BIOL*3300 Lab3 F21

Advanced Command Lines

To be sure we are still working in the same place, let's login in Compute Canada Graham account and run the following commands:

```
cd scratch/Biol3300
mkdir Lab3
cd Lab3
pwd
```

Compressed Files with gzip

Previously, we use gunzip to extract the gff3 file from Ensembl. These files had a.gz suffix which indicated the data had been compressed. We may want to compress files. How do we do it?
Let's first create some data in some directories.

```
cp ~/scratch/Biol3300/Lab2/gff3file .
mkdir -p Compress/Compress_sub
head -n 1000 gff3file > Compress/headfile.txt
tail -n 1000 gff3file > Compress/tailfile.txt
cp Compress/headfile.txt Compress/Compress_sub/headfile2.txt
```

We can compress the file headfile.txt into headfile.txt.gz:

```
 gzip Compress/headfile.txt
 ls -l Compress/
```

And we decompress the file by:

```
 gunzip Compress/headfile.txt.gz
 ls -l Compress/
```

We can compress all the txt file and decompress all the gz file by:

```
gzip Compress/*.txt
ls -l Compress/
gunzip Compress/*.gz
ls -l Compress/
```

We can also compress all the filenames in the directory and its subdirectories with -r (for recursive) option. This option is used to gzip the files in adirectory tree individually.

```
gzip -r Compress
ls -l Compress/
ls -l Compress/Compress_sub
```

To uncompress the file, we can also add option -d (for decompress):

```
gzip -dr Compress
ls -l Compress/
ls -l Compress/Compress_sub
```

More options of gzip:

```
man gzip
gzip --help
```

Compressed Files with tar

Note that the **gzip -r** command compressed the files in the directories. It did not compress the directories into one file. The command tar will put together files and directories. It makes a "tape archive".

Let’s create a tar file of the Compress directory and all its contents:

```
tar -cvf compress_archive.tar Compress
ls
```

This creates a new file, and the options:
-c is "create archive"
-v is verbose
-f is create archive with the given filename

We can extract the archives contents by:

```
mv Compress Compress_old
tar -xf compress_archive.tar
ls
```

These steps will create a new Compress directory in the current directory. We can archive and compress with one command:

```
tar -czf compress_archive.tar.gz Compress
ls
```

And decompress and extract from archive with one command.

```
mv Compress Compress_old_again
tar -xzf compress_archive.tar.gz
ls -l Compress
```

Summary of some tar options:
-c: Create a new archive containing the specified items.
-x: Extract to disk from the archive.
-f: Read the archive from or write the archive to the specified file
-v: Produce verbose output.
-z: De/Compress the resulting archive with gzip

More options of tar:

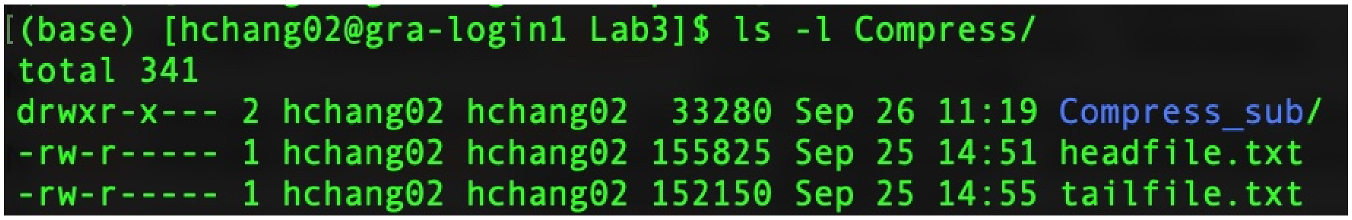
```
man tar
tar --help
```

File Permissions

In Unix, an individual can be a **user (u)**; an individual can be in a **group (g)**; and an individual can have an **other (o)** classification. These classifications affect what the individual can do with files and directories.

Files and directories have three types of permissions: **read (r)**, **write (w)** and **execute (x)**. We can see these permissions when we type:

```
ls -l Compress
```



```
(base) [hchang02@gra-login1 Lab3]$ ls -l Compress/
total 341
drwxr-x--- 2 hchang02 hchang02  33280 Sep 26 11:19 Compress_sub/
-rw-r----- 1 hchang02 hchang02 155825 Sep 25 14:51 headfile.txt
-rw-r----- 1 hchang02 hchang02 152150 Sep 25 14:55 tailfile.txt
```

After the character signalling if the entry is a file (-) or directory (d), the next three characters signify read, write, execute permission for the user followed by the group followed by other. In this case, I can read and write the file I made (**headfile.txt**), but I can not execute (rw-). For the files the user creates, the user will have read and write permission automatically. The user does not have execute permission by default.

On this Compute Canada Graham server, the files and directories I make are available to view by a member of the same group as me only. These people do not have execute permissions or permissions to write to a file or directory. We can see read is only available to members of my group (r--).

To enter a directory, one needs execute permission. The text above, "drwxr-x---" indicates that user can enter, read, and write to the directory. Group members can open the directory.

Changing permissions

The **chmod** (for change modes) command changes permissions of files and directories. The base method is "u/g/o classification" "add or remove" "execute/read/write"

Add execute permission for the user:

```
cd Compress
chmod u+x headfile.txt
ls -l
```

Remove read permission for the group:

```
chmod g-r headfile.txt
ls -l
```

Add write permission for the user:

```
chmod o+w headfile.txt
ls -l
```

Remove write for all classifications:

```
chmod a-w headfile.txt
ls -l
```

Set all classifications for read/write/execute:

```
chmod u=rwx,g=rx,o=r headfile.txt
ls -l
```

We can also use the digits 7, 5, and 4 to represent the permissions for the user, group, and others, in that order. Each digit is a combination of the numbers 4, 2, 1, and 0:
4 stands for "read",
2 stands for "write",
1 stands for "execute",
0 stands for "no permission".

```
chmod 754 tailfile.txt
```

You can also change the permissions for the whole directory Lab3 with -R option:

```
cd ../..
chmod -R 747 Lab3
```

I have changed the permissions for my folder Lab3, please copy this "superheroes.txt" file to your current Lab3 folder:

```
cp /home/hchang02/scratch/Biol3300/Lab3/superheroes.txt .
```

If you can't copy the above file, please create the file with **nano superheroes.txt**, by typing or pasting as the following:

```
Batman  Bruce Wayne Hero    DC
Invisible Woman        Susan Storm Richards    Hero    Marvel
Supergirl        Linda Danvers        Hero        DC
Superman        Clark Kent        Hero        DC
Wonder Woman    Diana Prince        Hero        DC
Iron Man    Tony Stark        Hero        Marvel
```

The simplest "grep" is to choose a pattern and a file

grep (for global regular expression) is a search tool. It looks through text files for strings (sequences of characters). In its default usage, grep will look for whatever string of characters you give it (1st positional argument), in whichever file you specify (2nd positional argument), and then print out the lines that contain what you searched for. Let's try it:

```
    grep Woman superheroes.txt
```

Let's search for man. If we are looking for lower case matches, then we would use 'man'. If we want to match letters regardless of capitalization '-i man'. The -i flag means "ignore case".

```
    grep -i man superheroes.txt
    grep man superheroes.txt
```

You may surprised to see some of these matches. We are detectng man in phrases.

The -v option

The v option turns the logic of the grep command upside down; it shows lines that don't match the pattern.

```
    grep -iv man superheroes.txt
```

Count pattern matches

```
    grep -ci man superheroes.txt
```

What line numbers have a matching pattern?

```
grep -n man superheroes.txt
grep -vn man superheroes.txt
```

Matching pattern positions

Sometimes we want to match a character/letter at the beginning of the text.

```
grep ^Super superheroes.txt
```

Sometimes we want to match a character/letter at the end of the text

```
grep C$ superheroes.txt
```

More options of grep:

```
man grep
grep --help
```

Grep Options:
-c prints a count of matching lines.
-i ignore case.
-A prints lines after the match.
-B prints lines before the match.
-v prints those lines that don't have pattern.
-n prints line numbers.

Try some grep commands yourself:

```
grep -B 2 Man superheroes.txt
grep -A 1 Bat superheroes.txt
grep -B 2 -n Man superheroes.txt
```

Redirecting input and output

Sandard output

Unix treats the output of programs likes a stream of data that can be redirected to different places. The official term for the output of any command is standard output (stdout). Your computer screen is the default destination for stdout.

Rather than have the output go to the screen, we have used the redirect operator to send it to a new file.

```
grep DC superheroes.txt > DC_superheroes.txt
```

A somewhat brutal feature of the redirect operator is if you accidentally redirect a commands output to a file that exists, it will clobber it. Redirection will re-write files, even if there is no output!

To append to an existing file, use >>

```
echo "Captain America   Steve Rogers    Hero    Marvel" >> superheroes.txt
```

Standard input

The standard input is a data stream, usually text, that can be provided as input for UNIX program. By default, stdin is from the keyboard, but differs from the input to commands .e.g. less superheroes.txt. Filename is an argument to the command, but it is not the standard input.

Not many commands take standard input, **tr** (for translate) is one. The tr command specifies a range of characters that are to be changed into others. It requires some typed input after the command has started. We can redirect standard input to come from a file with "<" the redirect operator. For example, if we want to convert m to M, one can use the following command.

```
tr 'm' 'M' < superheroes.txt
```

You can redirect both stdin and stdout.

```
tr 'm' 'M' < superheroes.txt > processed.txt
```

Reference

These lab materials are from the following tutorials:

1. https://j.p.gogarten.uconn.edu/mcb5472_2018/current.pdf
2. https://astrobiomike.github.io/unix/getting-started