Regular expressions: Text editing and Advanced manipulation

HORT 59000

Lecture 4

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Simple manipulations

- Tabular data files can be manipulated at a column-level.
- Cut: Divide file into columns using delimiter and extract one or more columns.
- Paste: Combine multiple columns into a single table/file.
- Sort: Sort lines in a file based on contents of one or more columns.

Text editors

- Programs built to assist creation and manipulation of text files, typically scripts.
- Often support the syntax of one or more programming languages.
- Provide a set of functions and options that makes it easier to find and manipulate text.
- Certain editors can incorporate additional functions such as syntax checking, compilation etc.

nano/pico editors

- nano is a pure text editor in GNU, that was build to emulate the original pico editor in UNIX.
- Easy-to-learn, supports syntax highlighting, regular expressions, scrolling etc.
- Lacks GUI, navigate within editor using keyboard.
- Special functions, such as toggling options/features, use the Ctrl or Meta (Alt) key.
- Check /usr/share/nano to see the list of supported syntax formats.
- For example: /usr/share/nano/python.nanorc provides syntax rules for Python.

emacs editor

- Powerful program that provides basic editing functions but also extendible to add functionality.
- Supports syntax highlighting, regular expressions, Unicode (other languages)
- Supports GUI, when connection invoked with X support (ssh -X <user>@server)
- Can install extensions that provide a wide range of functions. E.g. Calendar, debugging interface, calculator, version control etc.
- Learn more: https://www.gnu.org/software/emacs/tour/index.html

vi editor

- Powerful editor that provides extensive editing functions and relatively limited extensibility. My favorite text editor!!
- Normal or Command mode is default and captures keyboard input as commands or instructions to the editor.
- Insert mode is entered by pressing ‘i’ which then allows changes in text. Return to command mode by pressing ’Esc’.
- Steep learning curve… but very rewarding experience.
- ALL Unix systems include vi

Regular expressions

- Regular expressions (regex) are a specific way of defining patterns in text.
- Patterns allow us to look for exact and inexact matches.
- For example, British vs. US English
  - Centre vs. Center
  - Theatre vs. Theater
  - -ize vs –ise
- Regex allows us to mix fixed and variable characters.
- Typically written as follows: /<regex>/
- Regex is CaSe-SeNsiTive

Special characters

.	Matches any character except new line
\	Escape character that changes the meaning of the character following it
\s	space
\S	not a space
\t	tab
\n	new line character (Unix)
\r	new line character (Older Mac OS)
\r\n	new line character(DOS/Windows)

Special characters

\d	digit, i.e., 0-9
\D	anything except a digit
\w	word (includes letter, digit, underscore)
\W	any character that is not included in word
^	Start of line
$	End of line

- Examples: /\d\d$/

Special character examples

1. /^\d\dth\s/ matches number written as 10th – 99th except numbers such as 21st or 42nd or 53rd
2. /\w\sdogs\s/ matches all lines that have some word followed by the word dogs

Character classes

- A class/set is used to define a group of characters that are allowed in the pattern.
- Class is defined using the [] construct.
- Each character within the [] is treated as a possible option for the character.
- Each class refers to one character in the pattern.
- Character ranges, such as all numbers or all letters supported.

Character classes

- [A-Z]   matches all upper-case letters
- [a-z]   matches all lower-case letters
- [0-9]   matches all digits
- [tnr][hd]   matches th or nd or rd
- Character class can be negated by using ^ as the first character in the class.
- [^0-9]   matches all characters that are not a number

Quantifiers

- Patterns can be modified or extended by using quantifiers.
- A quantifier defines the number of times the character preceding it is matched.
- Can specify exact or minimum or maximum number of matches.
- Can also set a range of minimum and maximum matches

Quantifiers

• *	zero or more matches
• +	one or more matches
• ?	zero or one matches
• {2}	exactly 2 matches
• {2,10}	at least 2, maximum of 10 matches
• {,10}	0-10 matches

Quantifiers examples

- /G+/ at least one G
- /G*/ zero or more Gs (will match every line)
- /G{5}/ Exactly 5 Gs (continuous)
- /AG{5,10}/ A followed by 5-10 Gs
- /CG{5,}/ C followed by >= 5 Gs
- /ATCG*/ ??
- /[0-9]{2,4}/ ??

Character groups

- Can group two or more patterns using the (a|b) construct.
- For example, the British vs. US spelling can be captured as
  - cent(er|re)   Matches center and centre
  - analy(s|z)e   Matches analyse and analyze
- Character groups can be used in combination with quantifiers and special characters.

grep

- grep command searches for the specified pattern in every line of the file.
- By default returns (prints) every line in file that matches the pattern.
- Supports many options/arguments that alter the behavior of grep.
- Very useful to select rows of data that match a pattern the user is interested in.

grep

- -c returns the number of matching lines
- -n show line number along with matching line
- -m limits the number of matches grep looks for
- -v inverts match, i.e., return non-matching lines
- -i case-insensitive match
- -f <file> read patterns from file
- -B <N> return N lines before the matching line
- -A <N> return N lines after the matching line

sed

- grep is useful for finding matches but not editing.
- sed is a stream editor, i.e., it is used to edit the stream (STDIN or file) that is passing through it.
- sed s/<pattern>/<replacement>/ <file>
  - Replace every match of <pattern> in the file with <replacement>
- Useful for repetitive editing of one or multiple files.

awk

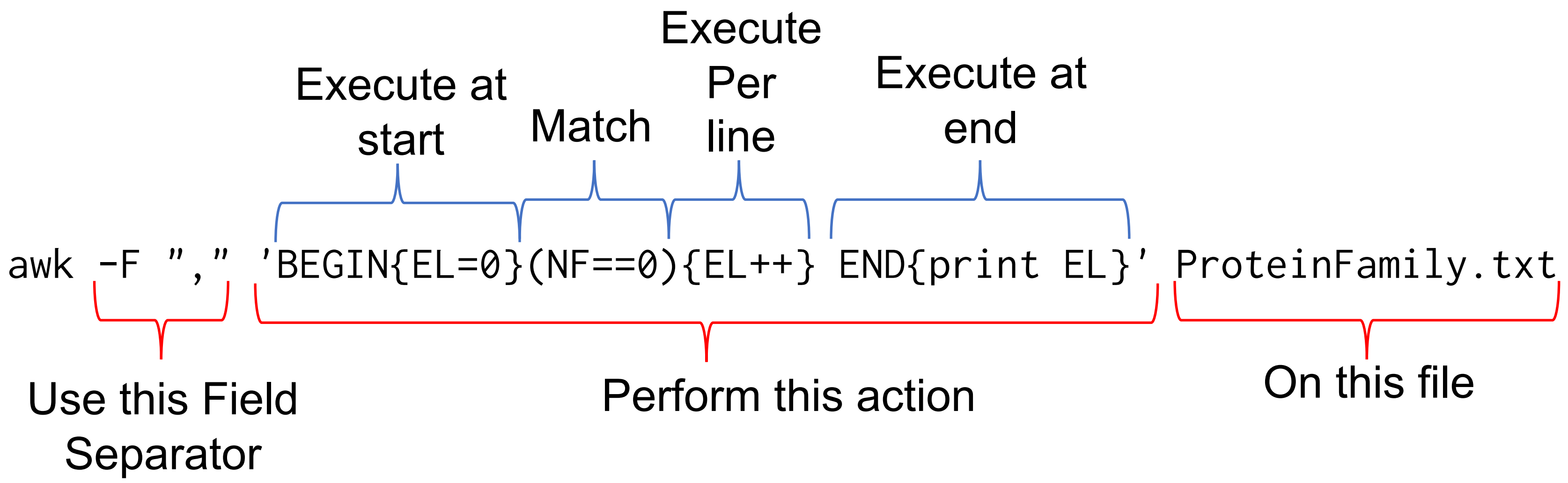
- awk is a programming language that allows one line programs, therefore can be used as a command.
- Each line in a file is a ‘record’ and each word in the line is a ‘field’. Default separator is space.
- Works best with tabular data files since the ‘fields’ are consistent across the ‘records’.

```
awk (condition/pattern){action/script} filename
```

awk variables

- Special variables in awk have predefined meaning.
- FS = Field separator
- RS = Record separator
- OFS= Output Field separator
- ORS = Output Record separator
- $0 = Current record/line
- $N = Nth field in current record
- BEGIN = execute at start of command
- END = execute at end of command

awk example



```
awk -F "," 'BEGIN{EL=0}(NF==0){EL++} END{print EL}' ProteinFamily.txt
```