CS2044 - Advanced Unix Tools & Scripting

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Today's slides are from David Slater

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Random Bash Tip of the Day

The more you use BASH the more you see what options you use all the time. For instance `ls -l` to see permissions, or `rm -i` to insure you don't accidentally delete a file. Wouldn't it be nice to be able to make shortcuts for these things?

Alias:

`alias name=command`

- The alias allows you to rename or type something simple instead of typing a long command
- You can set an alias for your current session at the command prompt
- To set an alias more permenantly add it to your `.bashrc` or `.bash_profile` file.

Alias Examples

Examples

```
alias ls='ls --color=auto'
alias dc=cd
alias rm='rm -i'
alias ll='ls -l'  alias canhaz='sudo apt-get install'
```

- Quotes are necessary if the string being aliased is more than one word
- To see what aliases are active simply type `alias`
- Note: If you are poking around in .bashrc you should know that # is the UNIX comment character. So any line that starts with # is commented out.

A Bit of Translation

What does this print?

```
echo '1337 5p34k !5 n07 5p0k3n 4m0n9 2341 h4ck325' |
tr '01234579!'  'olreastgi'
```

A Bit of Translation

What does this print?

```
echo '1337 5p34k !5 n07 5p0k3n 4m0n9 2341 h4ck325' |
tr '01234579!'  'olreastgi'
```

```
leet speak is not spoken among real hackers
```

Variables

- Variables are denoted by `$varname`, and set by

  `varname=value`

- No spaces!

  Example:

```
$ world=Earth
$ echo "Yo $world"
Yo Earth
```

- There are a ton of built-in variables ($USER $SHELL ... etc)

grep

The purpose of `grep` is to print the lines that match a particular pattern.

`grep password file` - prints all lines that contain the word `password`.

How many lines contain the word monster in Frankenstein?

```
grep '[Mm]onster' Frankenstein.txt | wc -l
33
```

Grep options

- `grep -i` - ignores case
- `grep -A 20 -B 10` - prints the 10 lines before and 20 lines after each match
- `grep -v` - inverts the match
- `grep -o` - shows only the matched substring
- `grep -n` - displays the line number

A simple script

```
#!/bin/bash
tr ' ' '\n' $1 | grep '^[[:upper:]]' | wc -l
```

- `$1` refers to the first argument passed to the script (more on this next time)
- `'^[[:upper:]]'` is our first example of a regular expression. Here `^` refers to the beginning of a line and `[[:upper:]]` is any uppercase letter.

Regular Expression

`grep` like many operations takes in a **regular expression** as its argument. Pattern matching with regular expressions is more sophisticated than shell expansion and also uses different syntax.

More precisely, a regular expression is a set of strings; these strings **match** the expression.

When we use regular expressions, it is (usually) best to enclose them in single quotes to stop the shell from expanding it before passing it to `grep` or other tools.

Regular Expression Rules

- `.` - matches any single character
- `*` - matches 0 or more occurences of the character immediately proceeding
- `\?` - matches 0 or 1 occurrences of the character immediately preceding
- `\+` - matches 1 or more occurrences of the character immediately preceding

`$ grep 't.a'` - prints lines with things like `tea, taa, steap`
`$ grep 't*a` - prints lines with things like `aste, taste, ttaste, tttaste`

Regular Expression Rules

- `[c1,c2]` - matches either character (comma optional)
- `^` - matches the beginning of a line
- `$` - matches the end of a line
- `e\{i,j\}` matches between `i` and `j` occurrences of strings that match `e`.

`grep -o '[0-9]\{3\}-\{0,1\}[0-9]\{2\}-\{0,1\}[0-9]\{4\}'` prints all social security numbers in a file (both `111-11-1111` and `111111111`)

Regular Expression Rules

- `c1\|c2` matches the expression c1 or the expression c2.
- `\(txt\)` groups for applying postfix operators
- `\<` matches the beginning of a word
- `\>` matches the end of a word

`grep '\(top\)\{3\}'` searches for `toptoptop`.

`grep 'top\{3\}'` searches for `toppp`.

`grep '[0-5]\{2\}\|[6-9]\{2\}'` searches for things like 12, 15, 68, 97, but not 19, 61.

A word about extended regular expressions

With extended regular expressions you do not need to escape special characters such as ?, +, () and . To use extended regular expressions with grep use the variant egrep.

Extended regular expressions tend to be cleaner and easier to read:

`grep '\(woo\+t\)\{2,3\}'` becomes `egrep '(woo+t){2,3}'`.

There is also `fgrep` which does not understand any regular expressions (fastest).

Why we quote regular expressions

Suppose we have a directory with the following files in it:

```
num, num2, test
```

Now suppose we want to search the file test for the regular expression `nu*`. If we don't quote,

```
grep nu* test
```

gets expanded to

```
grep num num2 test
```

, which searches num2 and test for the string num.

Regular Expression Examples

How would you match any word that begins with `c` and ends with `d`?

Regular Expression Examples

How would you match any word that begins with c and ends with d?

```
grep '\<c[A-Za-z]*d\>'
```

```
grep '\<c.*d\>'
```

Regular Expression Examples

How would you match any word that begins with c and ends with d?

```
grep '\<c[A-Za-z]*d\>'
```

```
grep '\<c.*d\>'
```

If we just want 5 letter words beginning with c and ending with d:

```
grep -o '\<c...d\>' /usr/share/dict/words | uniq
```

```
caged
caked
caned
caped
cared
⋮
```

Great for crosswords!

More Grep Examples

```
$ grep '^smug'
```

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searches for lines that begin with smug

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$ grep '^$'
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More Grep Examples

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$ grep '^smug'
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searches for lines that begin with smug

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$ grep '[[:digit:]]\{5\}'
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searches for zip codes

```
$ grep '^$'
```

searches for blank lines

More Grep Examples

```
$ grep '^smug'
```

searches for lines that begin with smug

```
$ grep '[[:digit:]]\{5\}'
```

searches for zip codes

```
$ grep '^$'
```

searches for blank lines

```
$ grep 'B[oO][bB]$'
```

More Grep Examples

```
$ grep '^smug'
```

searches for lines that begin with smug

```
$ grep '[[:digit:]]\{5\}'
```

searches for zip codes

```
$ grep '^$'
```

searches for blank lines

```
$ grep 'B[oO][bB]$'
```

searches for lines that end in either BOB, Bob, BOb, or BoB.

Convenient Shortcuts for Sets of Characters

- `[[:alnum:]]` - `[A-Za-z0-9]`
- `[[:alpha:]]` - `[A-Za-z]`
- `[[:punct:]]` - Punctuation and symbols
- `[[:digit:]]` - `[0-9]`
- `[[:xdigit:]]` - hexadecimal digits [0-9A-Fa-f]

Examples:
`grep '[a-t[:digit:]]'` looks for any letter from a to t or any digit.
`[[:digit:][:alpha:]]` is equivalent to `[[:alnum:]]`

sed

sed is a *stream editor*. We will only cover the basics, as it is a completely programming language!

- `sed 's/regexp/txt/g'` - substitution

```
sed 's/not guilty/guilty/g' filename
```

What happens if we don't have the g?

sed

sed is a *stream editor*. We will only cover the basics, as it is a completely programming language!

- `sed 's/regexp/txt/g'` - substitution

```
sed 's/not guilty/guilty/g' filename
```

What happens if we don't have the g?

Without the g, it will only do one substitution per line.

- `sed '/regexp/d'` - deletion

```
sed '/[Dd]avid/d' filename > filename2
```

deletes all **lines** that contain either David or david and saves the file as `filename2`.

Why Sed?

Sed is designed to be useful especially if:

- your files are too large for comfortable interactive editing
- your sequence of editing commands is too complicated to be comfortably typed in iteractive mode
- you want to globally apply your edits in one pass through

sed understands regular expressions!

The power of sed is that it treats everything between the first pair of /'s as a regular expression. So we could do

```
sed 's/[[:alpha:]]\{1,3\}[[:digits:]]*@cornell\.edu/cornell email
removed/g' file
```

to print a file with all cornell email addresses removed.

use -r to use extended regular expressions.

sed is greedy!

sed matches a given regular expression to the **longeset** string as soon as possible:

```
$ echo filename1
a b col d e f lapse h i j k lapse m n
$ sed 's/col.*lapse/collapse/g' filename1
```

sed is greedy!

sed matches a given regular expression to the **longeset** string as soon as possible:

```
$ echo filename1
a b col d e f lapse h i j k lapse m n
$ sed 's/col.*lapse/collapse/g' filename1
a b collapse m n

$ echo filename2
a b c col d e f col g h i lapse
sed 's/col.*lapse/collapse/g' filename2
```

sed is greedy!

sed matches a given regular expression to the **longeset** string as soon as possible:

```
$ echo filename1
a b col d e f lapse h i j k lapse m n
$ sed 's/col.*lapse/collapse/g' filename1
a b collapse m n

$ echo filename2
a b c col d e f col g h i lapse
sed 's/col.*lapse/collapse/g' filename2
a b c collapse
```

sed can save the string

Another Example:

```
sed 's/^\([A-Z][A-Za-z]*\), \([A-Z][A-Za-z]*)/\2 \1/' filename
```

- Searches for an expression at the beginning of the line of the form `e1, e2` where `e1` and `e2` are "words" starting with capital letters.
- Placing an expression inside ( ) tells the editor to save whatever string matches the expression
- Since ( ) are special characters we escape them
- We access the saved strings as `\1, \2`.
- This script for example could convert a database file from

`Lastname, Firstname` to `Firstname Lastname`

More sed

You can specify which lines to check by numbers or with regular expressions:

`sed '1,20s/john/John/g' filename` - checks lines 1 to 20

`sed '/^The/s/john/John/g' filename` - checks lines that start with The

& cooresponds to the pattern found:

```
sed  's/[a-z]\+/\(&\)/g' filename
```

replaces words with words in quotes For more on sed check out

http://www.grymoire.com/Unix/Sed.html

Even more sed

How could we use sed to remove a specific regular expression?

Even more sed

How could we use sed to remove a specific regular expression? `sed 's/regexp/ /g' file`

Example:

```
sed 's/[[:alnum:]]/ /g' Frankenstein.txt
```

Other Sed Options

Besides substitution and deletion we can use sed to

- append lines
- change lines
- insert
- print lines

among other things

Appending a Line

append

`/address/a\ text` - append a line with text following each line matched by address

`/address/i\text` - append a line with text preceeding each line matched by address

Example: `sed '/[Mm]onster/a\ A monster is on the line above look out!'`

More Sed

Change

`/address/c\ text` replaces a line that contains address with text `/address1/,/address2/c\ text` replaces all lines between address1 and address2 (including them) with text **yes change can work with multiple lines**

```
sed '/[Mm]onsters\?/c\ This line deleted because monsters scare me'
Frankenstein.txt
```

```
sed '/^From /,/^$/c\ <Mail Header Removed>' / mail
```

Print

Print

`sed '/address1/,/address2/p'` prints all lines between address1 and address2
Most usefull when used with the flag -n that suppresseds normal output

`sed -n /debt/p' databasefile` - prints all lines that contain the word debt

`sed -n /begin{equation}/,/end{equation}/p' texfile` - prints all equations in your tex file

sed scripting

sed is a complete programming language and we can write sed scripts.

- **Recall:** Any file that begins with #! is a script file

Example

- Create a new text file named trim.sed

```
#! /usr/bin/sed -f
s/^ *//
s/ *$//
```

You can run this script from the shell like any other program:

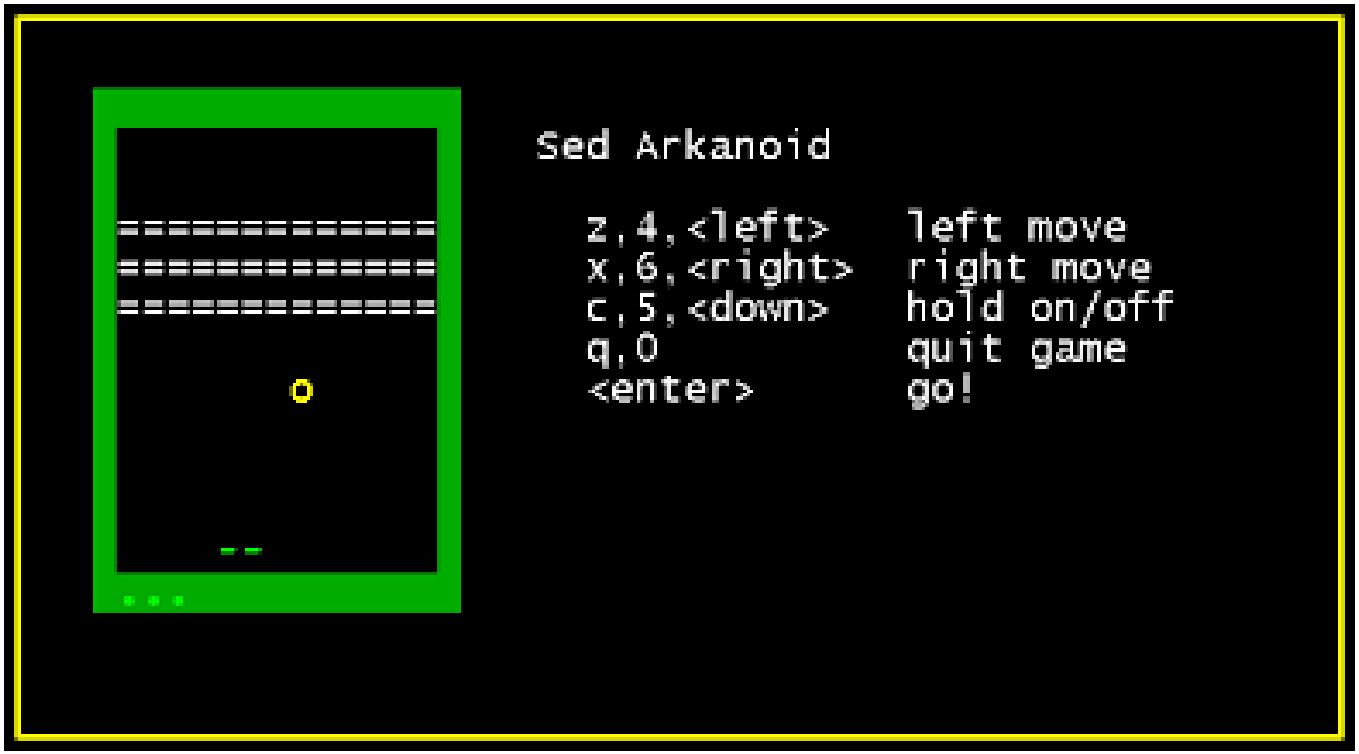
- `echo " this is a test " | ./trim.sed`

```
this is a test
```

We now have a script that trims leading and trailing whitespace!

Sed Arkanoid

Sed is a complete programming language. In fact people have written entire games as sed scripts.



http:aurelio.net/soft/sedarkanoid/