

1. More Linux Commands

In this exercise, we will learn a few more Linux commands. For each command, please use `man` to learn what it does and how to use it correctly. First, change your directory to `~`.

1.1 [2 points] Make a link called `data_demo_link` to `data_demo` folder using `ln`.

```
[ese-zhouyq@login01 ~]$ ln -s data_demo data_demo_link
[ese-zhouyq@login01 ~]$ ls
data_demo  data_demo_link  exam  t1.py  test
[ese-zhouyq@login01 ~]$ ls -s
total 3
1 data_demo 1 data_demo_link 1 exam 1 t1.py 1 test
```

1.2 [2 points] Print your home directory using `echo`.

```
[ese-zhouyq@login01 ~]$ echo "$(ls)"
data_demo
data_demo_link
exam
t1.py
test
```

1.3 [2 points] Go to `data_demo/molecules/`, make an empty file `test.pdb` with `touch`.

```
[ese-zhouyq@login01 ~]$ cd data_demo
[ese-zhouyq@login01 data_demo]$ cd molecules
[ese-zhouyq@login01 molecules]$ touch test.pdb
[ese-zhouyq@login01 molecules]$ ls
cubane.pdb  ethane.pdb  methane.pdb  octane.pdb  pentane.pdb  propane.pdb  test.pdb
```

1.4 [3 points] Find how many files in `data_demo/data/elements/` using `find`.

```
[ese-zhouyq@login01 molecules]$ cd ~
[ese-zhouyq@login01 ~]$ cd data_demo/data/elements/
[ese-zhouyq@login01 elements]$ find . -type f -print | wc -l
103
```

1.5 [2 points] Compare `data_demo/data/pdb/ethane.pdb` and `data_demo/data/pdb/ethanol.pdb` with `diff`.

```
[ese-zhouyq@login01 ~]$ cd data_demo
[ese-zhouyq@login01 data_demo]$ cd data
[ese-zhouyq@login01 data]$ cd pdb
```

```
[ese-zhouyq@login01 pdb]$ diff ethane.pdb ethanol.pdb -y -W 50
COMPND      ETHANE      | COMPND      ETHANOL
AUTHOR      DAVE WOOD  | AUTHOR      DAVE WOOD
ATOM        1  C      | ATOM        1  C
ATOM        2  C      | ATOM        2  O
ATOM        3  H      | ATOM        3  H
ATOM        4  H      | ATOM        4  H
ATOM        5  H      | ATOM        5  H
ATOM        6  H      | ATOM        6  C
ATOM        7  H      | ATOM        7  H
ATOM        8  H      | ATOM        8  H
ATOM        9          | ATOM        9  H
TER          | > TER        10
END          | END
```

1.6 [3 points] Count how many `But she` string appears in `data_demo/writing/data/LittleWomen.txt` with `grep`.

```
[ese-zhouyq@login01 ~]$ cd data_demo
[ese-zhouyq@login01 data_demo]$ ls
creatures data molecules north-pacific-gyre notes pizza.cfg solar.pdf writing
[ese-zhouyq@login01 data_demo]$ cd writing
[ese-zhouyq@login01 writing]$ ls
data haiku.txt thesis tools
[ese-zhouyq@login01 writing]$ cd data
[ese-zhouyq@login01 data]$ ls
LittleWomen.txt one.txt two.txt
```

```
[ese-zhouyq@login01 data]$ grep -r "But she" LittleWomen.txt | wc -l
15
```

1.7 [2 points] Check the total file size of the `data_demo/data/` folder using `du`.

```
[ese-zhouyq@login01 data]$ cd ~
[ese-zhouyq@login01 ~]$ ls
data_demo data_demo_link exam t1.py test test.pdb
[ese-zhouyq@login01 ~]$ cd data_demo
[ese-zhouyq@login01 data_demo]$ cd data
[ese-zhouyq@login01 data]$ ls
amino-acids.txt animals.txt morse.txt planets.txt sunspot.txt
animal-counts elements pdb salmon.txt
[ese-zhouyq@login01 data]$ du
407      ./pdb
52       ./elements
1        ./animal-counts
719      .
```

1.8 [3 points] Copy the `data_demo/writing/` folder to `data_demo/writing_new/`, compress `data_demo/writing_new/` using `zip`, and decompress the `.zip` file with `unzip`.

```
[ese-zhouyq@login01 data_demo]$ cp -r writing/ writing_new
[ese-zhouyq@login01 data_demo]$ zip -r writing_new.zip writing_new
adding: writing_new/ (stored 0%)
adding: writing_new/haiku.txt (deflated 29%)
adding: writing_new/tools/ (stored 0%)
adding: writing_new/tools/stats (stored 0%)
adding: writing_new/tools/old/ (stored 0%)
adding: writing_new/tools/old/oldtool (stored 0%)
adding: writing_new/tools/format (deflated 13%)
adding: writing_new/data/ (stored 0%)
adding: writing_new/data/one.txt (deflated 53%)
adding: writing_new/data/LittleWomen.txt (deflated 61%)
adding: writing_new/data/two.txt (deflated 59%)
adding: writing_new/thesis/ (stored 0%)
adding: writing_new/thesis/empty-draft.md (stored 0%)
[ese-zhouyq@login01 data_demo]$ unzip -n writing_new.zip
Archive: writing_new.zip
[ese-zhouyq@login01 data_demo]$ ls
creatures data molecules north-pacific-gyre notes pizza.cfg solar.pdf writing writing_new writing_new.zip
```

1.9 [3 points] Change the file permissions flags on `writing_new` to `drwxr-x---` using `chmod`.

```
[ese-zhouyq@login01 data_demo]$ chmod 750 writing_new
[ese-zhouyq@login01 data_demo]$ ls
creatures data molecules north-pacific-gyre notes pizza.cfg solar.pdf writing writing_new writing_new.zip
[ese-zhouyq@login01 data_demo]$ ll
total 644
drwxr-xr-x 2 ese-zhouyq ese-ouycc 4096 Nov 24 19:22 creatures
drwxr-xr-x 5 ese-zhouyq ese-ouycc 4096 Nov 24 19:22 data
drwxr-xr-x 2 ese-zhouyq ese-ouycc 4096 Dec 1 20:21 molecules
drwxr-xr-x 3 ese-zhouyq ese-ouycc 4096 Nov 24 19:22 north-pacific-gyre
-rwxr-xr-x 1 ese-zhouyq ese-ouycc 69 Nov 24 19:22 notes
-rwxr-xr-x 1 ese-zhouyq ese-ouycc 32 Nov 24 19:22 pizza.cfg
-rwxr-xr-x 1 ese-zhouyq ese-ouycc 21583 Nov 24 19:22 solar.pdf
drwxr-xr-x 5 ese-zhouyq ese-ouycc 4096 Nov 24 19:22 writing
drwxr-x--- 5 ese-zhouyq ese-ouycc 4096 Dec 2 09:26 writing_new
-rw-r--r-- 1 ese-zhouyq ese-ouycc 422584 Dec 2 09:27 writing_new.zip
```

1.10 [3 points] Print the last 10 commands you made using `history`.

```
[ese-zhouyq@login01 data_demo]$ history 10
174  ls
175  cp -r writing_new/ writing
176  cp -r writing/ writing_new
177  zip -r writing_new.zip writing_new
178  unzip -n writing_new.zip
179  ls
180  chmod 750 writing_new
181  ls
182  ll
183  history 10
```

2. BASH for Loop

The general syntax of a BASH loop goes like:

```
for thing in list_of_things
do
    operation_using $thing
done
```

[5 points] Write a shell script to print file size (in bytes) of each *.pdb file in data_demo/data/pdb/, line by line.

Firstly, go to `data_demo/data/pdb/` and nano a `.sh` file named `practice`:

```
[ese-zhouyq@login01 ~]$ cd data_demo/data/pdb/
[ese-zhouyq@login01 pdb]$ pwd
/work/ese-zhouyq/data_demo/data/pdb
[ese-zhouyq@login01 pdb]$ ls
aldrin.pdb      cinnamaldehyde.pdb  cyclopropane.pdb    lactic-acid.pdb     methane.pdb          norethindrone.pdb   quinine.pdb        tnt.pdb
ammonia.pdb    citronellal.pdb      ethane.pdb           lactose.pdb          methanol.pdb         octane.pdb          strychnine.pdb     tuberin.pdb
ascorbic-acid.pdb codeine.pdb          ethanol.pdb          lanoxin.pdb          mint.pdb             pentane.pdb         styrene.pdb        tyrian-purple.pdb
benzaldehyde.pdb cubane.pdb            ethylcyclohexane.pdb lsd.pdb              morphine.pdb          piperine.pdb        sucrose.pdb        vanillin.pdb
camphene.pdb   cyclobutane.pdb      glycol.pdb           maltose.pdb          mustard.pdb           propane.pdb          testosterone.pdb    vinyl-chloride.pdb
cholesterol.pdb cyclohexanol.pdb     heme.pdb             menthol.pdb          nerol.pdb             pyridoxal.pdb       thiamine.pdb       vitamin-a.pdb
[ese-zhouyq@login01 pdb]$ nano practice.sh
[ese-zhouyq@login01 pdb]$ nano practice.sh
```

Type the following codes in `practice.sh`:

```
for pdb in *.pdb
do
    du -b $pdb
done
```

Then, do these operations:

```
[ese-zhouyq@login01 pdb]$ ls
aldrin.pdb      cinnamaldehyde.pdb  cyclopropane.pdb    lactic-acid.pdb     methane.pdb          norethindrone.pdb   pyridoxal.pdb      thiamine.pdb      vitamin-a.pdb
ammonia.pdb    citronellal.pdb      ethane.pdb           lactose.pdb          methanol.pdb         octane.pdb          quinine.pdb        tnt.pdb
ascorbic-acid.pdb codeine.pdb          ethanol.pdb          lanoxin.pdb          mint.pdb             pentane.pdb         strychnine.pdb     tuberin.pdb
benzaldehyde.pdb cubane.pdb            ethylcyclohexane.pdb lsd.pdb              morphine.pdb          piperine.pdb        styrene.pdb        tyrian-purple.pdb
camphene.pdb   cyclobutane.pdb      glycol.pdb           maltose.pdb          mustard.pdb           practice.sh          sucrose.pdb        vanillin.pdb
cholesterol.pdb cyclohexanol.pdb     heme.pdb             menthol.pdb          nerol.pdb             propane.pdb          testosterone.pdb    vinyl-chloride.pdb
[ese-zhouyq@login01 pdb]$ chmod 750 practice.sh
[ese-zhouyq@login01 pdb]$ ./practice.sh
```

Here are the results:

1516	aldrin.pdb	
306	ammonia.pdb	
1444	ascorbic-acid.pdb	
1030	benzaldehyde.pdb	
1830	camphene.pdb	
5049	cholesterol.pdb	
1090	cinnamaldehyde.pdb	
1694	citronellal.pdb	
2452	codeine.pdb	
1158	cubane.pdb	
895	cyclobutane.pdb	
1384	cyclohexanol.pdb	
695	cyclopropane.pdb	
622	ethane.pdb	
690	ethanol.pdb	
2396	ethylcyclohexane.pdb	
765	glycol.pdb	
4209	heme.pdb	
1064	lactic-acid.pdb	
2562	lactose.pdb	
11193	lanoxin.pdb	
3395	lsd.pdb	
2562	maltose.pdb	
2164	menthol.pdb	
422	methane.pdb	
490	methanol.pdb	
1869	mint.pdb	
2288	morphine.pdb	
2123	mustard.pdb	
1680	nerol.pdb	
2729	norethindrone.pdb	
1828	octane.pdb	
1226	pentane.pdb	
2287	piperine.pdb	
825	propane.pdb	
1256	pyridoxal.pdb	
3303	quinine.pdb	
2675	strychnine.pdb	
1159	styrene.pdb	
2562	sucrose.pdb	
2787	testosterone.pdb	
2196	thiamine.pdb	
1508	tnt.pdb	
2395	tuberin.pdb	
2103	tyrian-purple.pdb	
1361	vanillin.pdb	
423	vinyl-chloride.pdb	
2894	vitamin-a.pdb	