Josep Carreras LEUKAEMIA Research Institute

Advancing with the Shell

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http://www.carrerasresearch.org/en/units/bioinformatics

IJC Bioinformatics

Who we are

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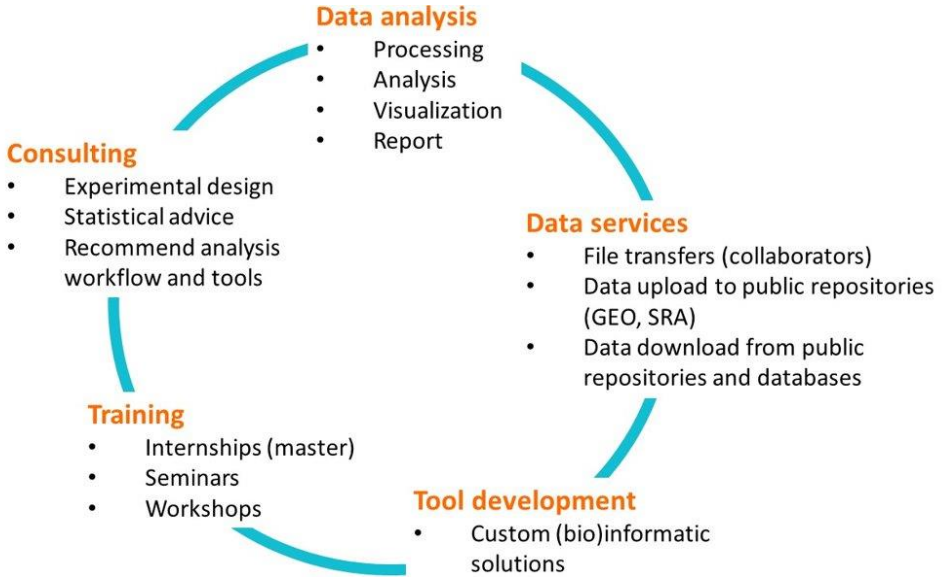

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https://carrerasresearch.sharepoint.com/sites/BIT

https://www.carrerasresearch.org/en/bioinformatics-unit

Overview

- Customizing your Shell
- Bash: Expansions and substitutions
- Egrep and regular expression
- File manipulations with sed and awk

Linux course server @:

https://vpn.carrerasresearch.org

Workshop materials

https://ijcbit.github.io/Workshops/

Customize your Shell

Bash start-up files: .bashrc & .bash_profile

- **~/.bashrc** executed on interactive non-login terminal windows
  - Use for commands that are executes every time you open a terminal (e.g. aliases, prompt)

- **/etc/profile , ~/.bash_profile, ~/.bash_login, ~/.profile** executed on interactive login terminal windows
  - Use for commands that are executed once (e.g. environmental variables),
  - .bash_profile typically sources .bashrc

```
if [ -f ~/.bashrc ]; then
   . ~/.bashrc
fi
```

Environment variable and aliases

Set the path for your executable files

```
export PATH=$PATH:/place/with/the/file
```

Create command short cuts using an alias:

```
alias alias_name="command_to_run"
```

Example:

```
$ alias ll="ls -lrth"
```

Customize your prompt

Current prompt:

[amerkel@IJC20571R ~]$ # Displays user, host, base working directory, with brackets and '$'

Change via the environmental variable PS1:

```
export PS1="\u >"                    # Display user and '>'
export PS1="\u@\H >"                 # Display user, hostname (separated by '@') and '>'
export PS1="\W > "                   # Export basename working directory and '>'
export PS1="\w > "                   # Export working directory and '>'
```

Change the color of your prompt

```
export PS1="\e[0;32m[\u@\h \W]\$\e[0m"
```

- **\e[** – Begin color changes
- **0;32m** – Specify the color code
- **[\u@\h \W]\$** – code for text BASH prompt (username@hostname Workingdirectory $)
- **\e[0m** – Exit color-change mode

Customize your prompt (text format)

The first number in the color code specifies the typeface:

- **0** – Normal
- **1** – Bold (bright)
- **2** – Dim
- **4** – Underline

The second number indicates the color:

- **30** – Black
- **31** – Red
- **32** – Green
- **33** – Brown
- **34** – Blue
- **35** – Purple
- **36** – Cyan
- **37** – Light gray

https://phoenixnap.com/kb/change-bash-prompt-linux

Customize the color scheme of 'ls'

Use Linux utility 'dircolors'

$ dircolors --print-database > ~/.dir_colors

$ less ~/.dir_colors

```
TERM vt100
TERM xterm*
# Below are the color init strings for the basic file types. A color init
# string consists of one or more of the following numeric codes:
# Attribute codes:
# 00=none 01=bold 04=underscore 05=blink 07=reverse 08=concealed
# Text color codes:
# 30=black 31=red 32=green 33=yellow 34=blue 35=magenta 36=cyan 37=white
# Background color codes:
# 40=black 41=red 42=green 43=yellow 44=blue 45=magenta 46=cyan 47=white
#NORMAL 00 # no color code at all
#FILE 00 # regular file: use no color at all
RESET 0 # reset to "normal" color
DIR 01;34 # directory
```

```
$ eval $(dircolors ~/.dir_colors)
```

Add color support of ls to your .bashrc

```
if [ -x /usr/bin/dircolors ]; then
    test -r ~/.dircolors && eval "$(dircolors -b ~/.dircolors)" || eval "$(dircolors -b)":
fi
```

Bash: Expansions and substitutions

Syntax elements in the command line can be interpreted or taken literally.

After splitting the command line into tokens (words), Bash scans for special elements and interprets them, resulting in a changed command line:

-> the elements are said to be **expanded** to or **substituted** to **new text and maybe new tokens** (words).

https://wiki.bash-hackers.org/syntax/expansion/intro

Simple expansions

Pathname expansion (wildcards)

- *.txt # any number of characters
- page_1?.html # any one particular character
- [SK][0-9].fastq # 'S' or 'K' followed by any number between 0 and 9

Example:

$ ls *.txt # list all files that end with '.txt'

Brace expansion

- {X,Y,Z} # individual elements
- {X..Y} # sequence from..to
- {X..Y..Z} # sequence from..to..by

Example:

$ echo a{d,c,b}e

ade ace abe

Tilde expansion

- ~ # home directory

Example:

$ cd ~ # go to your home directory

Parameter expansion

- $PARAMETER same as ${PARAMETER} # expand parameter value
- ${STUFF…} # expand value with modifications

Substring removal (also for **filename manipulation**!)

= **expand only a part** of a parameter's value, **given a pattern to describe what to remove** from the string

- ${PARAMETER#PATTERN} OR ${PARAMETER##PATTERN} # from the beginning, remove the shortest OR longest text matching the pattern
- ${PARAMETER%PATTERN} OR ${PARAMETER%%PATTERN} # from the end, remove the shortest OR longest text matching the pattern

Example:

$ MYSTRING="Be liberal in what you accept, and conservative in what you send"

Syntax	Result
${MYSTRING#*in}	~~Be liberal in~~ what you accept, and conservative in what you send
${MYSTRING##*in}	~~Be liberal in what you accept, and conservative in~~ what you send
${MYSTRING%*in}	Be liberal in what you accept, and conservative ~~in what you send~~
${MYSTRING%%*in}	Be liberal ~~in what you accept, and conservative in what you send~~

Expansions and substitutions

Arithmetic expansion

- $((EXPRESSION))

Example:

$((5+1))

Command substitution

- $(COMMAND) # better OR
- `COMMAND `

Use quotes to avoid word splitting in the subsequent step!

Example:

```
$ echo "$(echo "$(ls)")"
$ DATE="$(date)"
```

https://devhints.io/bash

Egrep and regular expression

egrep = print all lines matching a regular expression

egrep [command line options] <pattern> [path]

-v # print lines that do not match the regular expression
-w # match only complete words
-c # print a count of matching lines
-A N # after each matching line, print the next N lines from this file
-B N # before each matching line, print the next N lines from this file

Example:

$ grep –c 'chr1' peaks.bed

Regular expressions

Expression	Description
.(dot)	a single character.
?	the preceding character matches 0 or 1 times only.
*	the preceding character matches 0 or more times.
+	the preceding character matches 1 or more times.
{n}	the preceding character matches exactly n times.
{n,m}	the preceding character matches at least n times and not more than m times.
[agd]	the character is one of those included within the square brackets.
[^agd]	the character is not one of those included within the square brackets.
[c-f]	the dash within the square brackets operates as a range. In this case it means either the letters c, d, e or f.
()	allows us to group several characters to behave as one.
| (pipe symbol)	the logical OR operation.
^	matches the beginning of the line.
$	matches the end of the line.

Example:

```
$ egrep '2.+' peaks.bed
```

File manipulations with 'sed' (stream editor)

Sed = pattern-matching engine that can perform manipulations on lines of text

Examples

- $ sed 's/red/hat/g' myfile # print file and substitute all occurunces of "red" with "hat"
- $ sed '1,10d' myfile # print file with the first 10 lines removed
- $ sed 's/^\s*//' file.txt # remove all white spaces from the beginning of each line
- $ sed '5 s/old/new/' file.txt # Replace a string only on the 5th line

https://quickref.me/sed.html

File manipulations with awk

Awk/gawk/nawk = scripting language with pattern matching

```
$ awk '{print $1, $5}' FS=";", OFS="\t" myfile          # print first and fifth field; FS= input Field Seperator, OFS= Output Field Seperator *
$ awk '{if($1== "chr1" && $5 >100){print}}' myfile      # filter first and fifth field by strings/values
$ awk '{if($1 ~/chr1/){print}}' myfile                  # filter first field for matches of'chr1'
$ awk '{if(NR<=5){print NF}}' myfile                    # for the first 5 rows print the number of field; NR= Number of rows, NF= Number of fields *
```

* build-in variables to awk

Split function (string, array, pattern))

```
$ awk '{ split($2, string_elements_array, " "); print $1,  string_elements_array[2]}' myfile
```

Code structure (BEGIN{}, {}, END{})

```
awk '{ SUM+=$1 } END { print SUM }' myfile              #  Sum values of a field and print
```

https://linuxhandbook.com/awk-command-tutorial/

Questions?

Thank you!