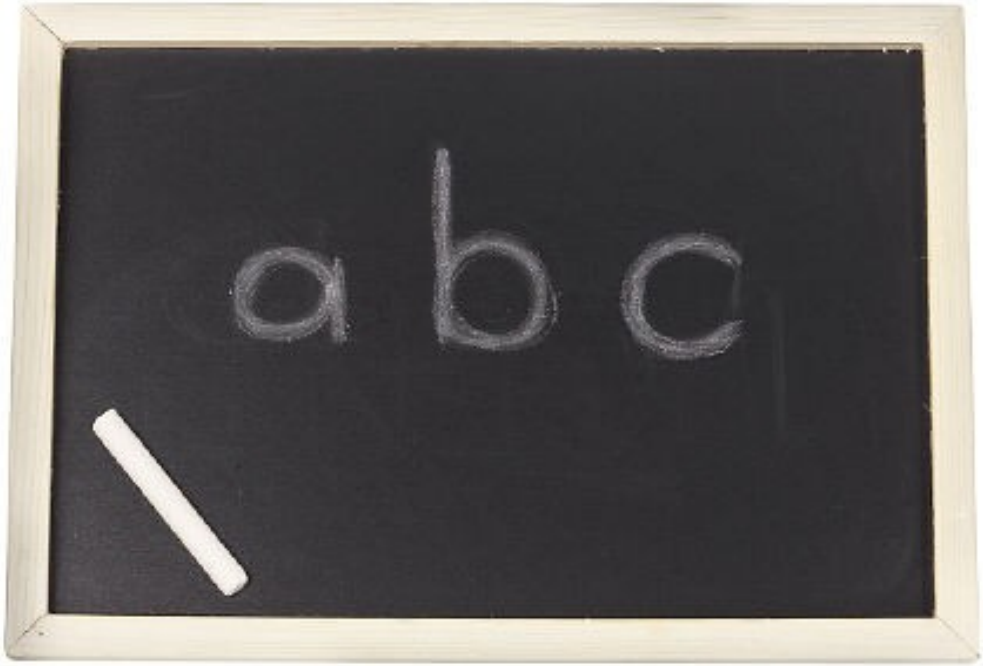


Okay, let's begin!

```
$ cd /usr/share/dict
$ egrep hello words
...
$ cat words | egrep hello
...
```

First lesson

- Letters, numbers, and a few other things match literally
  - Find all the words that contain “fgh”
  - Find all the words that contain “lmn”
- Note: a regex can match anywhere in the string
  - Doesn’t have to match the *whole* string



Anchors

- Caret ^ matches at the beginning of a line
- Dollar sign $ matches at the end of a line
  - Use '...' to protect characters from the shell!
- Try it
  - Find words ending in “gry”
  - Find words starting with “ah”
- What happens if we use both?

Single-character wildcard

- Dot . matches any single character (exactly one)
  - Find a 6-letter word where the second, fourth, and sixth letters are “o”
  - Find any words that are at least 23 characters long

Multi-character wildcard

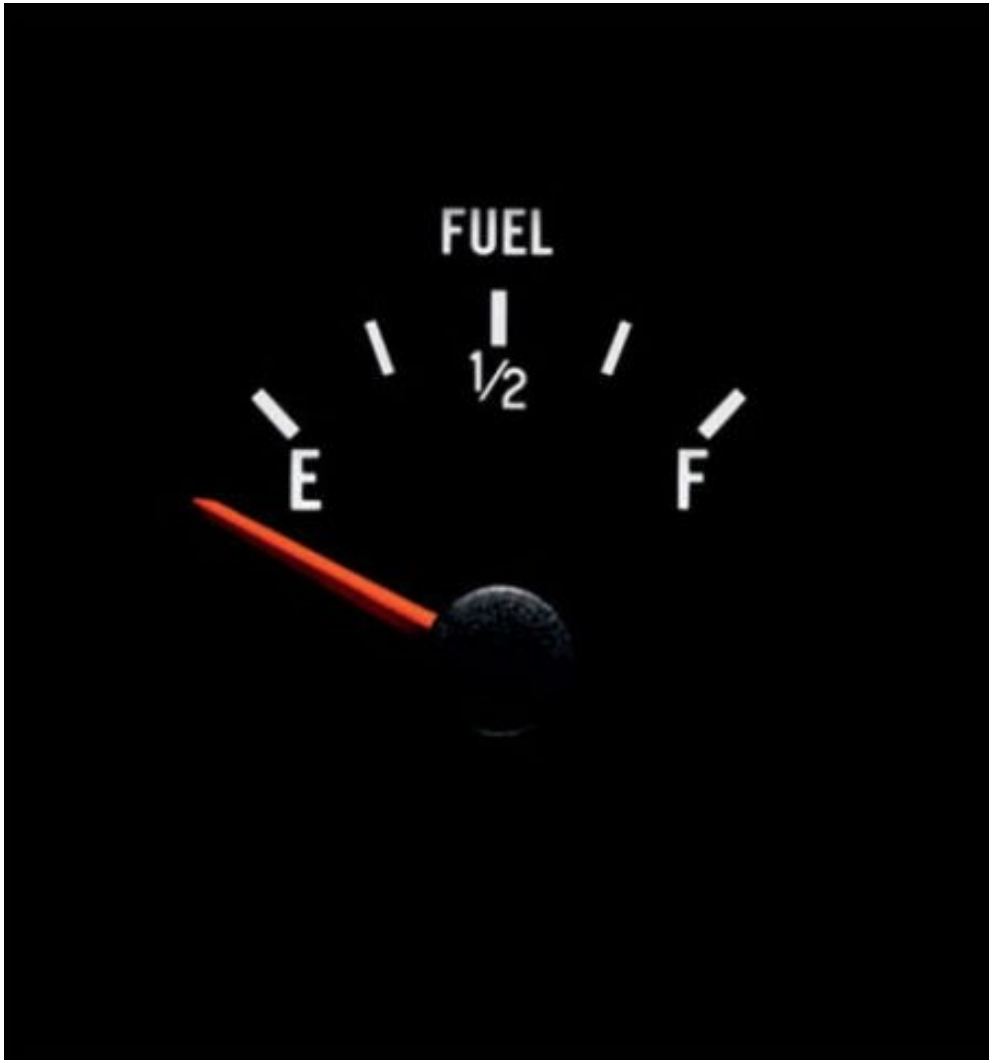
- Dot-star `.*` will match 0 or more characters
  - We'll see why on the next slide
  - Find all the words that contain a, e, i, o, u in that order (with anything in between)
  - How about u, o, i, e, a?

Quantifiers

- How many repetitions of the previous thing to match?
  - Star *: 0 or more
  - Plus +: at least 1
  - Question mark ?: 0 or 1 (i.e., optional)
- Try it out
  - Spell check: `necc?ess?ary`
  - Outside the US: `colou?r`
  - Find words with u, o, i, e, a in that order and at least one letter in between each

Careful!

- What happens if you search for the empty string?
  - Use `''` to give the shell an empty argument
- Now, what happens if you search for `z*`?
  - Why?
- Make sure your regex always tries to match *something!*

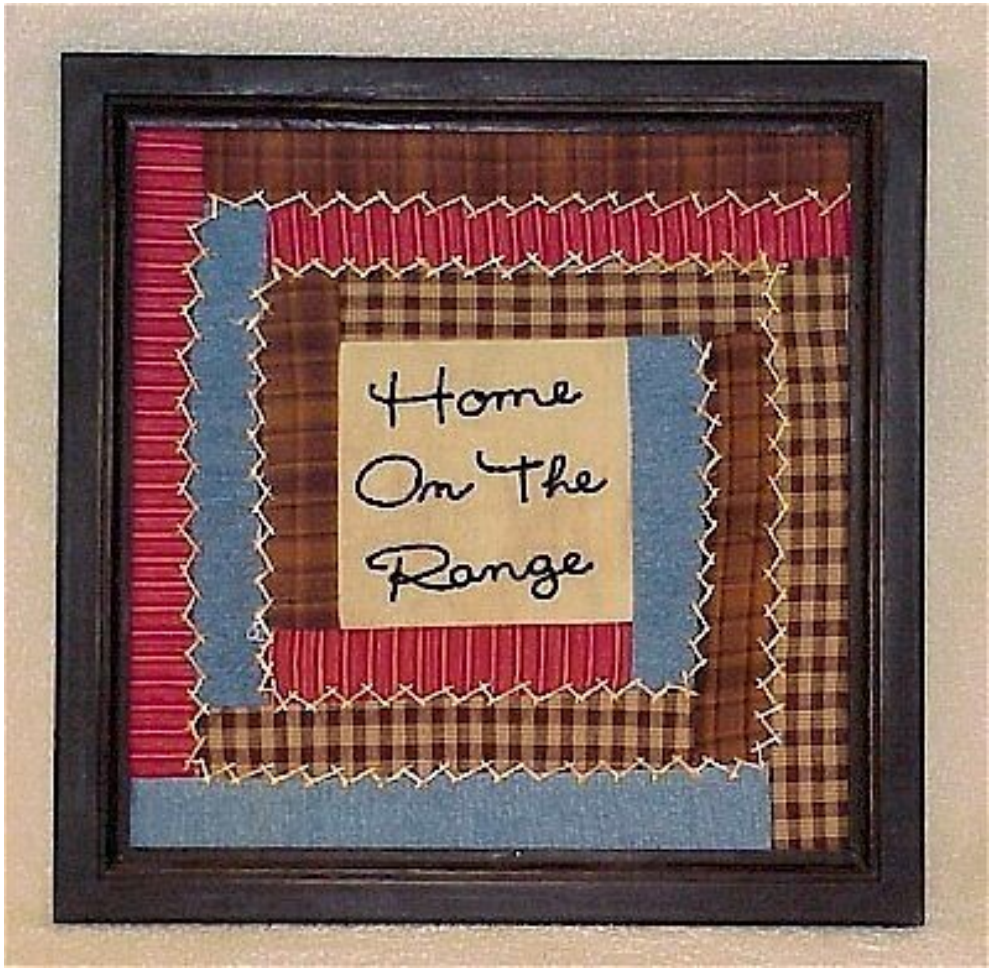


Character classes

- Square brackets `[abc]` will match any one of the enclosed characters
  - What will `[chs]andy` match?
  - You can use quantifiers on character classes
    - Find words starting with b where all the rest of the letters are a, n, or s
    - Find all the words you can type with ASDFJKL
    - Find all the words you can type with AOEUHTNS!

Ranges

- Part of character classes
- You can specify a range of characters with `[a-j]`
  - One hex digit: `[0-9a-f]`
  - Consonants: `[b-df-hj-np-tv-z]`
  - Find all the words you can make with A through E
    - … that are at least 5 letters long (hint: pipe the output to another egrep!)



Negative character classes

- If the first character is a caret, matches anything *except* these characters
  - Consonants: `[^aeiou]`
  - Find words that contain a q, followed by something other than u
  - Can be combined with ranges
    - Any character that isn't a digit: ???

Negative character classes

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  - Can be combined with ranges
    - Any character that isn't a digit: `[^0-9]`

Groups

- Parentheses (...) create groups within a regex
  - Quantifiers operate on the entire group
  - Find words with an m, followed by "ach" one or more times, followed by e
  - Find words where every other character, starting with the first, is an e

Branches

- The pipe | denotes that either the left or right side matches
  - It's the "or" operator
  - Useful inside parentheses
- Guess before you try:
  - `book(worm|end)`
  - `^(out|lay)+$`

Special characters

- We've seen a lot already
  - `^$.*+?[]()|\`
- Backslash `\` will escape a special character to search for it literally
  - For example, you could search your code for the expression `int \*` to find integer pointers

Backreferences

- Groups in ( ) can be referred to later
  - Must match exactly the same characters again
  - Numbered `\1`, `\2`, `\3` from the start of the regex
  - Try it: `(can)\1`
  - Find words that have a four-character sequence repeated immediately

Substituting – a demo

- The `sed` program has a lot of functions for modifying text
- Most useful is the `s///g` command: regular expression find-and-replace ("substitute")
  - Also available in Vim by typing `:%s/regex/replacement/g`
- Try it: run this command and type things

```
$ sed -r 's/([a-z]+) and ([a-z]+)/\2 and \1/g'
```

Like puzzles?

- regexcrossword.com
  - Great way to practice your regex-fu
  - Starts with simpler tutorial puzzles and works up