05 - Expansions and Regular Expressions

CS 2043: Unix Tools and Scripting, Spring 2016 [1]

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Table of contents

1. Shell Expansion

2. Sets, Regular Expressions, and Usage

3. More Git

Some Logistics

- The `assignments` repository on GitHub

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- Course pacing...

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- HW1 tonight

Shell Expansion

Wildcards

There are various special characters you have access too in your shell to expand phrases to match patterns, such as `*`, `?`, `^`, `{`, `}`, `[`, `]`.

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- Any string
- A single character
- A phrase
- A restricted set of characters

Shell Expansion: Example

- `*` matches any string, including the null string (e.g. 0 or more characters)

Input	Matched	Not Matched
`Lec*`	`Lecture1.pdf Lec.avi`	`AlecBaldwin/`
`L*ure*`	`Lecture2.pdf Lectures/`	`sure.txt`
`*.tex`	`Lecture1.tex Presentation.tex`	`tex/`

Shell Expansion: Example

- `?` matches a single character

Input	Matched	Not Matched
`Lec?.pdf`	`Lec1.pdf Lec2.pdf`	`Lec11.pdf`
`ca?`	`cat can cap`	`ca cake`

Shell Expansion: Example

- `[...]` matches any character inside the square brackets
  - Use a dash to indicate a range of characters
  - Can put commas between characters / ranges

Input	Matched	Not Matched
`[SL]ec*`	`Lecture Section`	`Vector.tex`
`Day[1-3]`	`Day1 Day2 Day3`	`Day5`
`[A-Z,a-z][0-9].mp3`	`A9.mp3 z4.mp3`	`Bz2.mp3 9a.mp3`

Shell Expansion: Example

- `[^...]` matches any character not inside the square brackets

Input	Matched	Not Matched
`[^A-P]ec*`	`Section.pdf`	`Lecture.pdf`
`[^A-Za-z]*`	`9Days.avi`	`vacation.jpg`

Shell Expansion: Example

- Brace Expansion: `{..., ...}` matches any phrase inside the comma-separated braces.
- Suports ranges as well!
- Brace expansion needs at least two options to choose from.

Input	Matched
`{Hello,Goodbye}\World`	`Hello World Goodbye World`
`{Hi,Bye,Cruel}\World`	`Hi World By World Cruel World`
`{a..t}`	Expands to the range `a` ... `t`
`{1..99}`	Expands to the range `1` ... `99`

Note: NO SPACES. We haven't covered loops yet...but this is most useful when you want to do something like

- `for x in 1..99; do echo $x; done`

Combining Them

Of course, you can combine all of these!

Input	Matched	Not Matched
`*h[0-9]*`	`h3 h3llo.txt`	`hello.txt`
`[bf][ao][row].mp?`	`bar.mp3 foo.mpg`	`foo.mpeg`

Interpreting Special Characters

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$ * < > & ? { } [ ]
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- A shell's ability to interpret and expand commands is one of the powers of shell scripting.
- These will become your friends, and we'll see them again...

Sets, Regular Expressions, and Usage

`tr` Revisited

`tr` does not understand regular expressions per se (and really for the task it is designed for they don't make sense), but it does understand ranges and `POSIX` character sets:

Useful Sets

- `[:alnum:]` - alphanumeric characters
- `[:alpha:]` - alphabetic characters
- `[:digit:]` - digits
- `[:punct:]` - punctuation characters
- `[:lower:]` - lowercase letters
- `[:upper:]` - uppercase letters
- `[:space:]` - whitespace characters

If you Leave this Class with Anything...

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Quite possibly the two most common things anybody uses in a terminal:

- `find`: searching for files / directories by name or attributes
- `grep`: search contents of files
- Used in conjunction with expansions, sets, and regular expressions

Finding Yourself

find

```
find [where to look] criteria [what to do]
```

- Used to locate files or directories
- Search any set of directories for files that match a criteria
- Search by name, owner, group, type, permissions, last modification date, and *more*
- Search is recursive (will search all subdirectories too)
    - Sometimes you may need to limit the depth

Some Find Options

- `-name`: name of file or directory to look for
- `-maxdepth num`: descend at most num levels of directories while searching
- `-mindepth num`: descend at least num levels of directories while searching
- `-amin n`: file last access was n minutes ago
- `-atime n`: file last access was n days ago
- `-group name`: file belongs to group name
- `-path pattern`: file name matches shell pattern pattern
- `-perm mode`: file permission bits are set to mode

Of course...a lot more in man find.

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    - The variable name is `{}`
    - You have to end the command with either a
        - `;` to execute the command on each individual result
        - `+` to execute on all results
        - Note: You have usually to escape them, e.g. `\;` and `\+`

Some Examples

Find all files accessed at most 10 minutes ago

```
find . -amin -10
```

Find all files accessed at least 10 minutes ago

```
find . -amin +10
```

Display all the contents of files accessed in the last 10 minutes

```
find . -amin -10 -exec cat  +
```

Accidentally did `git add` on a Mac and ended up with `.DS_Store` Everywhere?

```
find . -name .DS_Store -exec git rm -rf
```

Time for the Magic

Globally Search a Regular Expression and Print

`grep <pattern> [input]`

- Searches `input` for all lines containing `pattern`
- Can be as easy as specifying a `string` you need to find in a `file`
- Or it can be much more.
- Common: `<some_command> | grep <thing you need to find>`

Understanding how to use grep is really going to save you a lot of time in the future!

Grep Options

- `-i`: ignores case
- `-A 20 -B 10`: prints the 10 lines before and 20 lines after each match
- `-v`: inverts the match
- `-o`: shows only the matched substring
- `-n`: displays the line number
- `-H`: print the filename
- `--exclude <glob>`: ignore `glob` e.g. `--exclude *.o`
- `-r`: recursive, search subdirectories too.
  - Note: you're Unix version may differentiate between `-r` and `-R`, check the `man` page. We'll cover what that means soon.

Regular Expressions

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- `grep`, like many programs, takes in a regular expression as its `input`. Pattern matching with regular expressions is more sophisticated than shell expansions, and also uses different syntax.
- More precisely, a regular expression is a set of strings - these strings match the specified expression.
- When we use regular expressions, it is (usually) best to enclose them in quotes to stop the shell from expanding it before passing it to `grep` / other tools.

Regular Expression Notes

Some `regex` patterns perform the same tasks as the wildcards we learned:

Single Characters

Wild card: `?` Regex: `.`

- Matches any single character.

Wild card: `[a-z]` Regex: `[a-z]`

- Matches one of the indicated characters
- Don't separate multiple characters with commas in the `regex` form (e.g. `[a,b,q-v]` becomes `[abq-v]`)

A Simple Example

`grep 't.a'` - prints lines with things like `tea`, `taa`, and `steap`

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  - If you take a look at the ASCII codes I keep mentioning in [2], you will see that the lower case letters come after the upper case letters.
  - You should be careful about trying to do something like `[a-Z]`.
  - Instead, just do `[a-zA-Z]`.
  - Note: some programs very well could accept the range `[a-Z]` correctly.

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- Remember that you can flip the expressions with the not signal: `^`
- The `$` can be used to match the end of the line

To be continued...

There's a lot more going on here. We'll come back to it soon!

More Git

Syncing a Fork...

...again!

References I

[1] B. Abrahao, H. Abu-Libdeh, N. Savva, D. Slater, and others over the years.
Previous cornell cs 2043 course slides.

[2] A. Table.
Ascii character codes and html, octal, hex, and decimal chart conversion.
`http://www.asciitable.com/`.