BASH Essentials

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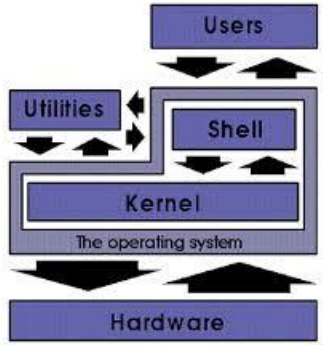
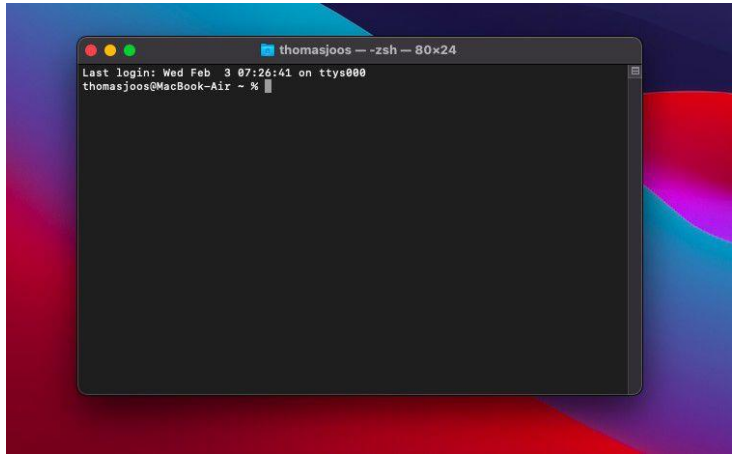
GeoZentrum Nordbayern

Terminal emulators

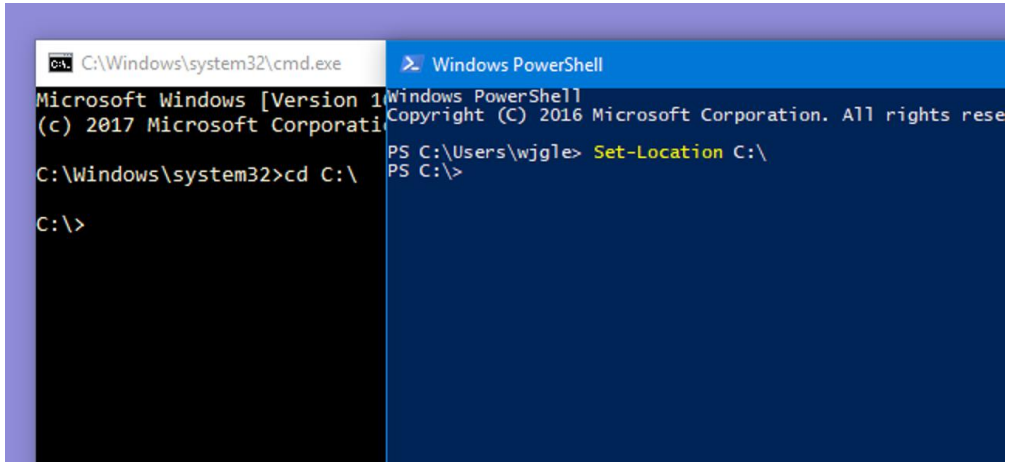
- Every OS has at least one
- Graphical applications that run a program called the “shell”: an interpreter program that translates instructions
- Console applications can be run with the shell
  - Automation
  - Program building
  - Scientific calculations
- Shells are programmable



Mac (zsh or bash)



Windows (cmd and powershell)



The BASH shell

- Ubiquitous
- Most frequently used on servers and clusters
- UNIX-native: most programming systems use UNIX-like paths – even on Windows!
- Mac: have it, z shell (zsh) is almost the same
- Windows: a simplified version is available with git (git bash)

BASH

THE BOURNE-AGAIN SHELL

https://git-scm.com

BASH essentials

Most important functions and browsing directories

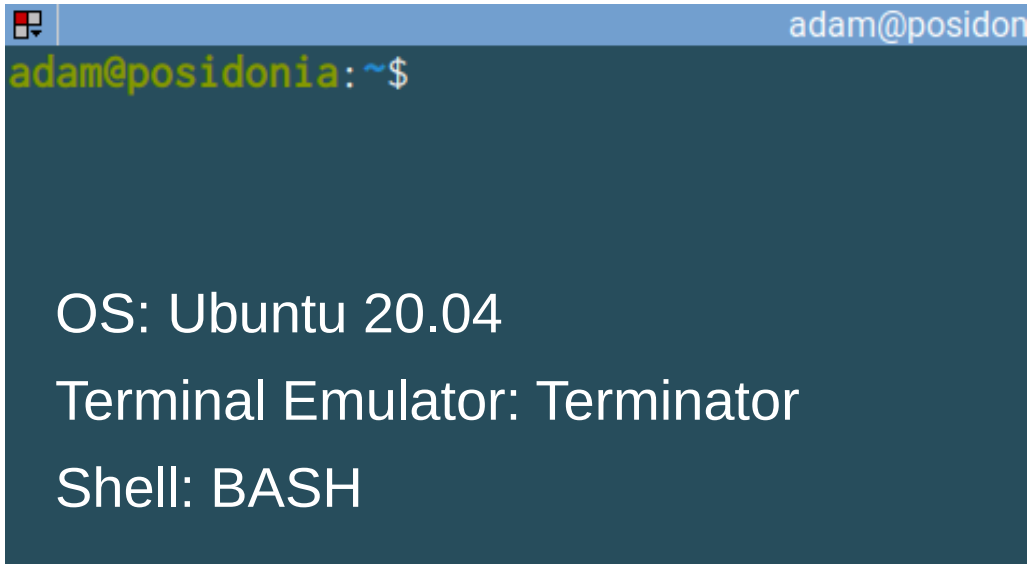
The prompt

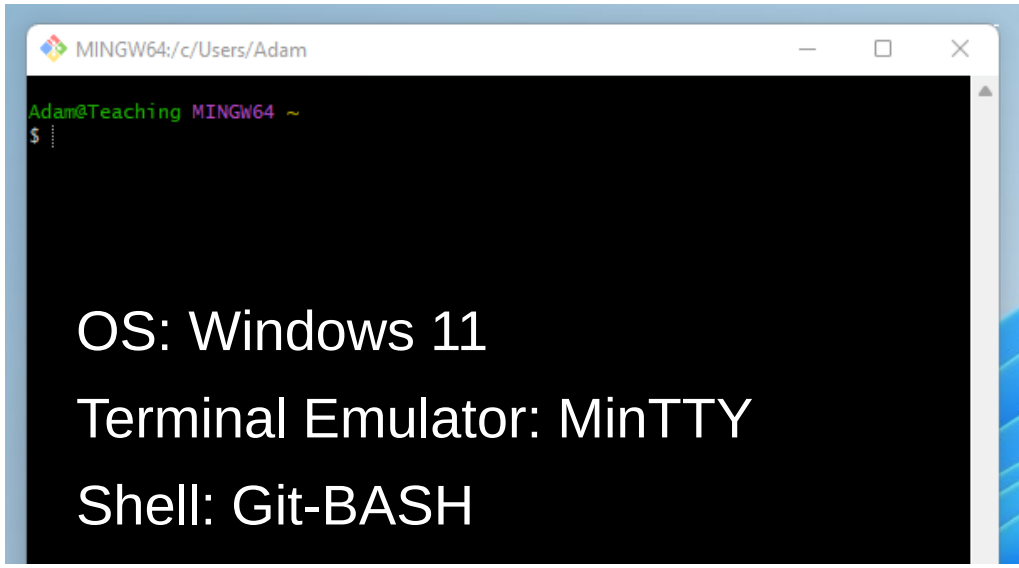
- User input expected (typing)
- Looks different on all, but there are conventions:

`user@host`

`~`: is shorthand for user home

`$`: means normal user mode





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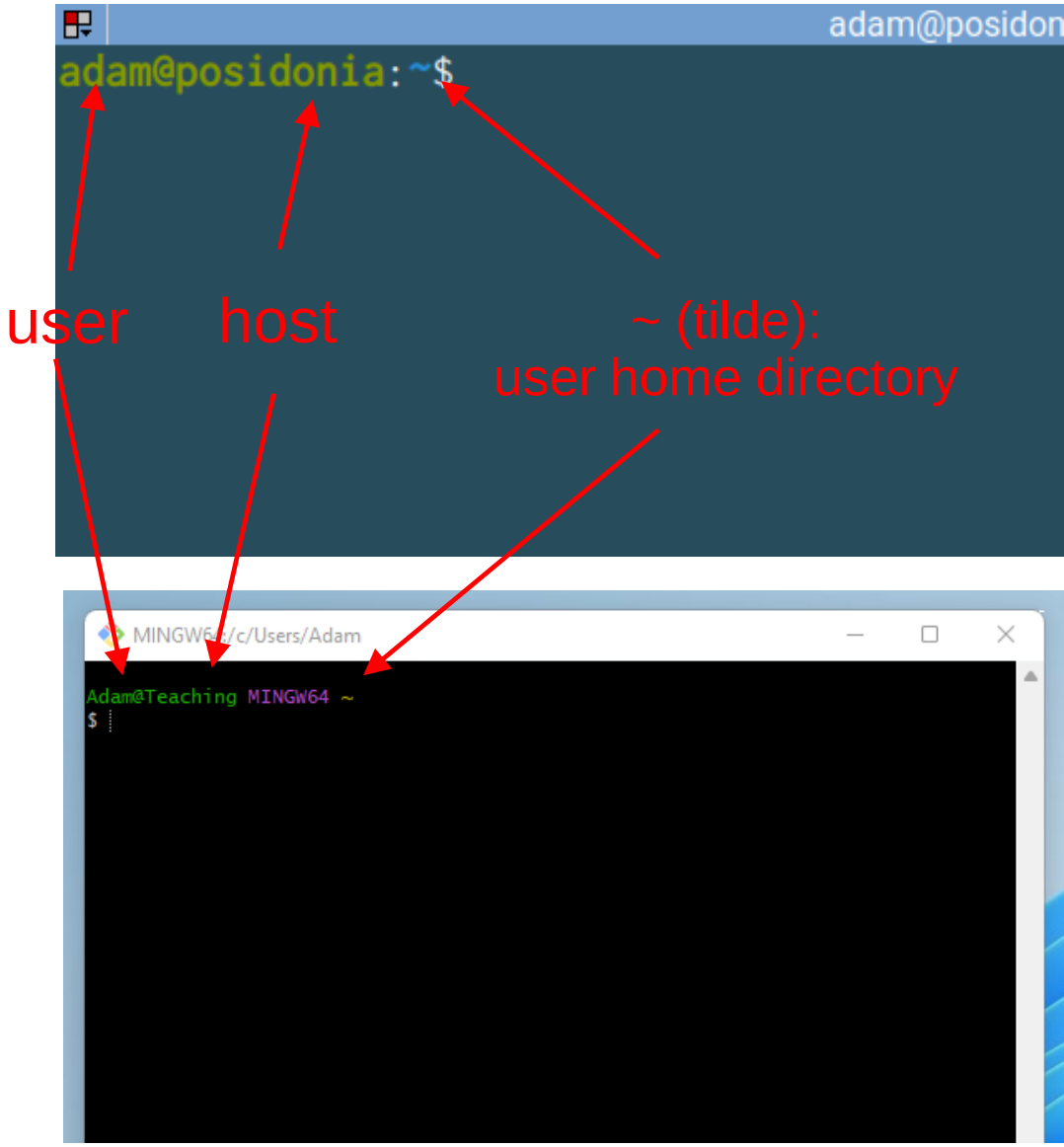
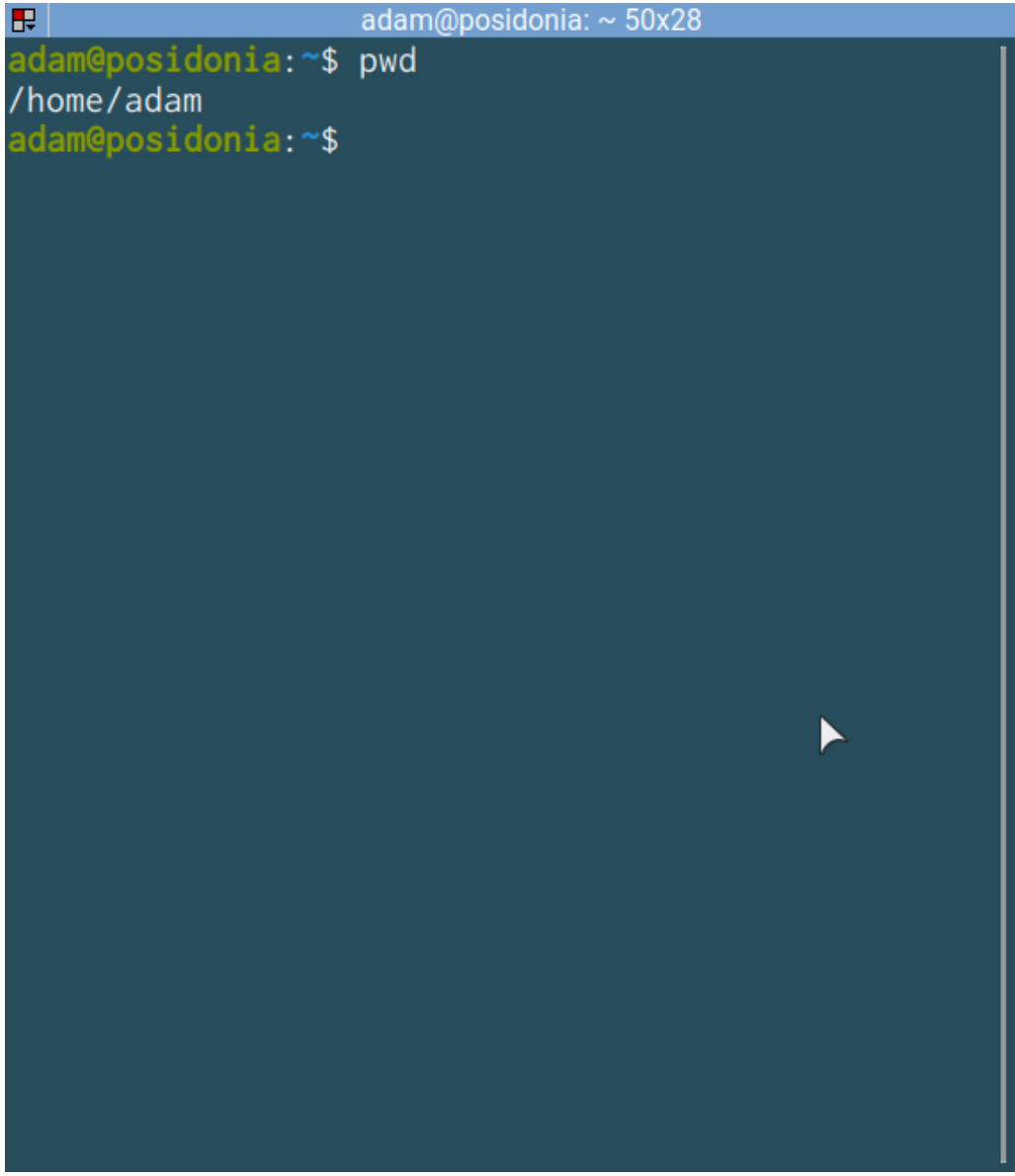


pwd

Return path to current directory

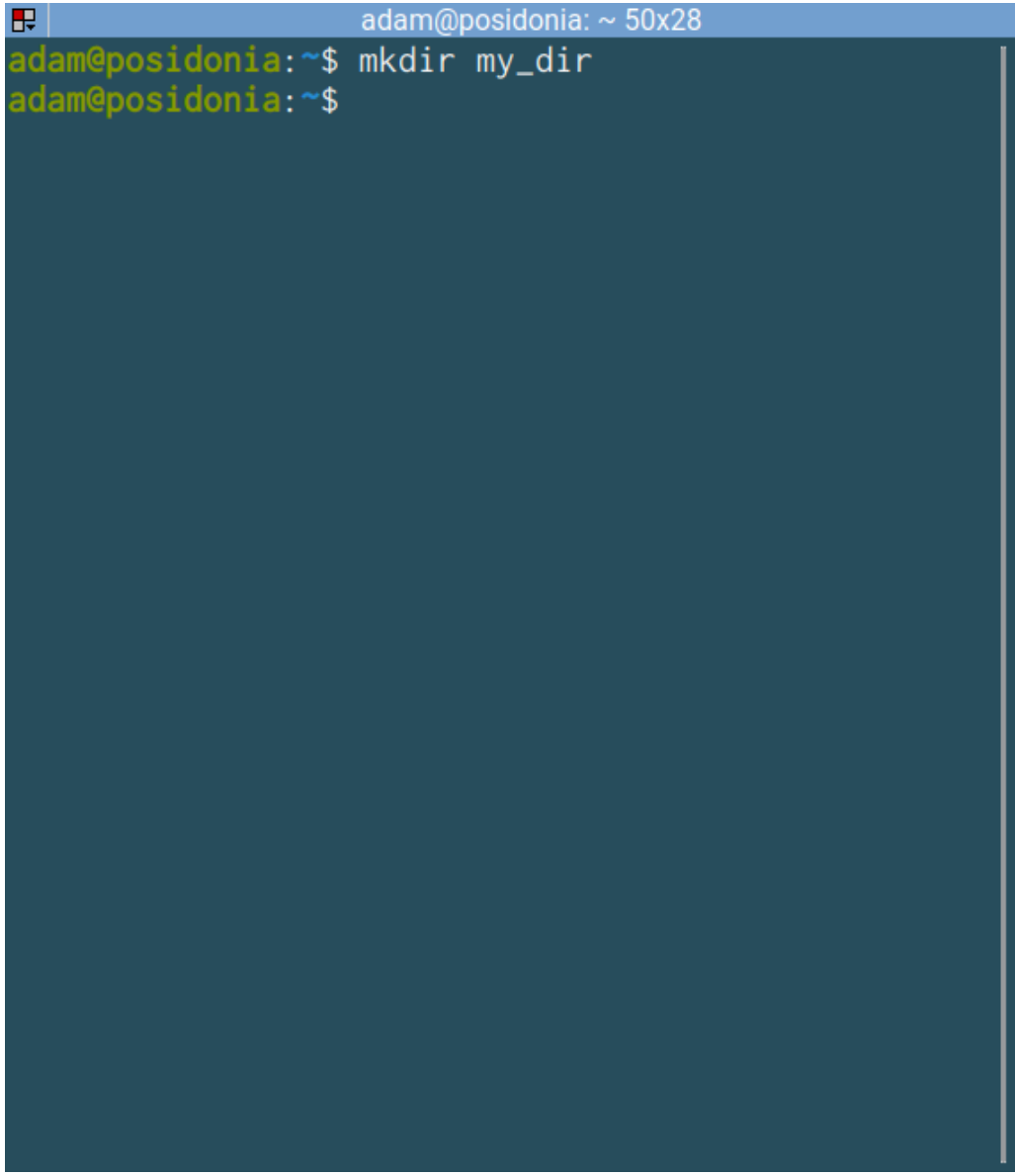


```
mkdir␣<name>
```

space

Create a directory

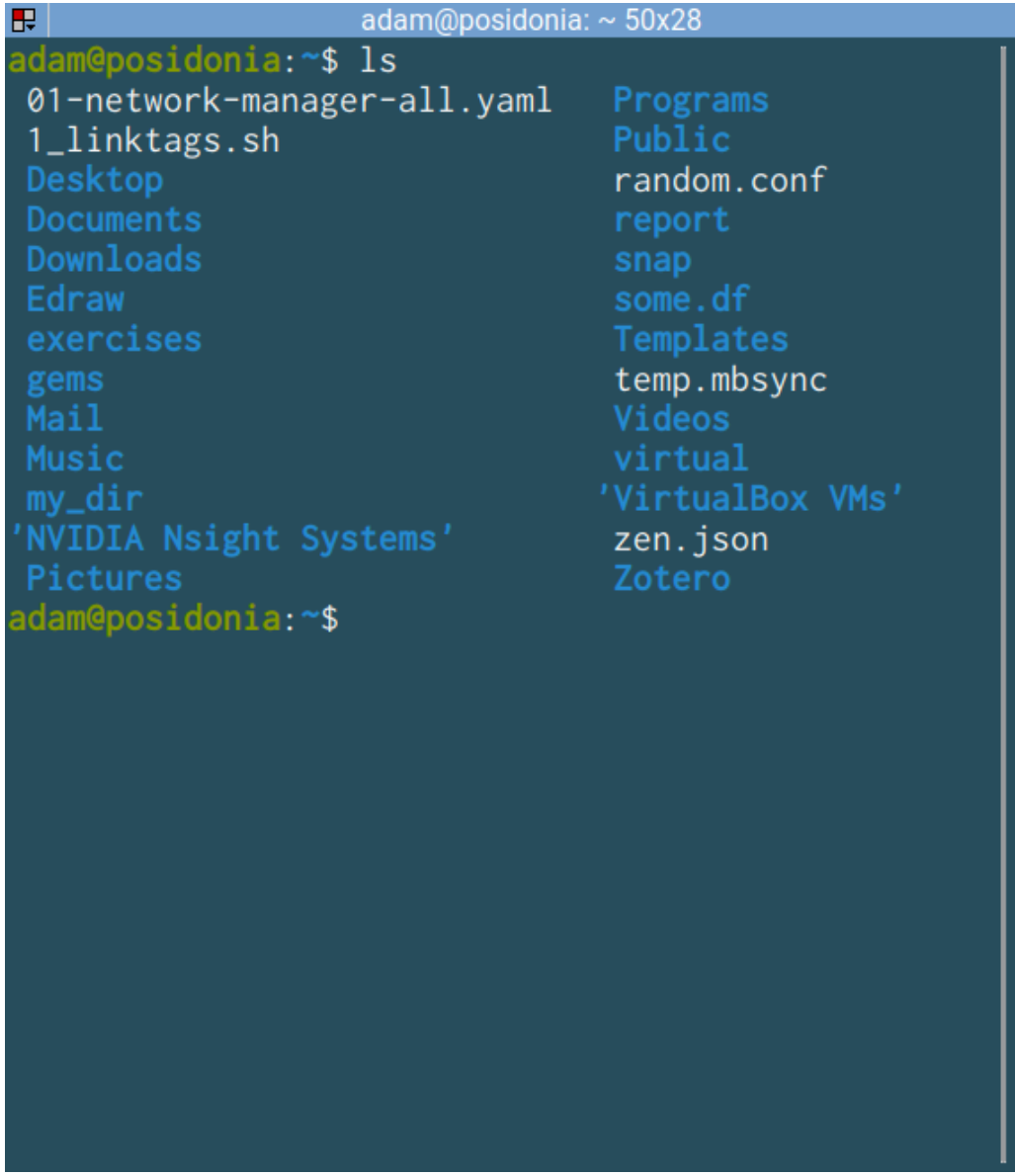
- No output to the console: no error occurred (directory was created)



`ls`

List directory contents

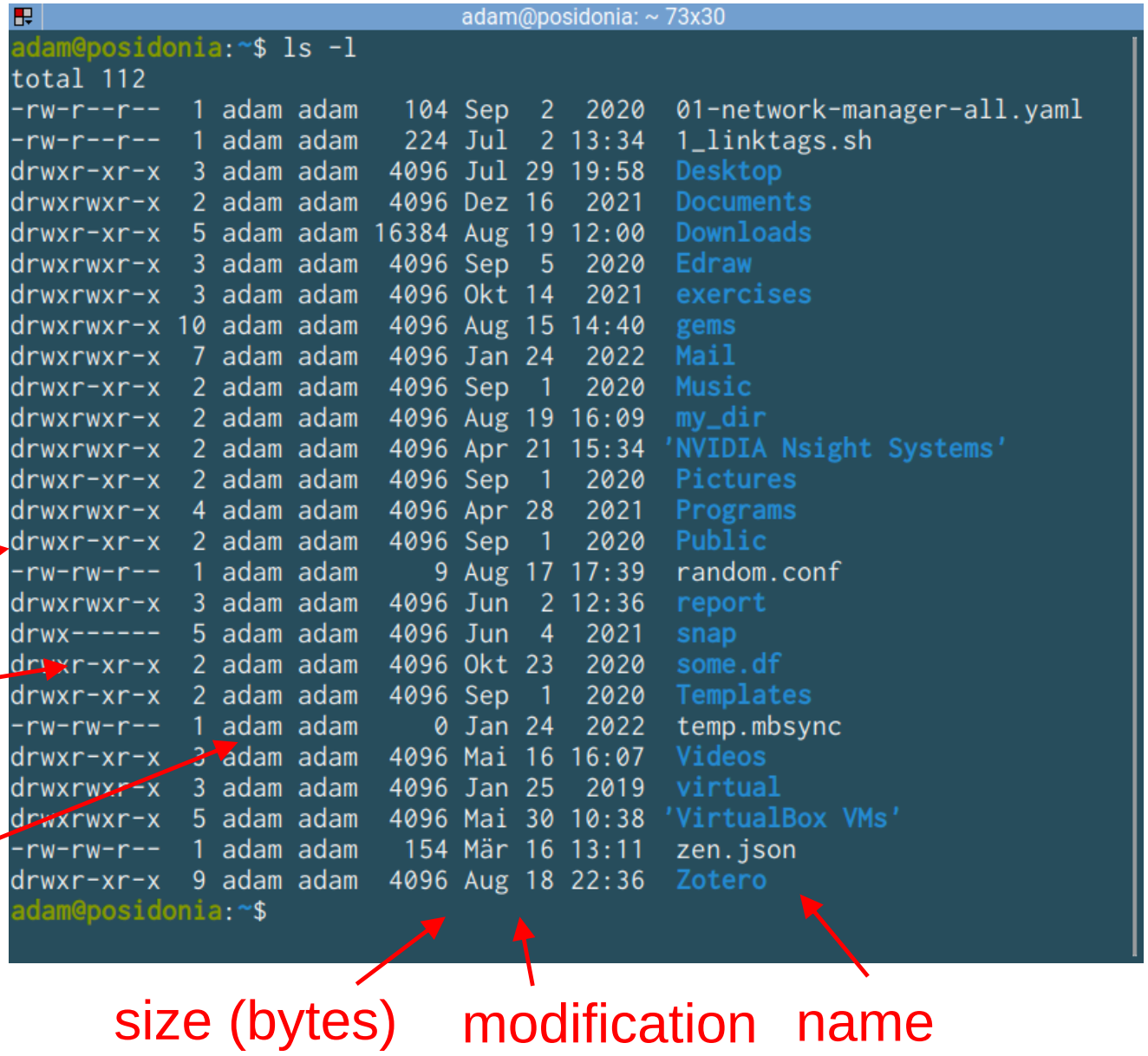
- Returns a list of entries (both normal files and directories) – can be colored
- Note the quotes around entries with spaces in them!



ls_-l

List directory contents (with option l)

- Long output, includes attributes



cd␣<path_to_directory>

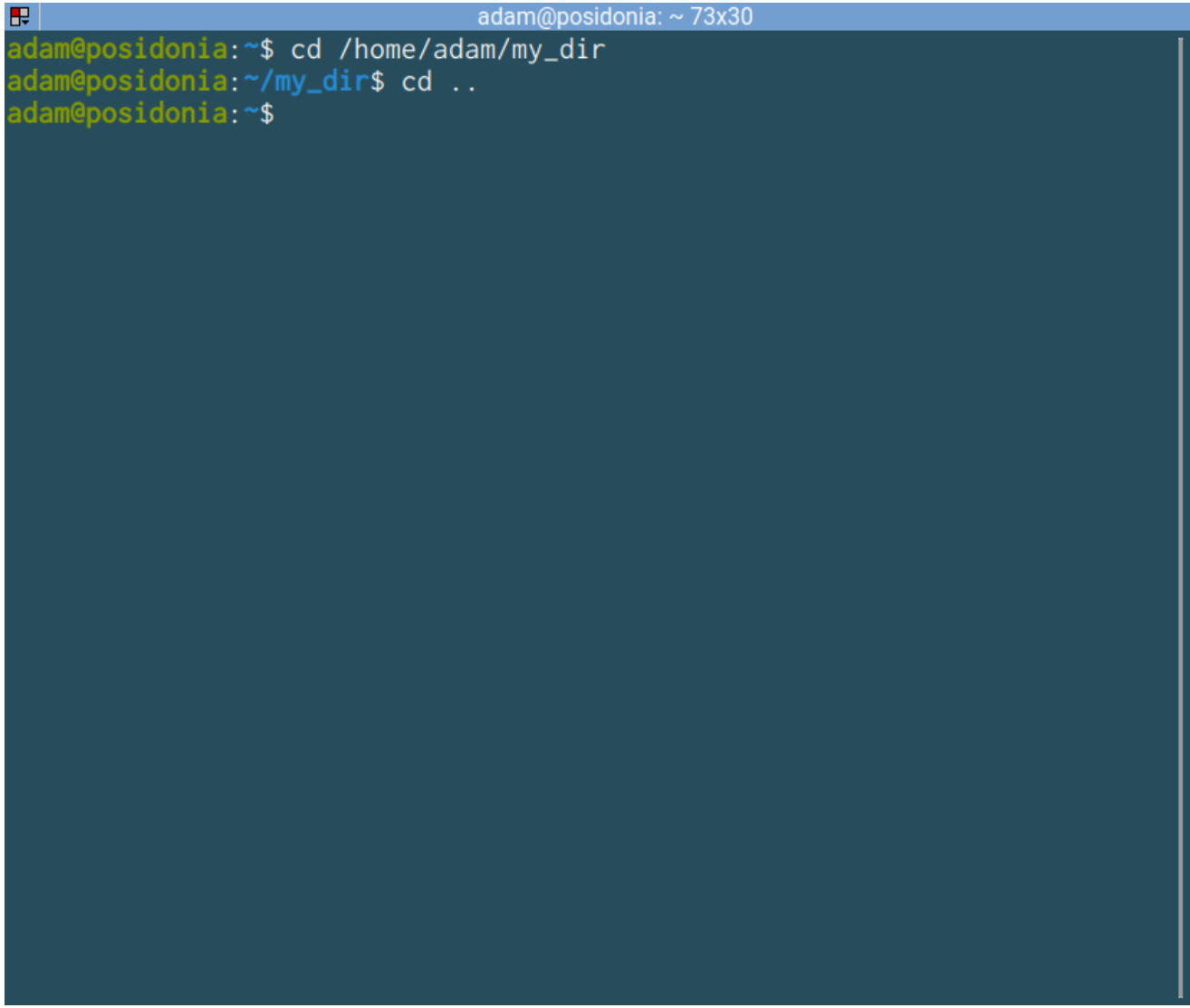
Go to a directory

- Can be relative or absolute!

cd ..

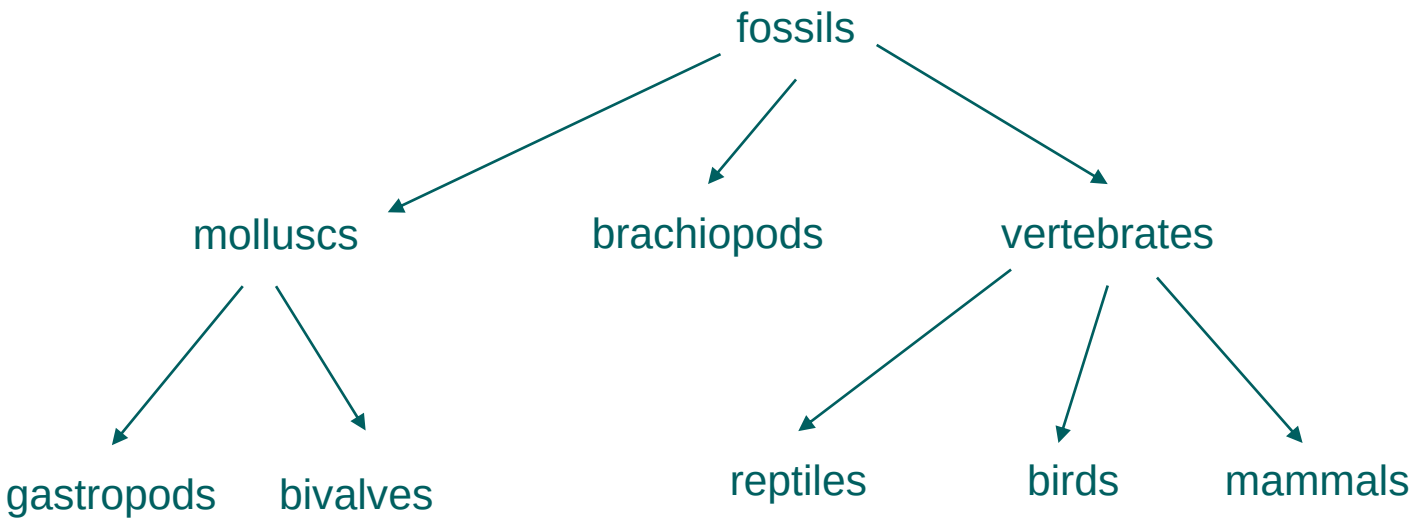
Go to parent directory

- .. (dot dot) is a placeholder for the parent of the current directory (one up in the hierarchy)



Exercise (5 minutes)

- Create this directory structure using the combinations of the previous commands!



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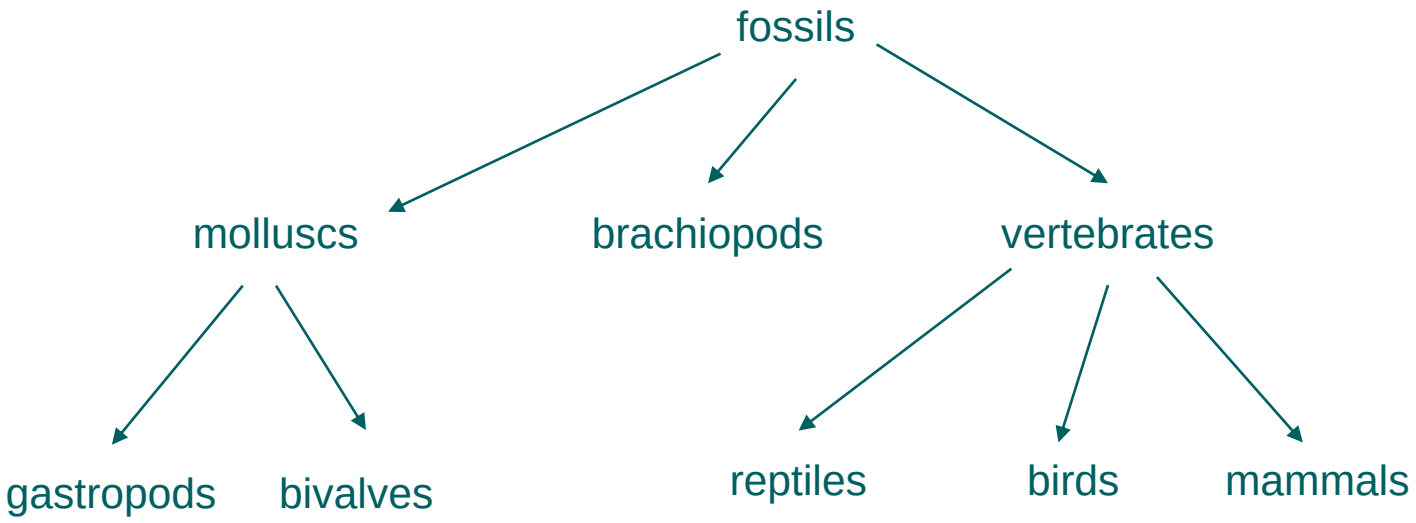

Hints

- use <TAB> completion (try <TAB> <TAB> to see multiple solutions)
- use <UP> and <DOWN> to search command history for already given commands

Solution 1 – changing directory

```
adam@posidonia: ~/fossils/vertebrates 73x30
adam@posidonia:~$ mkdir fossils
adam@posidonia:~$ cd fossils
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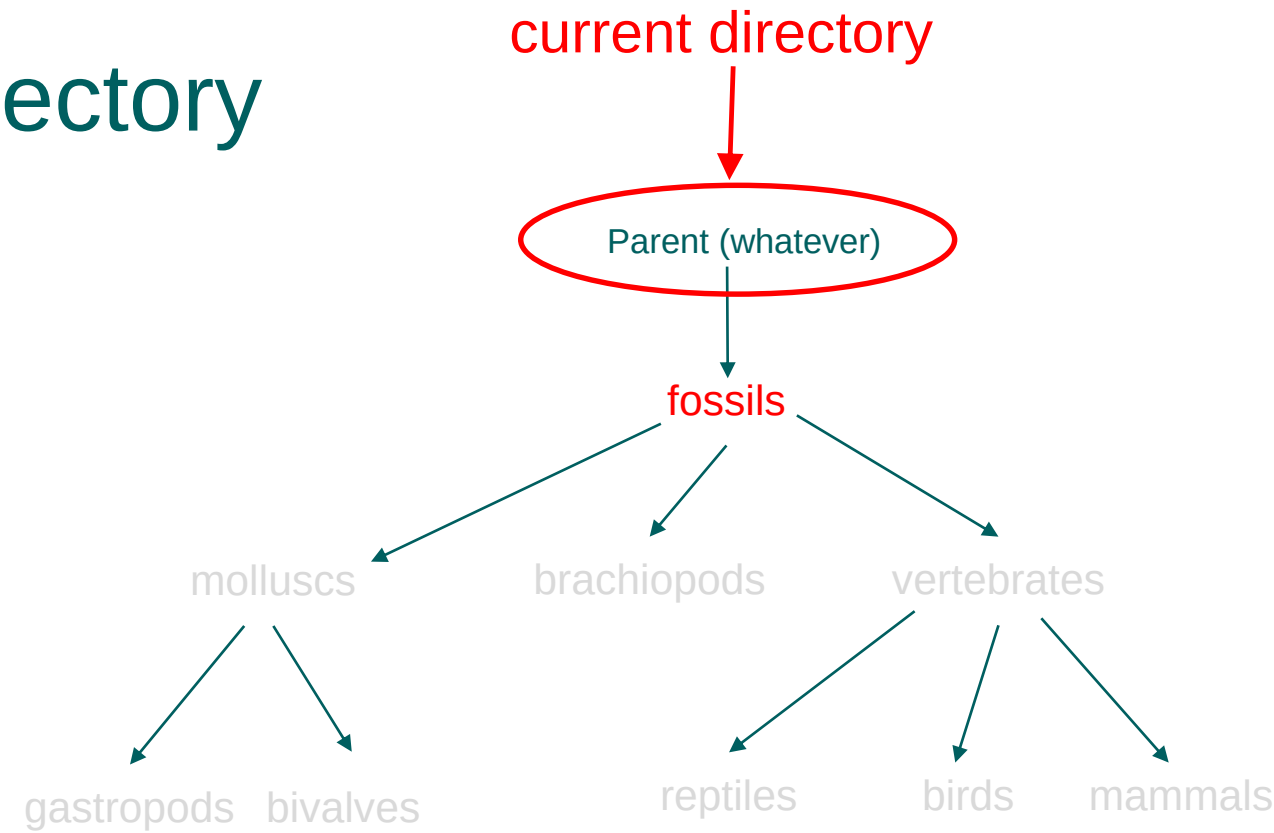

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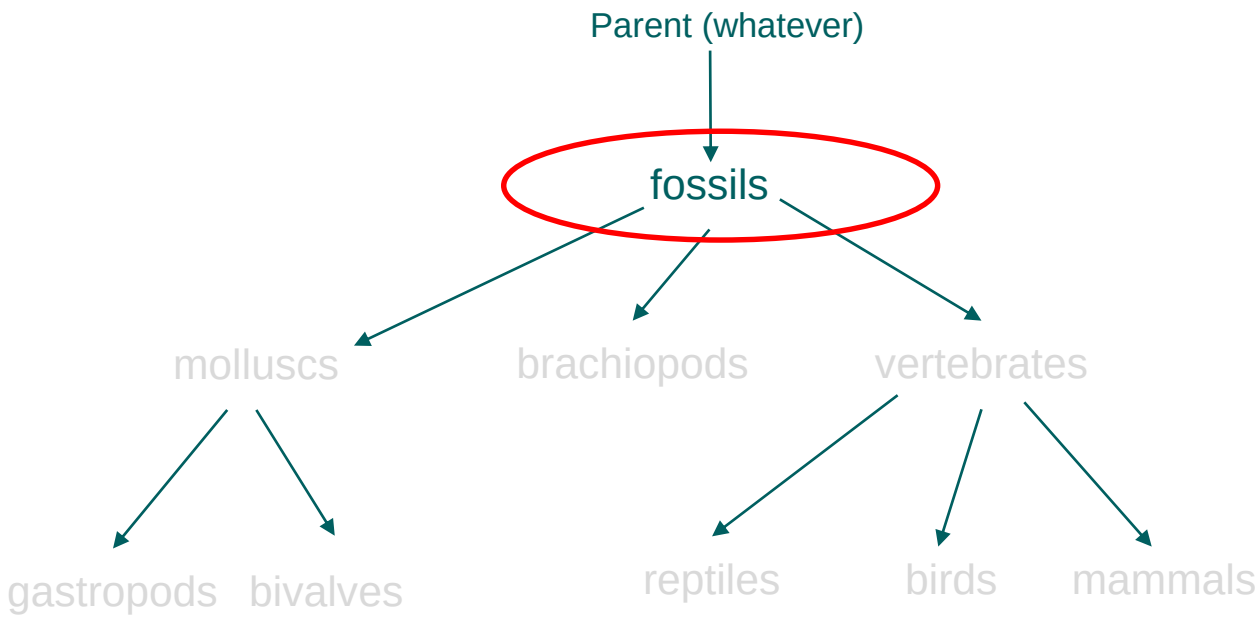

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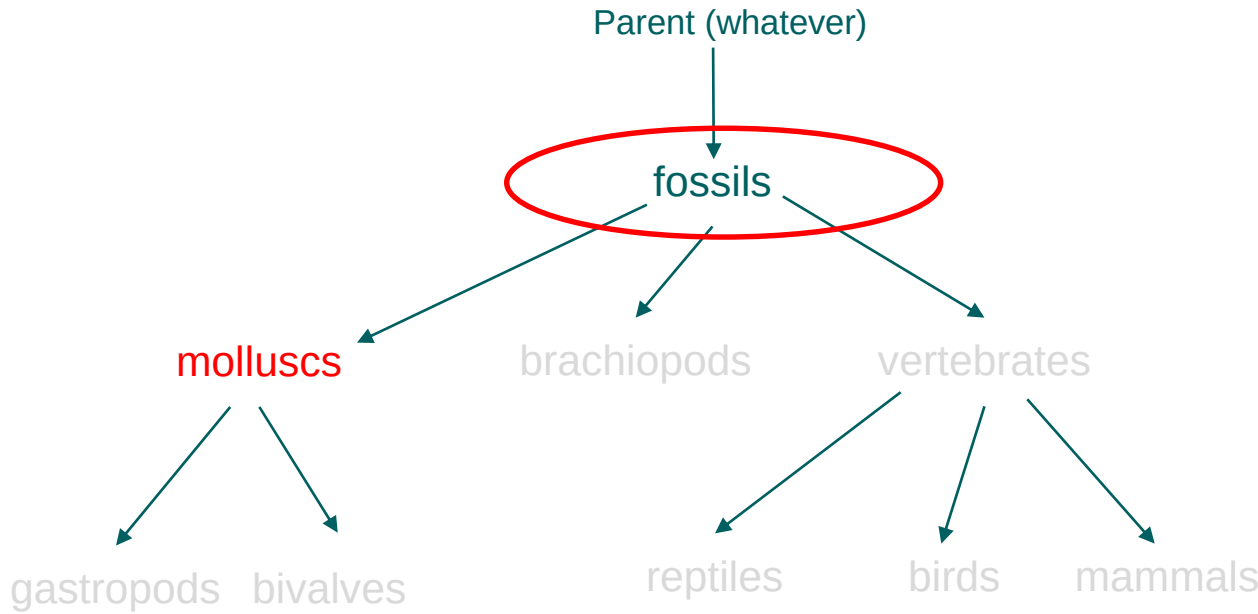

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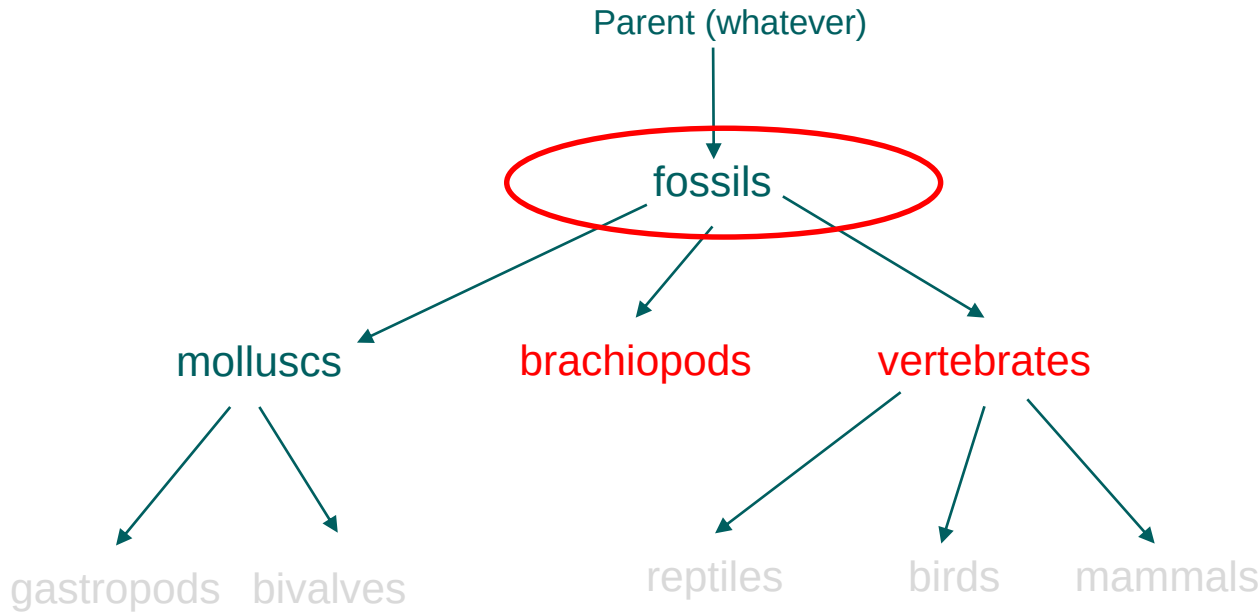

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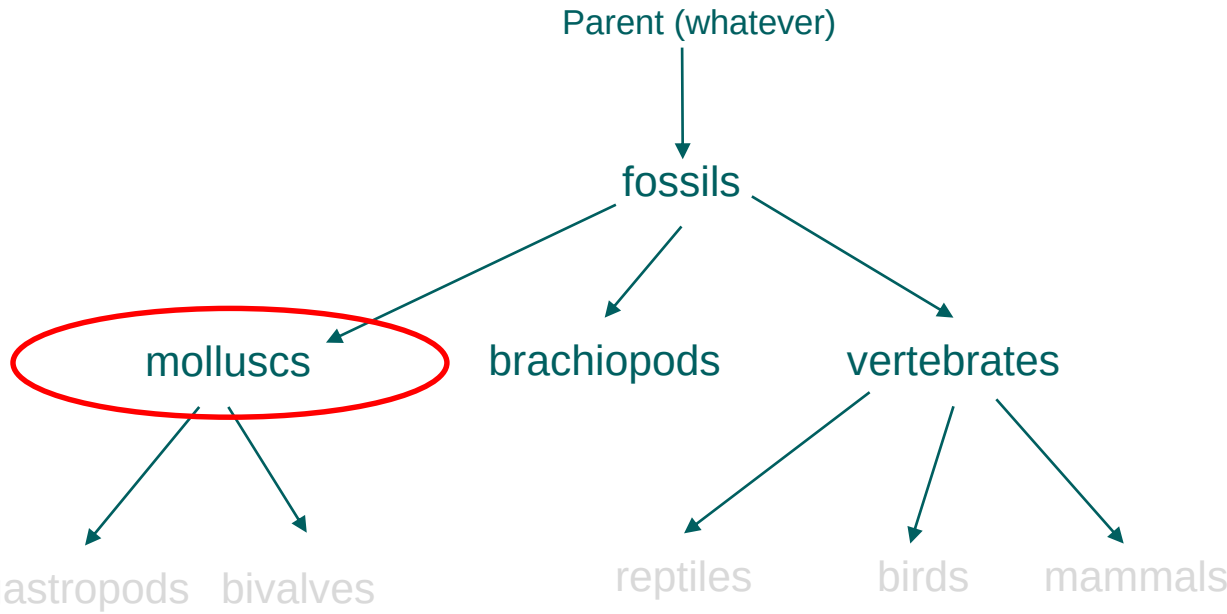

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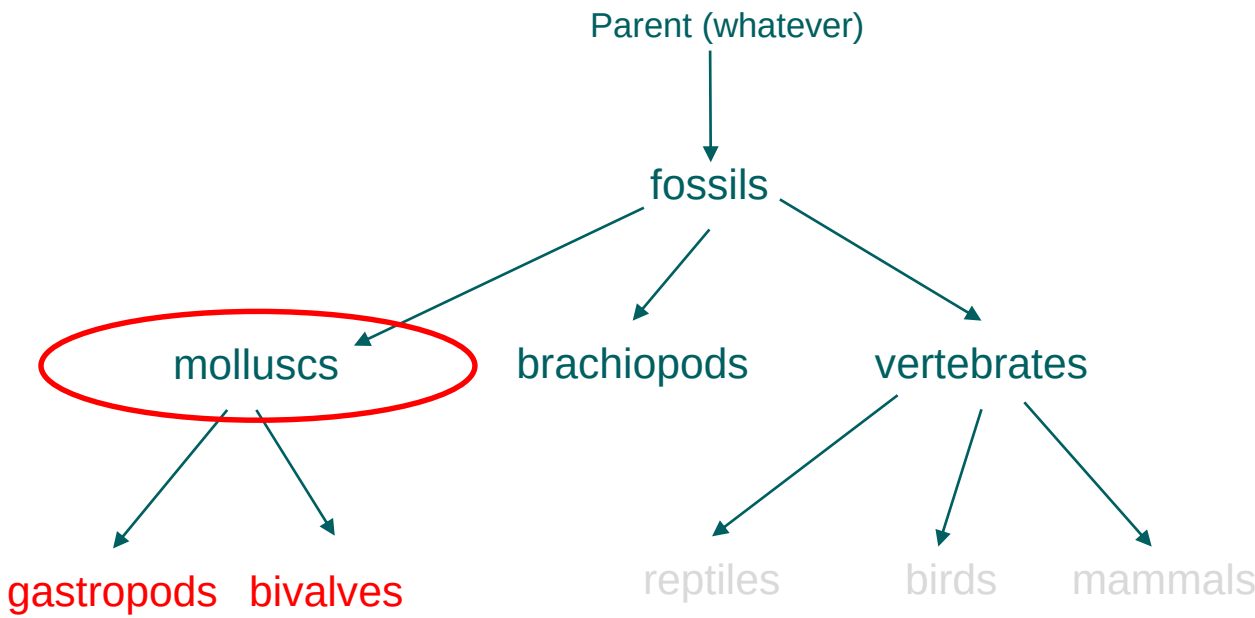

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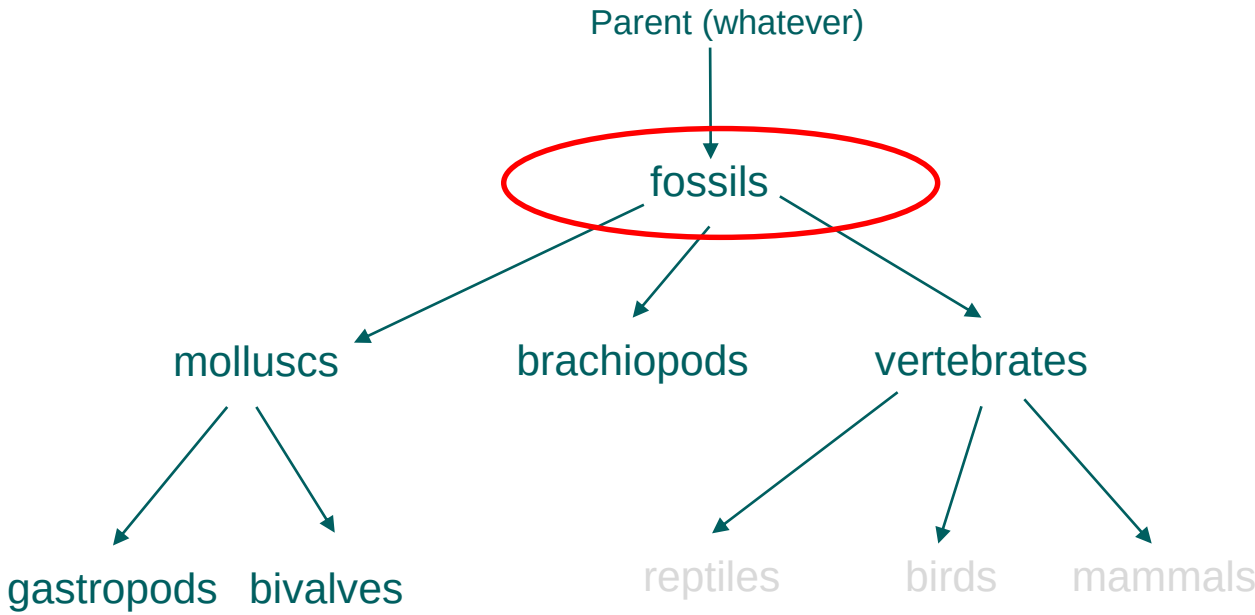

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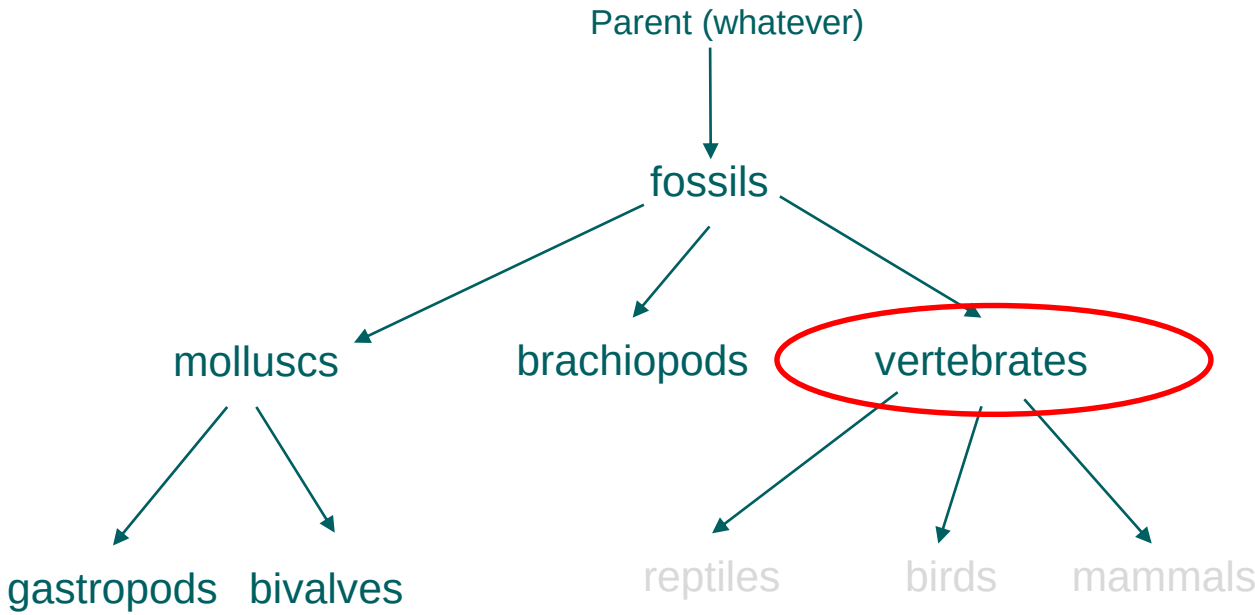

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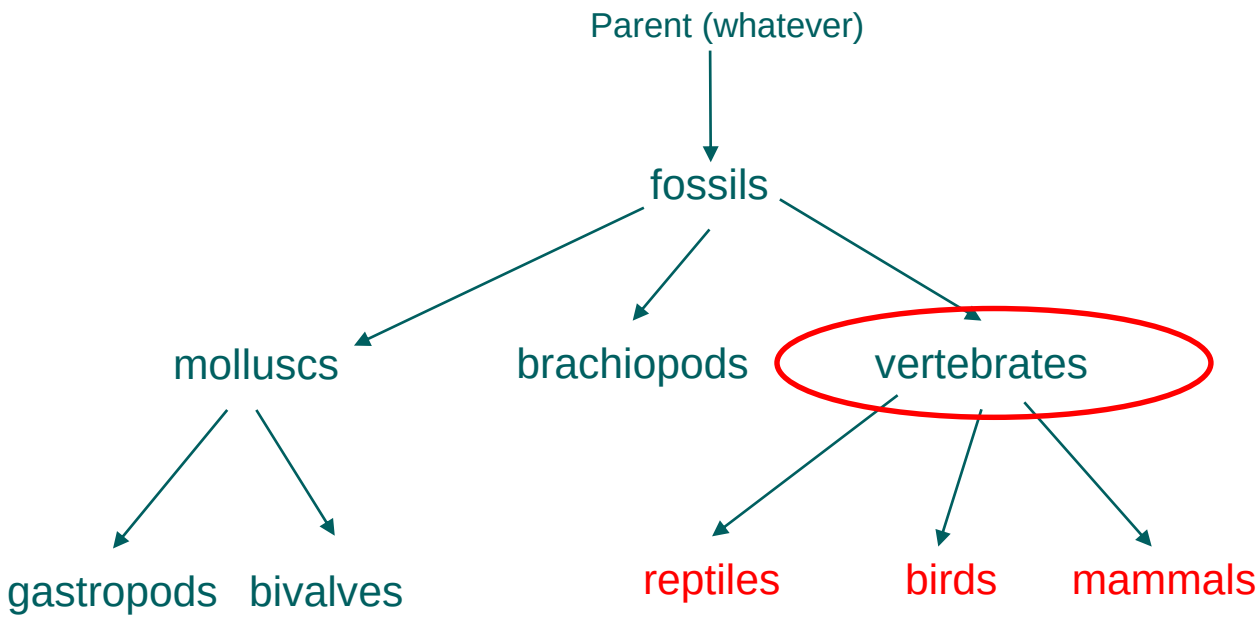

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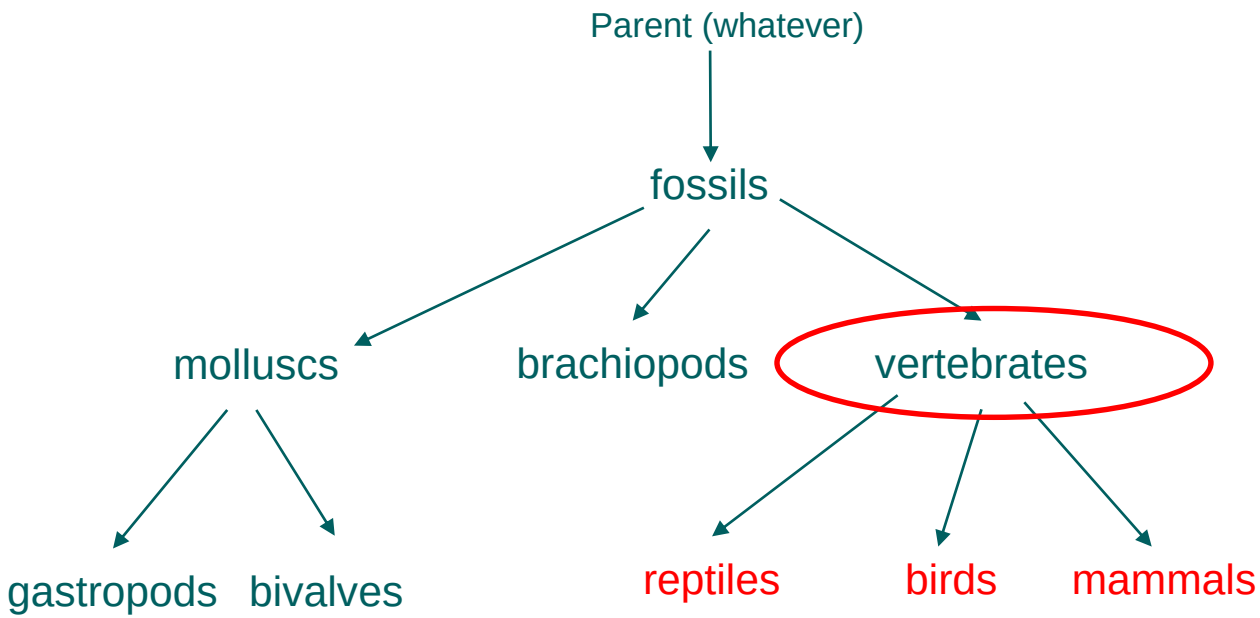
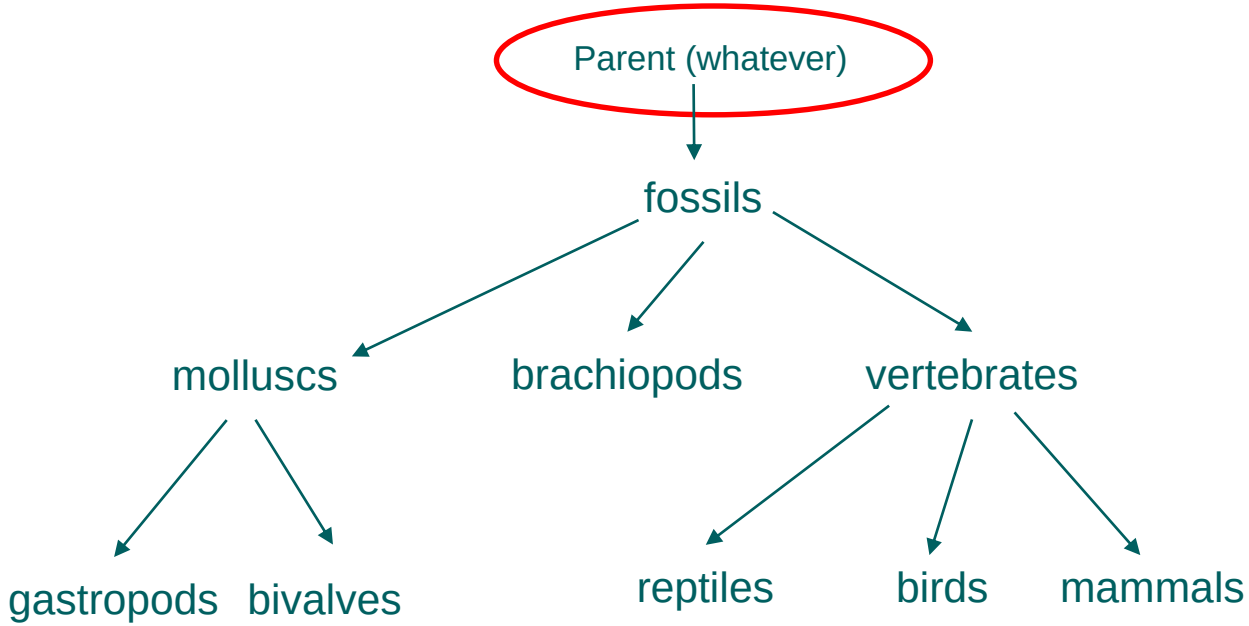


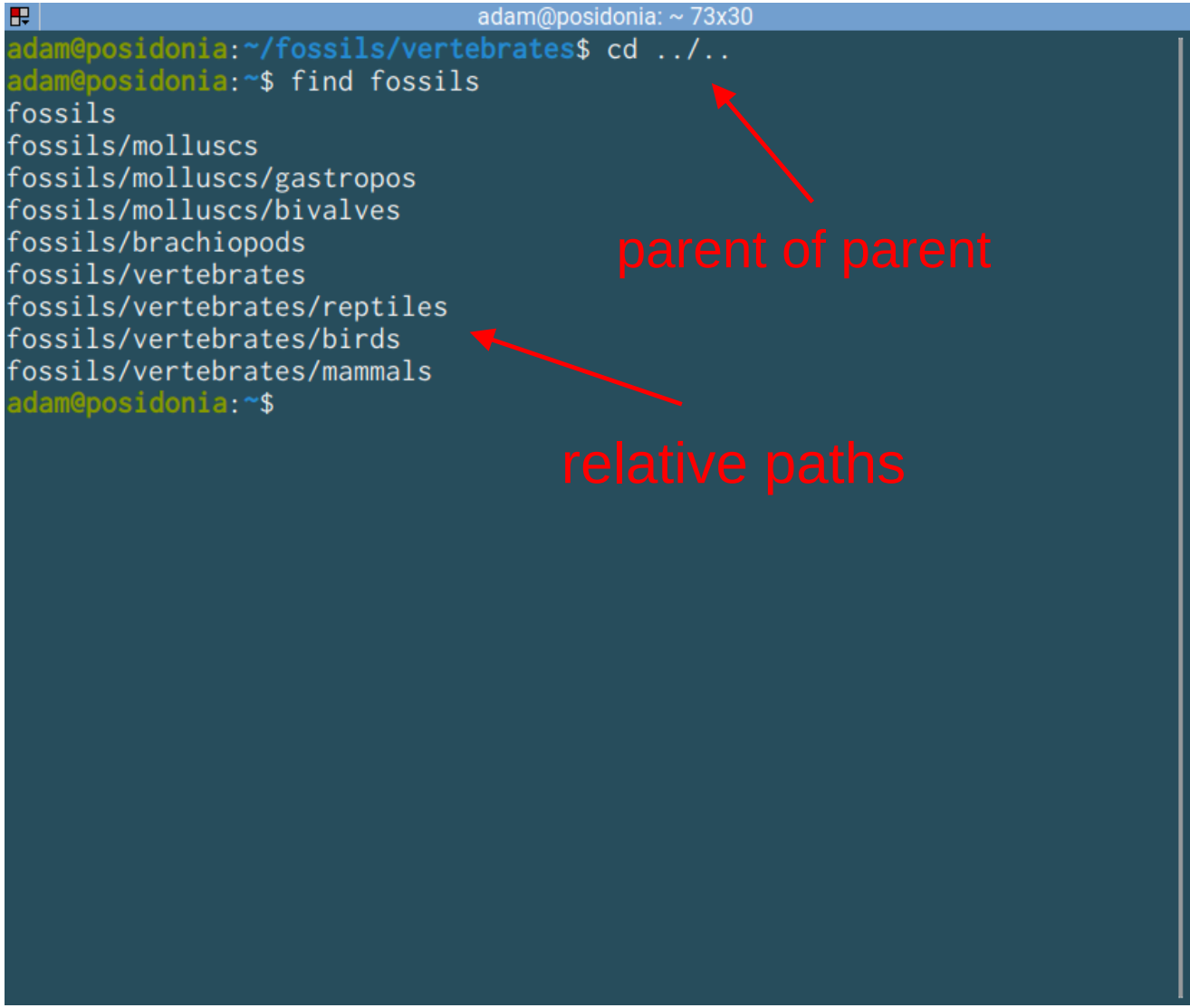
How to check?

find _<path to directory>

Recursive listing

- 1. Go back to the parent
- 2. Use find there!



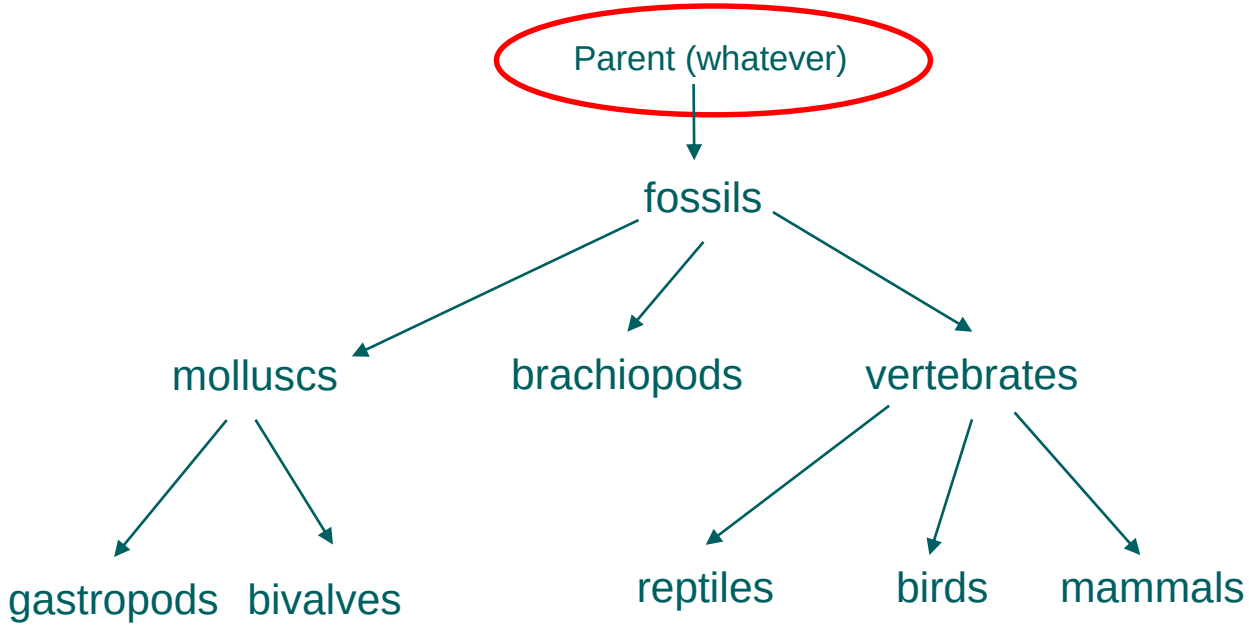


Angled bracket or ***chevron***

find␣<path>␣>␣<path_to file>

Output redirection

- Whatever was output to the console is now in a new file!




```
adam@posidonia: ~ 73x30
adam@posidonia:~/fossils/vertebrates$ cd ../..
adam@posidonia:~$ find fossils
fossils
fossils/molluscs
fossils/molluscs/gastropos
fossils/molluscs/bivalves
fossils/brachiopods
fossils/vertebrates
fossils/vertebrates/reptiles
fossils/vertebrates/birds
fossils/vertebrates/mammals
adam@posidonia:~$ find fossils > fossil_path.txt
adam@posidonia:~$
```

“>” Will overwrite existing files!

Suggested nomenclature

( ): **Parenthesis** (open and close)

[ ]: **Bracket** (open and close)

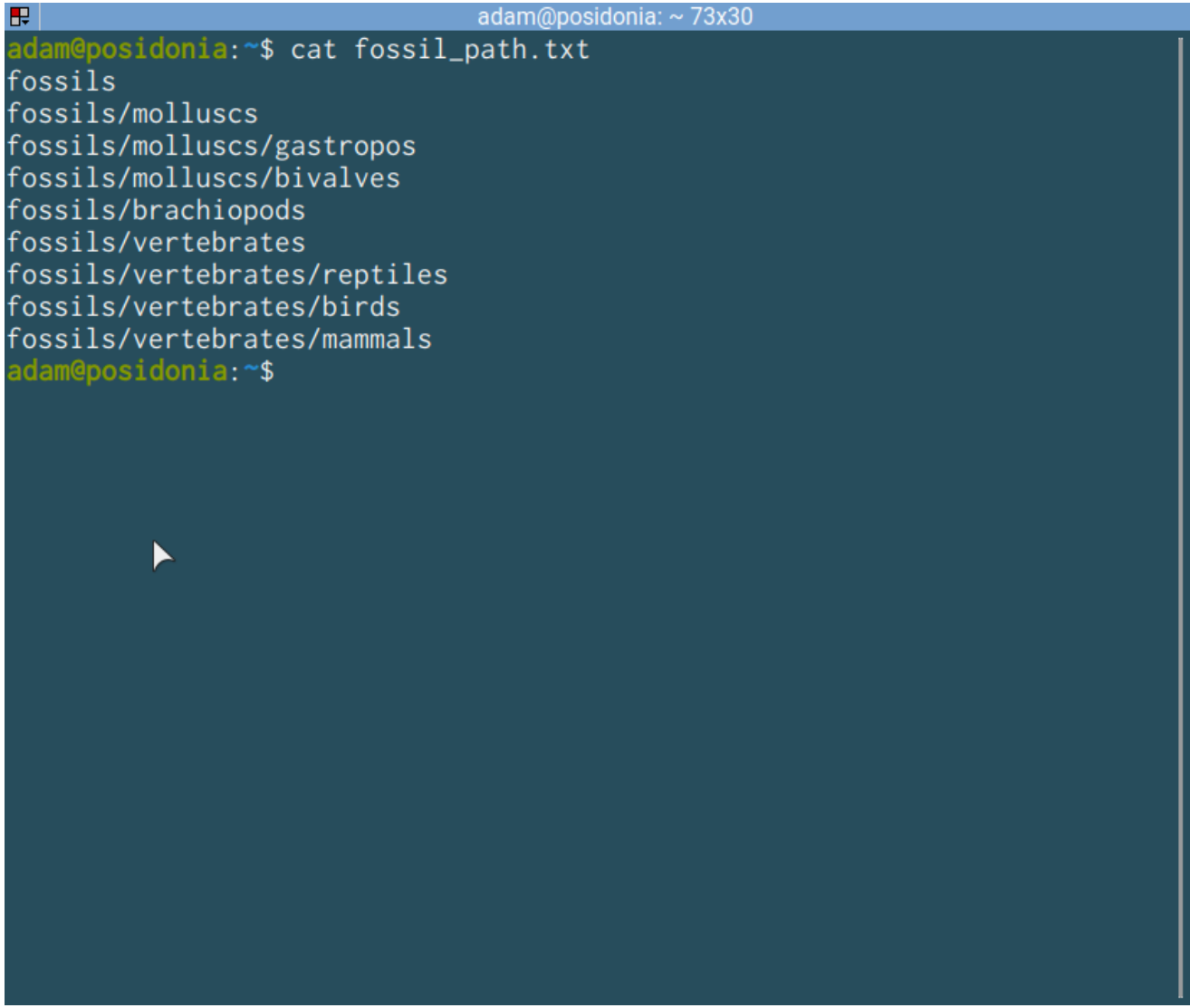
{ }: **Brace** (open and close)

< >: **Chevrons** (left and right)

cat␣<path to file>

Display contents of file

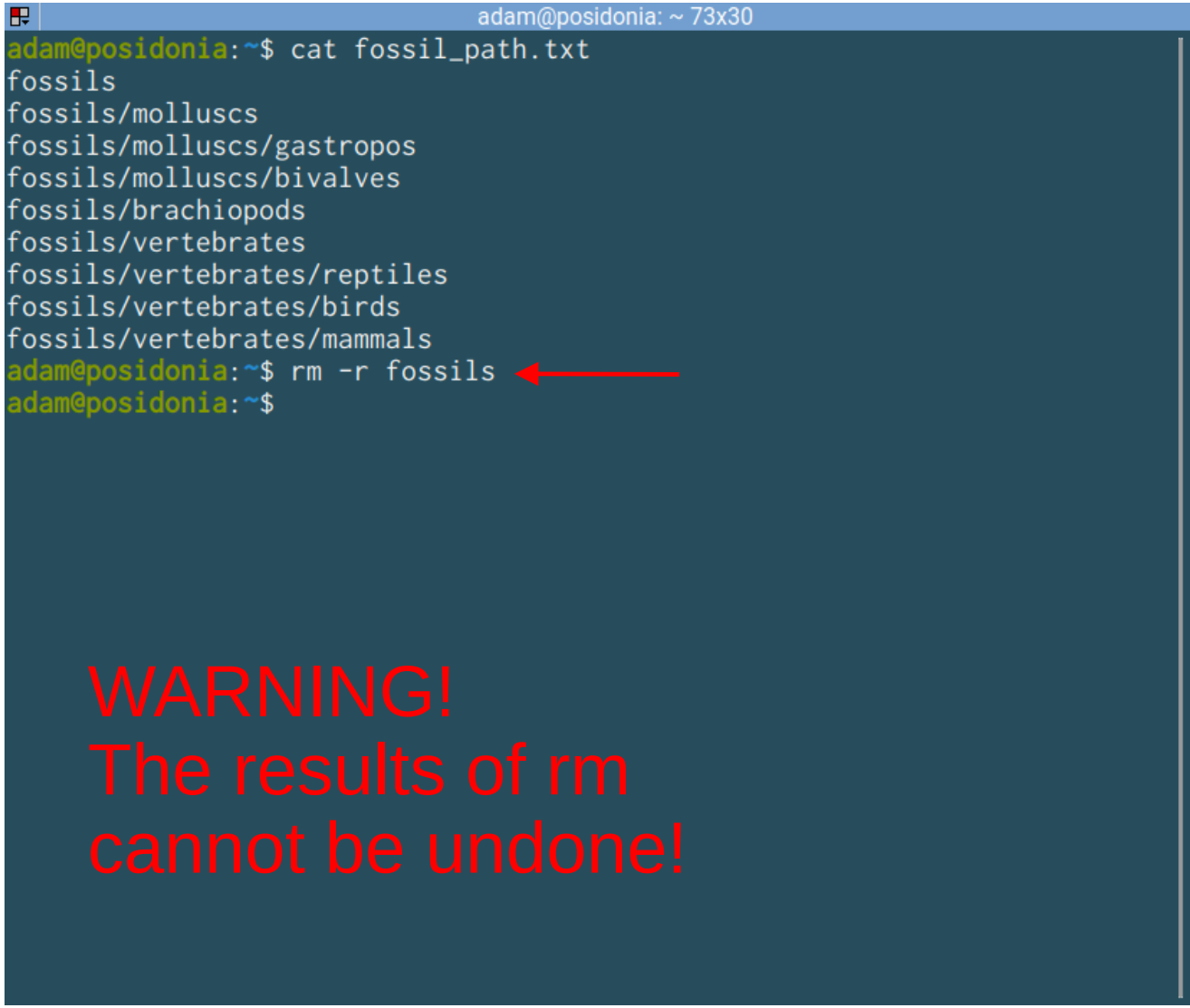
- Exactly as it was output to the console



rm␣-r␣<path to dir>

Recursive deletion (-r)

- Deletes the content of the directory and the directory itself
- rmdir doesn’t work! for the
- No output = success?!

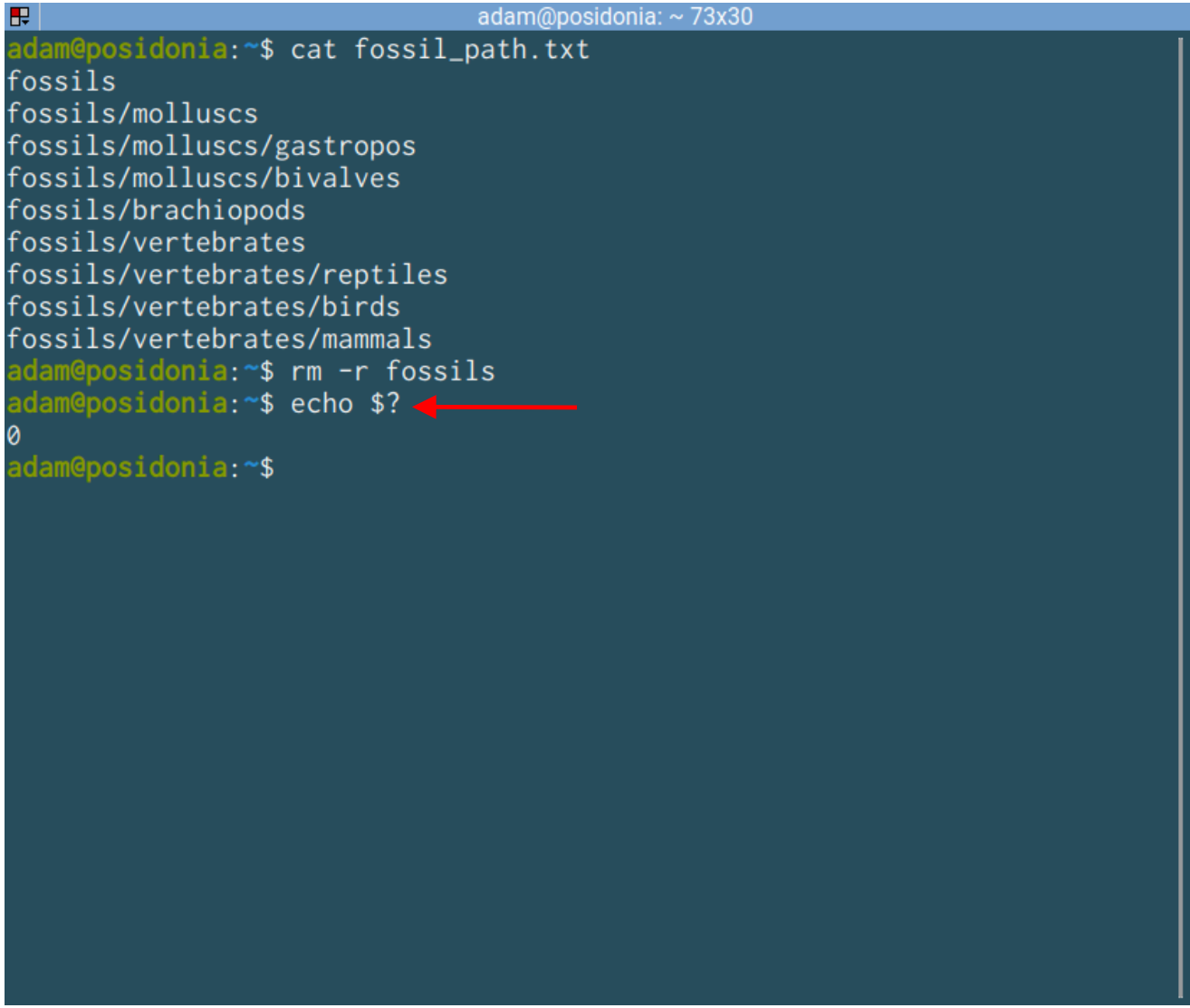


echo <text>

Print something

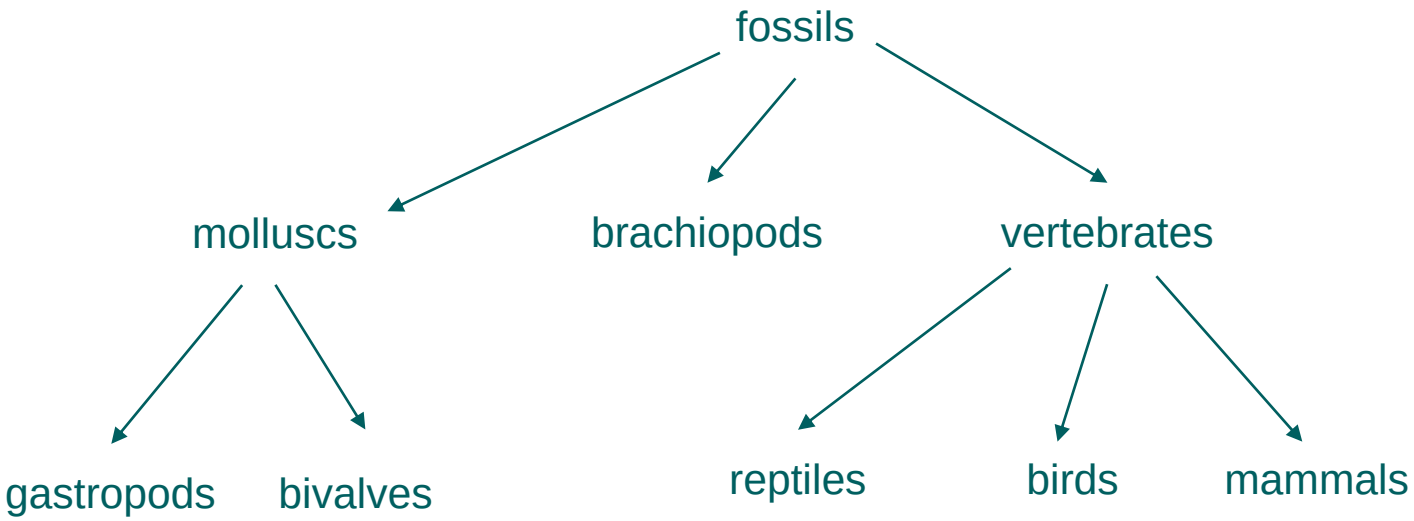
- Used to print things to the console (standard output)
- $? Is a special symbol: the exit code of the last command:
  - 0: Success
  - Other: Failure

https://www.redhat.com/sysadmin/exit-codes-demystified



Recreate the structure!

- Did you type things into the console?!



Hint 1. Use a general-purpose text editor!

Novice-friendly:

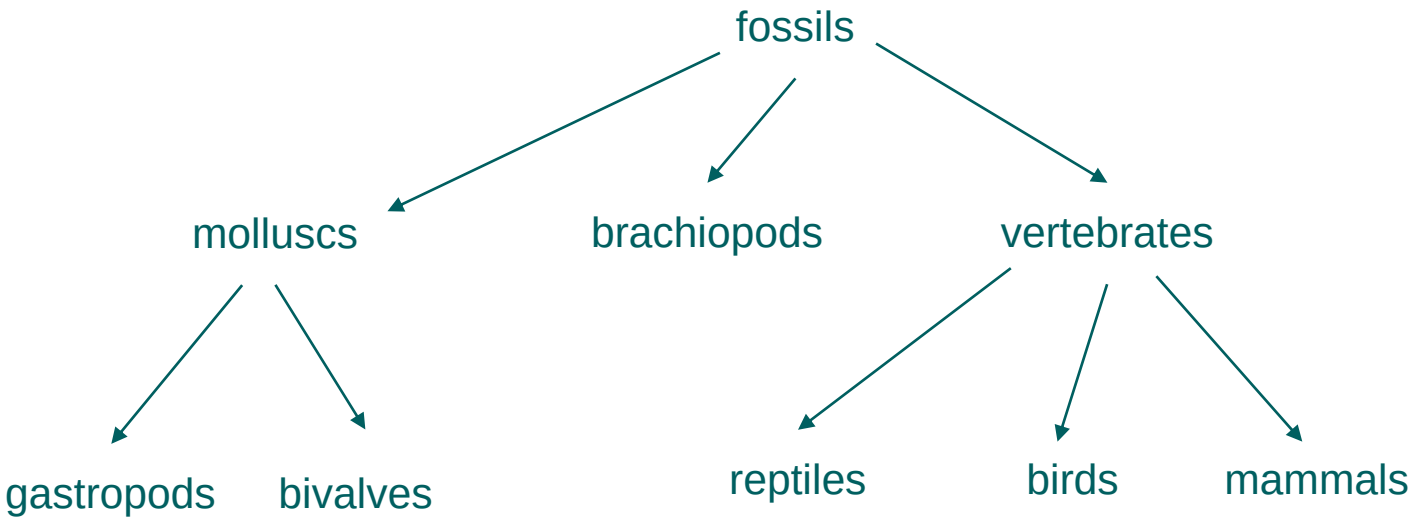
- Sublime Text
- **VS Code**
- Atom

Expert-friendly:

- Vim
- Emacs

Solution 2

- Using the same reference directory



Hint 2. we can use the contents of fossil_path.txt

Add mkdir in front of every line, then copy and paste into the console!

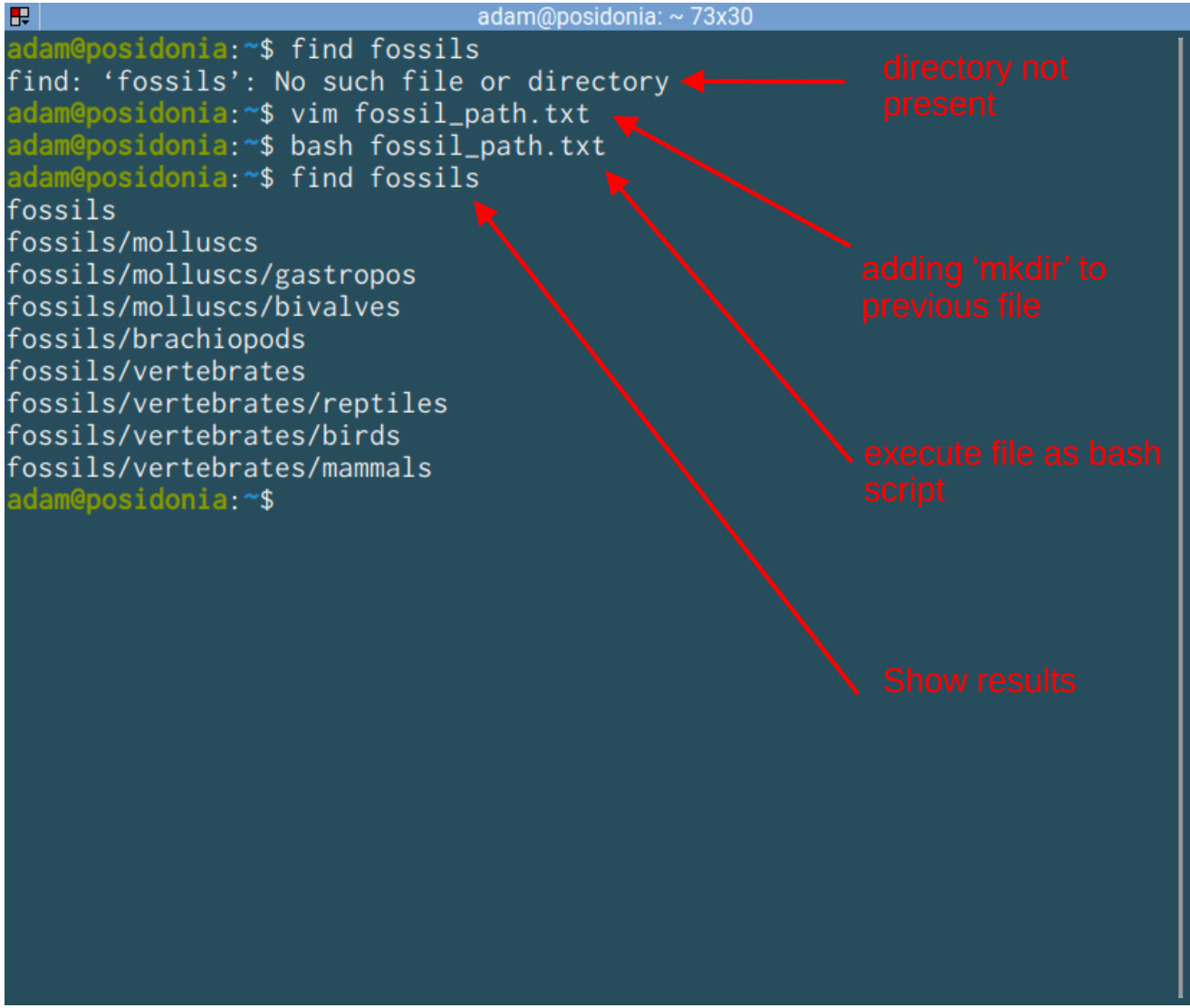
```
1 mkdir fossils
2 mkdir fossils/molluscs
3 mkdir fossils/molluscs/gastropods
4 mkdir fossils/molluscs/bivalves
5 mkdir fossils/brachiopods
6 mkdir fossils/vertebrates
7 mkdir fossils/vertebrates/reptiles
8 mkdir fossils/vertebrates/birds
9 mkdir fossils/vertebrates/mammals
```

bash_<path>

Executing shell scripts

- The text we created is actually a shell script
- The “bash” console application program can be used to execute it.

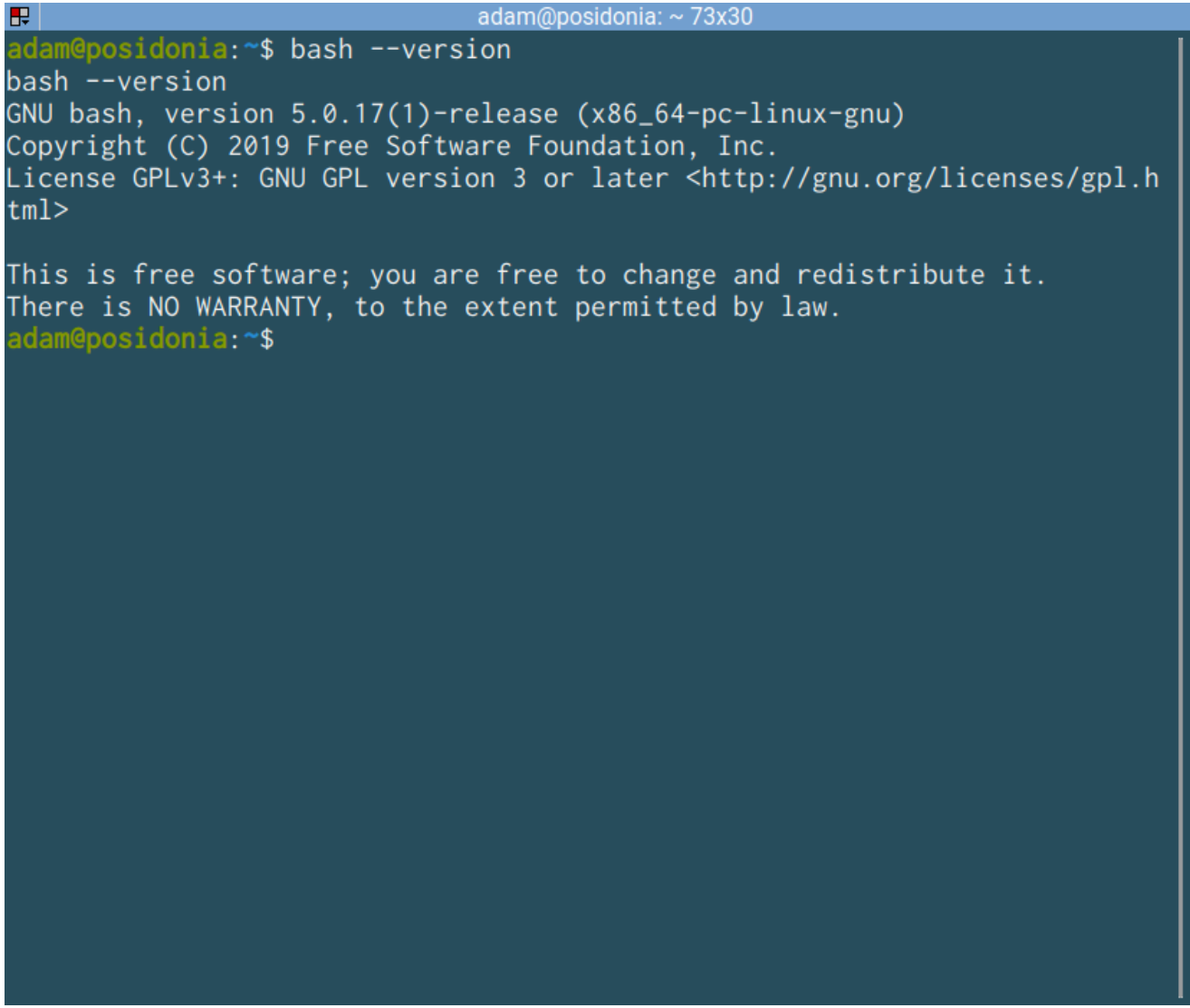
https://www.redhat.com/sysadmin/exit-codes-demystified



`bash --version`

Running console applications

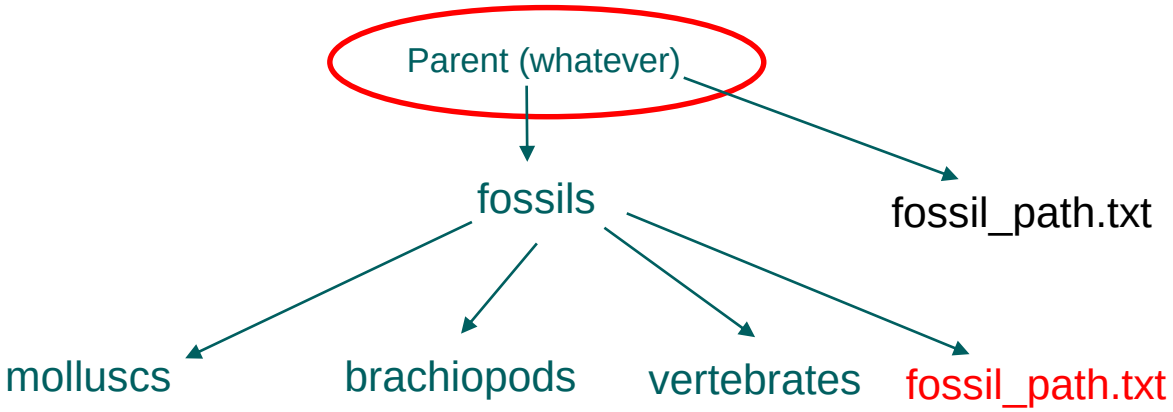
- `--version`: ask for program version
- `--help`: display help for program

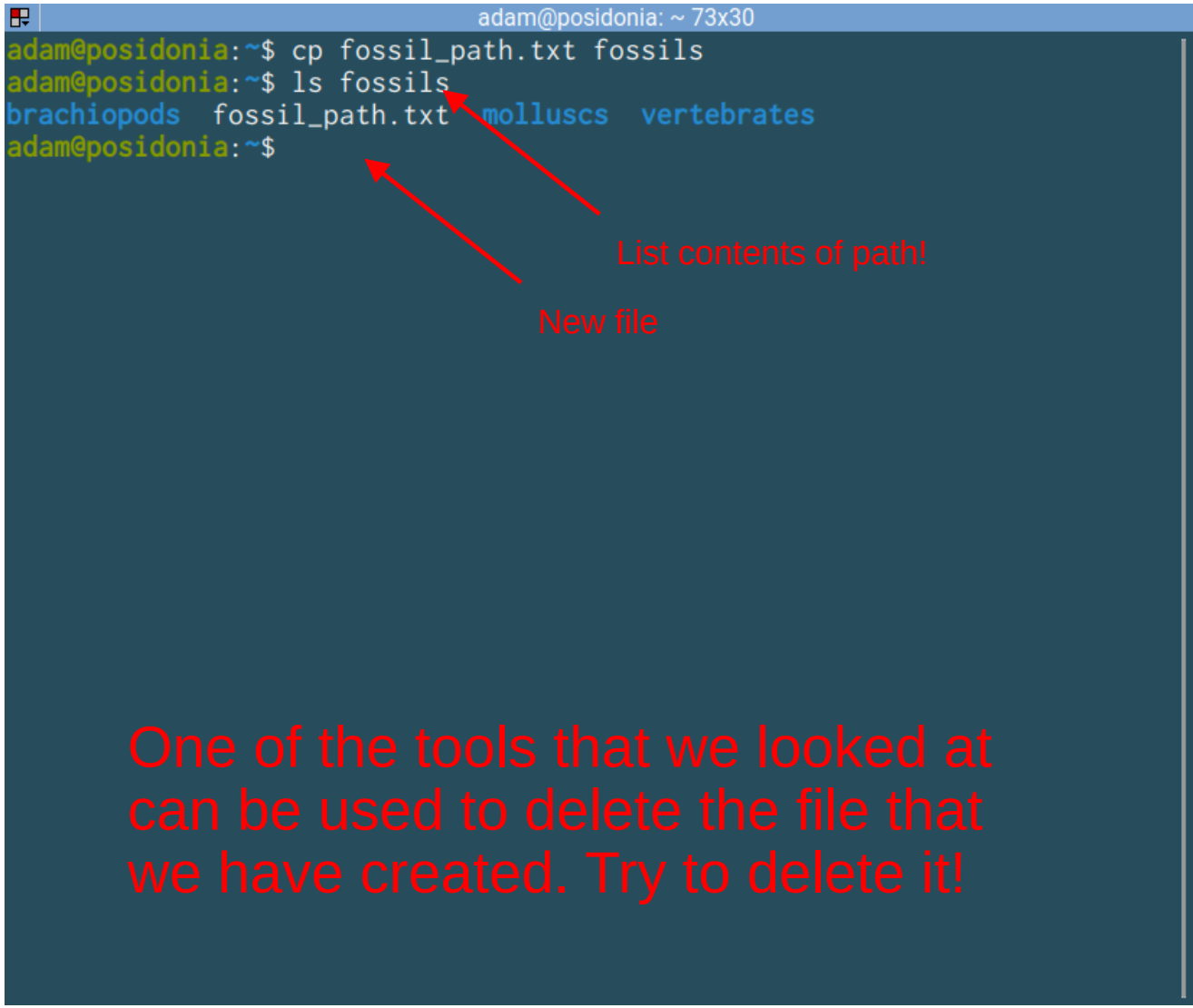


cp_<what>_<where>

Copying a file or directory

- Target directory or file
- If directory, the file will be put into it

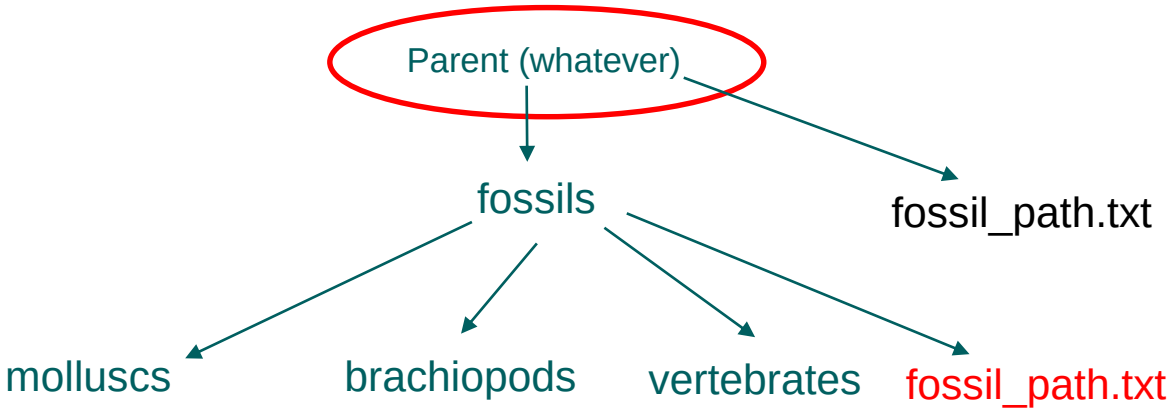


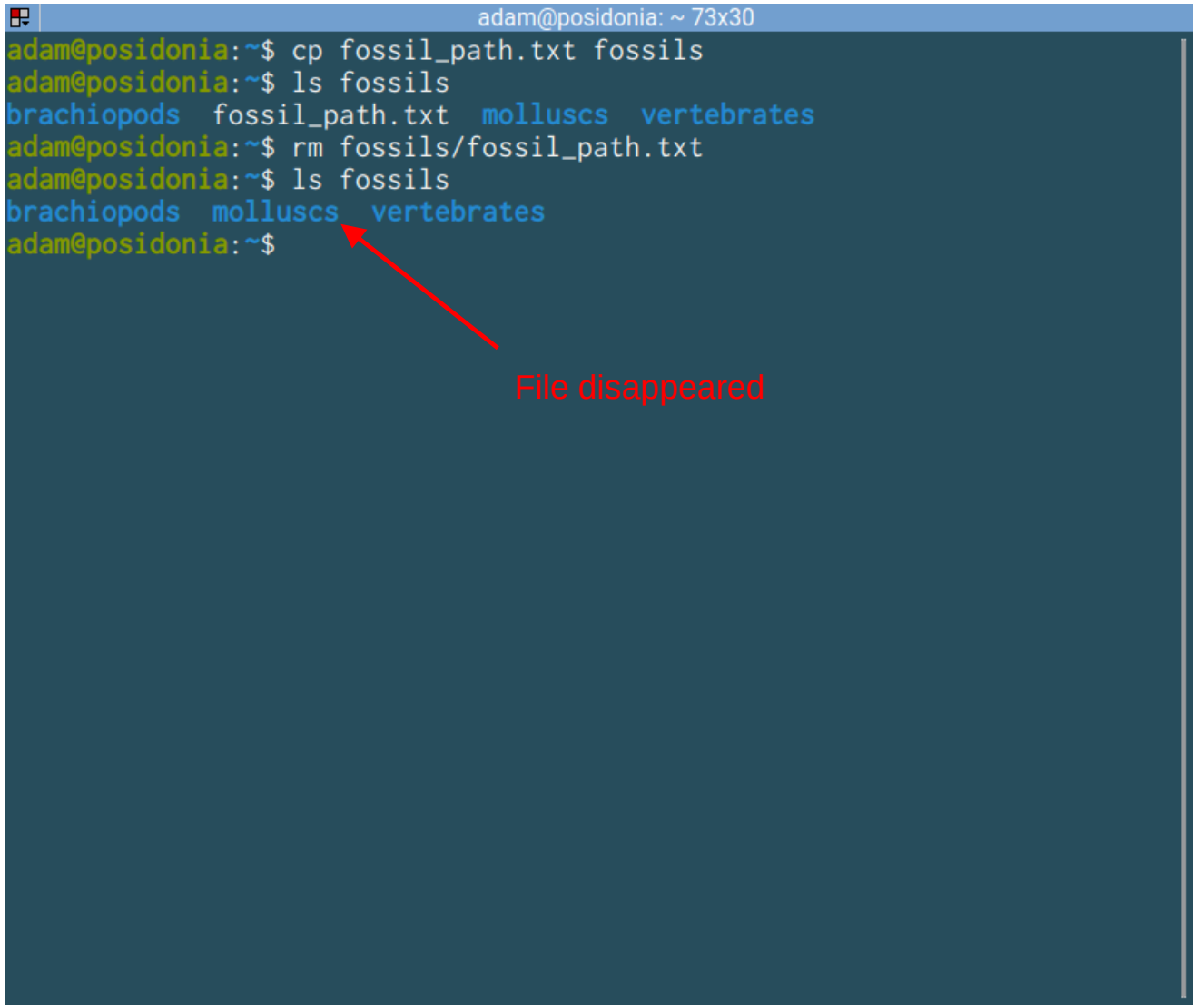


rm_<path_file>

Without –r removes a single file

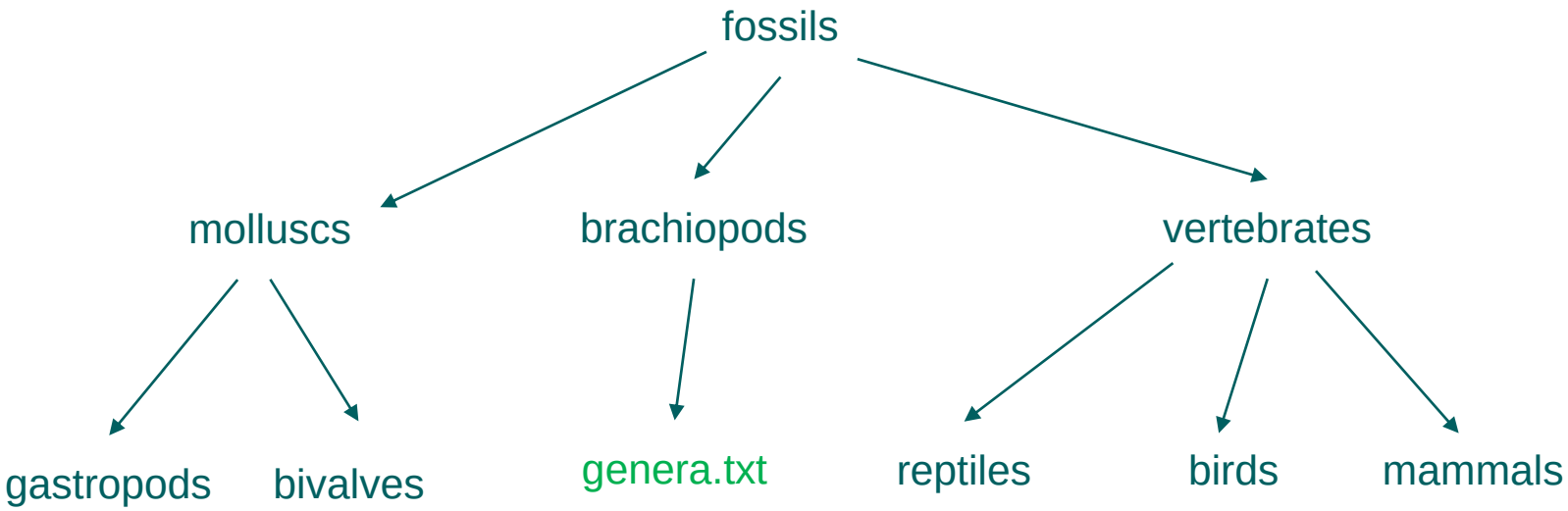
- As with cp, multiple files can be passed to this (separated by spaces)





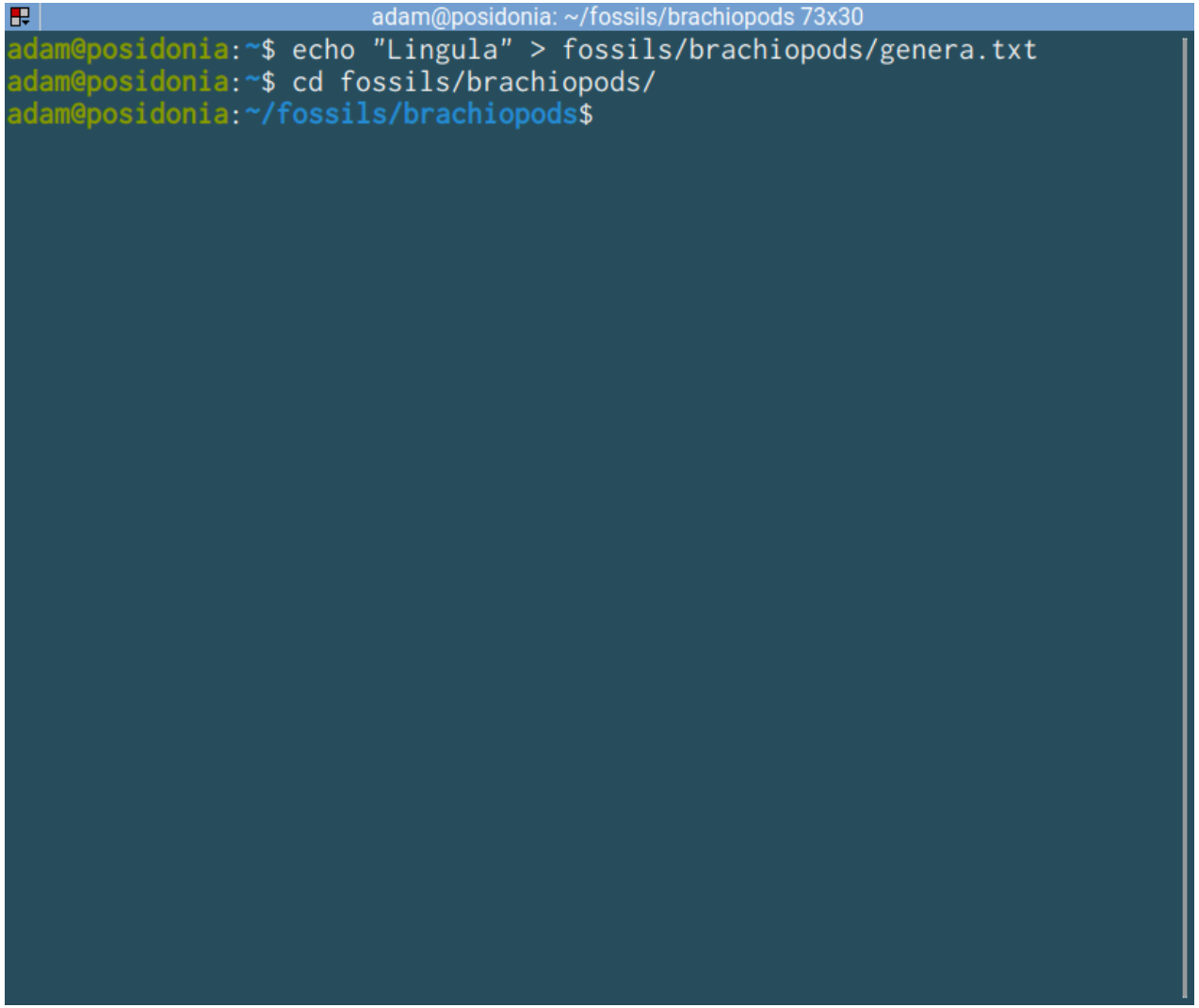
Exercise!

1. Use an `echo` statement to write the genus name "*Lingula*" into `fossils/brachiopods/genera.txt`!
2. Then change directory to `brachiopods`.



echo␣“Lingula”␣>␣fossils/brachiopods/genera.txt

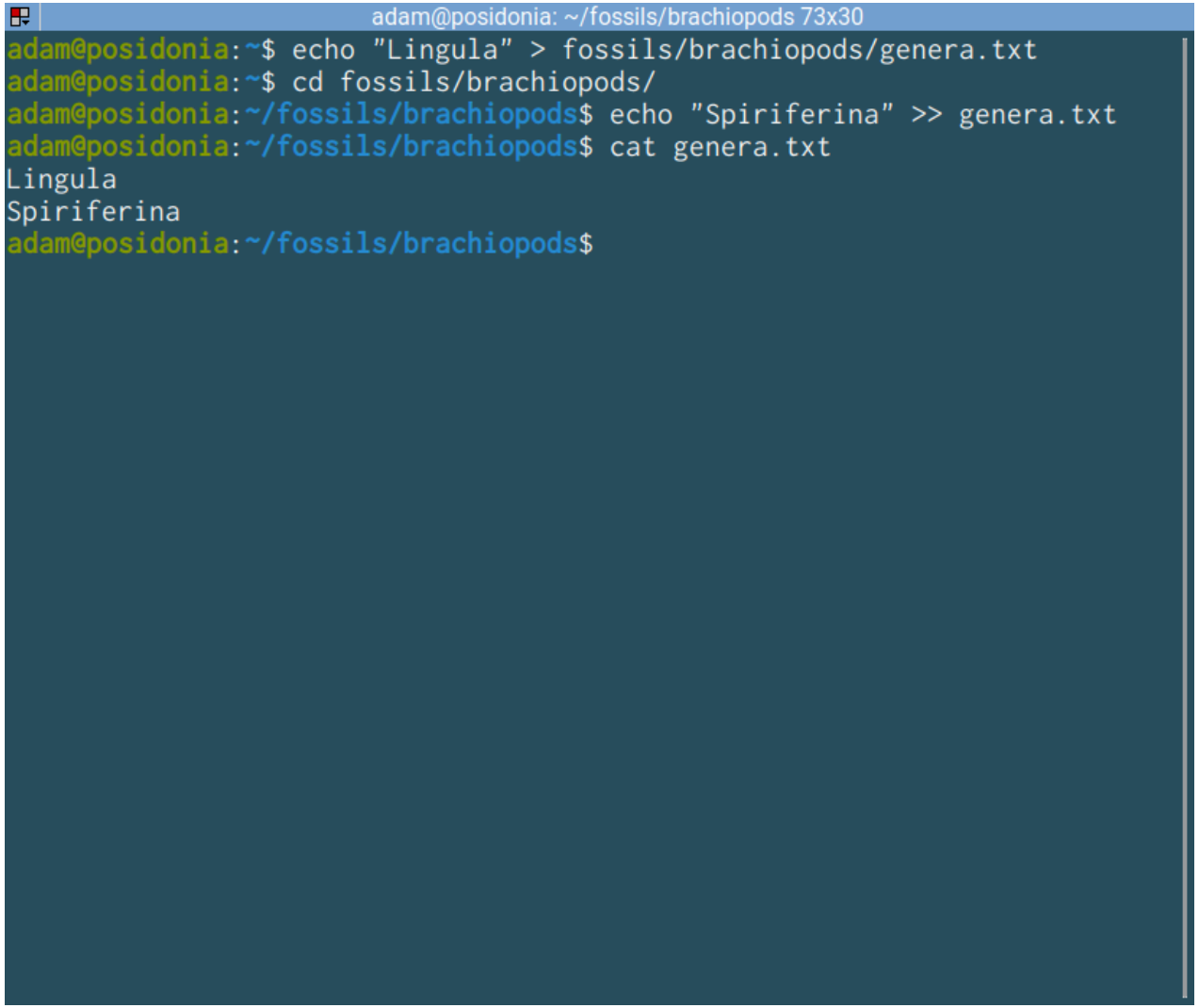
- You can use the double chevron >> to append to an existing file



echo␣"Spiriferina"␣>>␣genera.txt

Appending to files

- You can use the double chevron >> to append to an existing file
- Added to new line!



Special characters

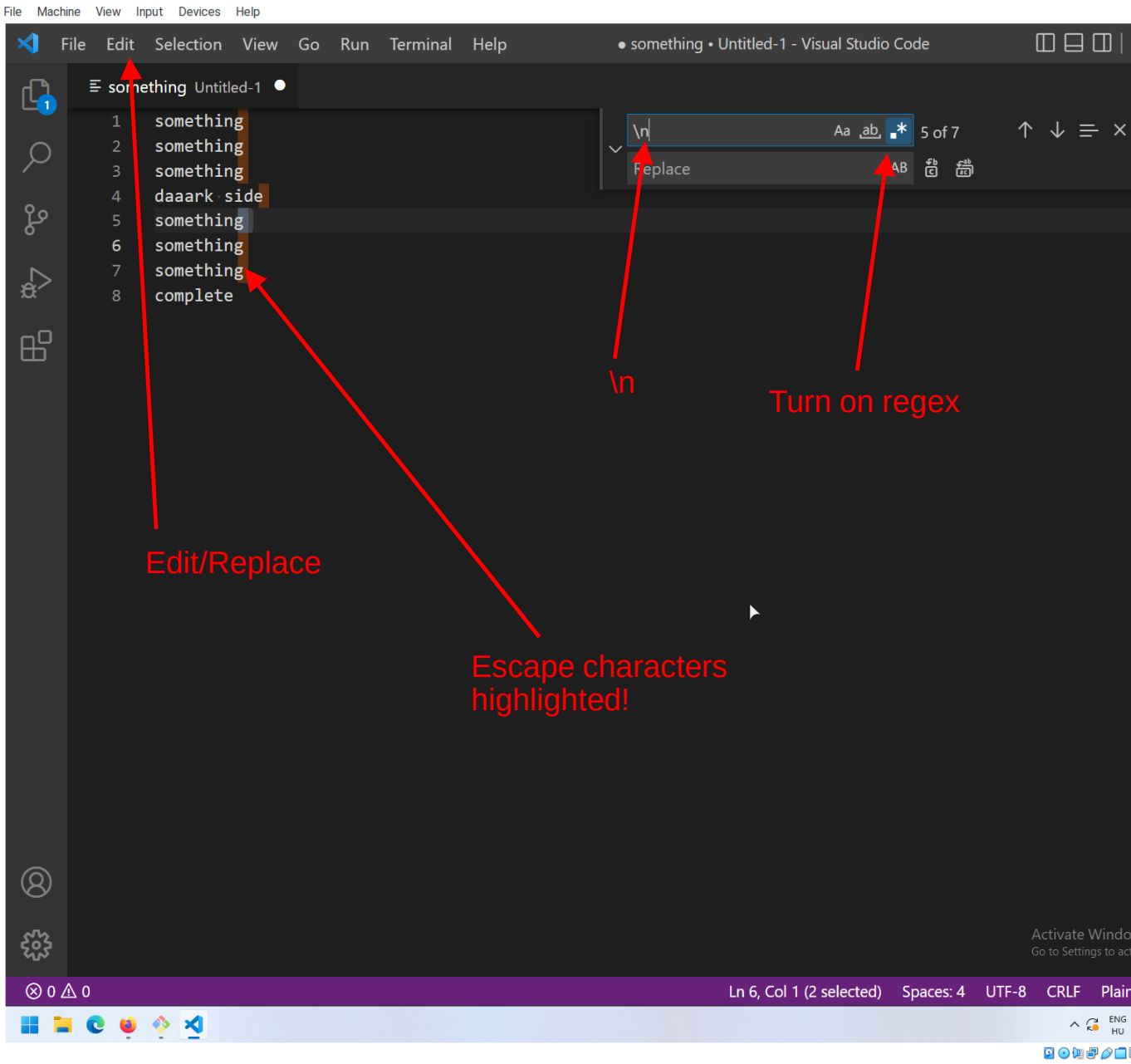
We use so called “escape characters to denote special symbols, that sometimes have other meanings.

\n: newline escape

\t : tab escape

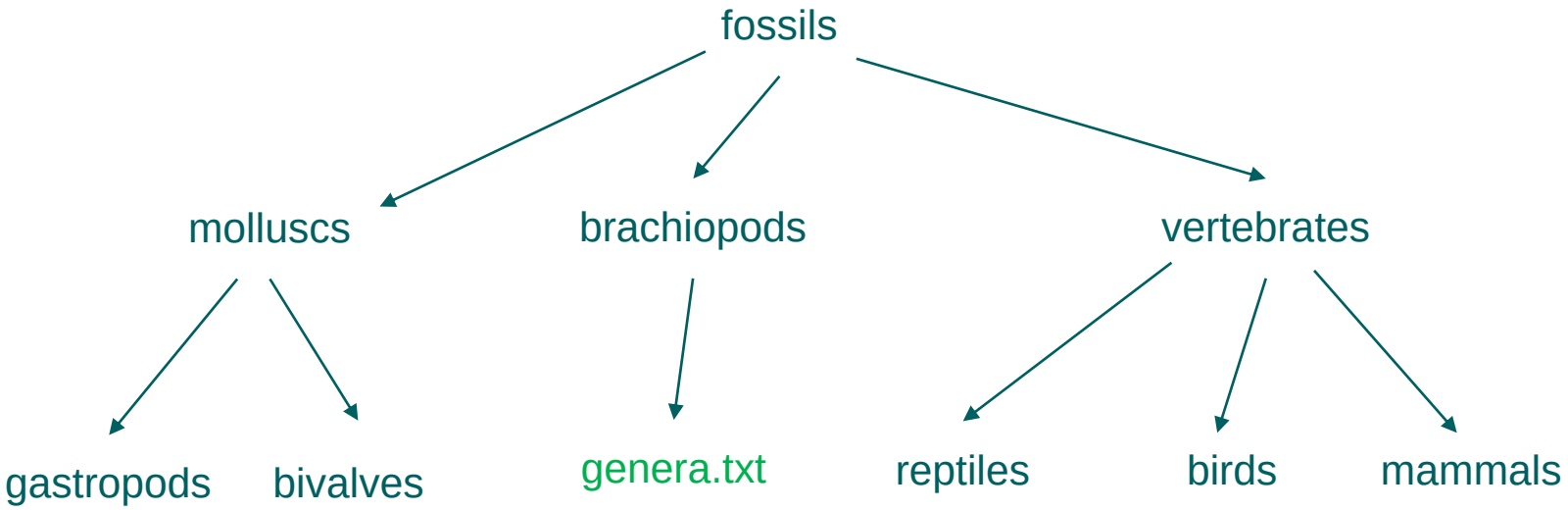
\” : double quote escape

\’ : single quote escape



Exercise!

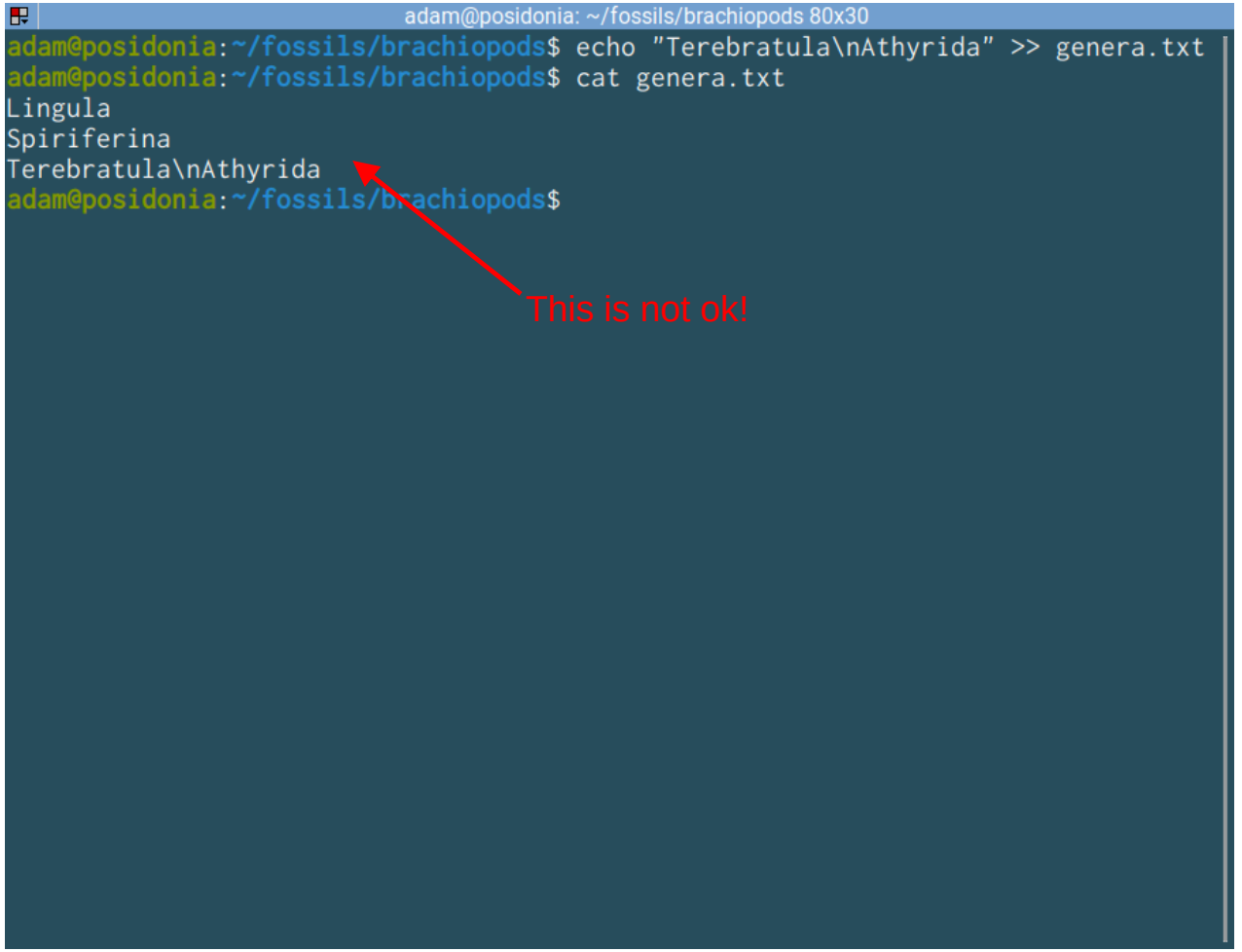
1. Use an `echo` statement to write the genus name "*Terebratula*" and "*Athyris*" into `fossils/brachiopods/genera.txt`, **`use a newline escape between them!`**
2. Then change directory to `brachiopods`.



`echo␣"Terebratula\nAthyrida"␣>>␣genera.txt`

Appending to files

- It doesn't seem to work!
- Echo needs to know to replace the combination `\n` with the newline character!

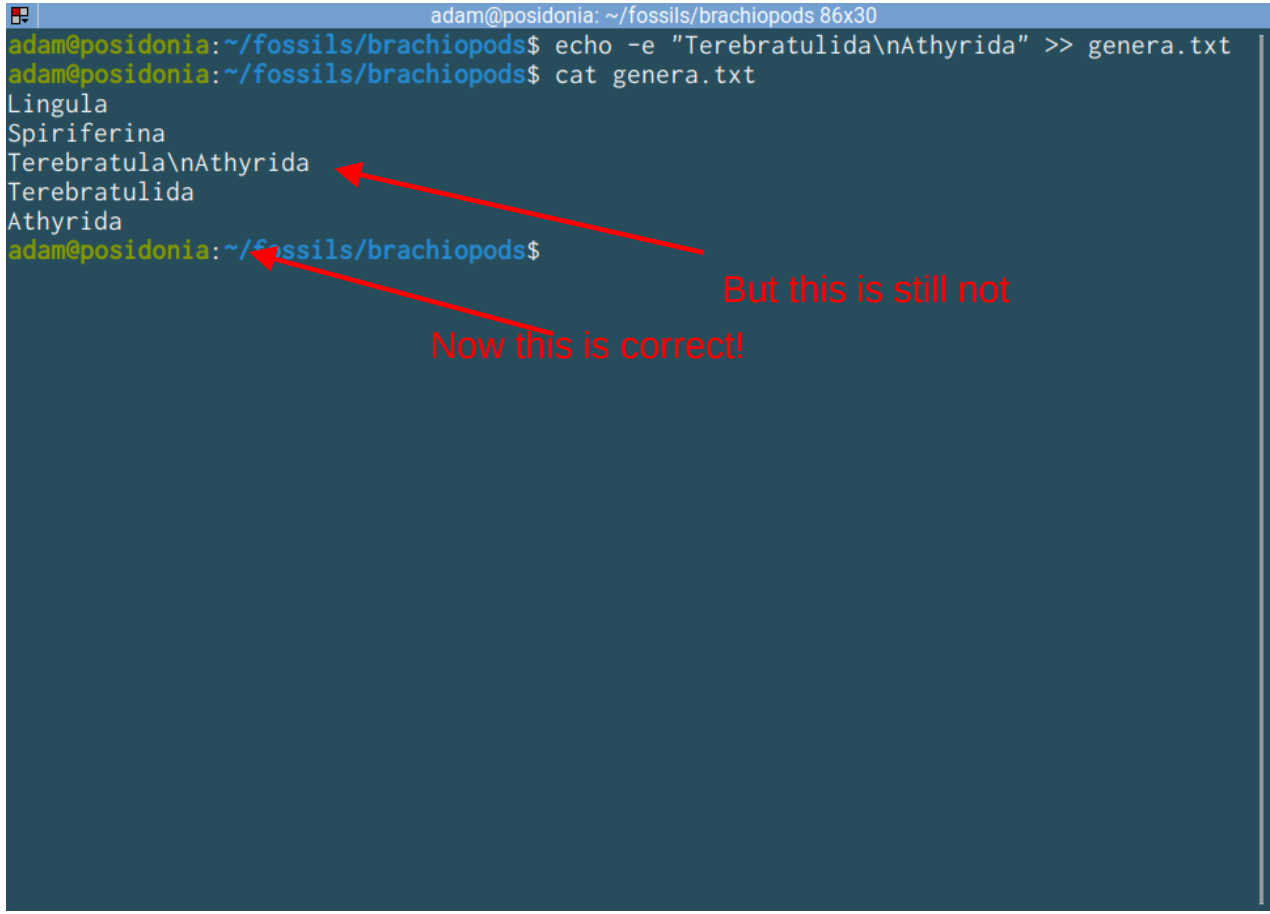


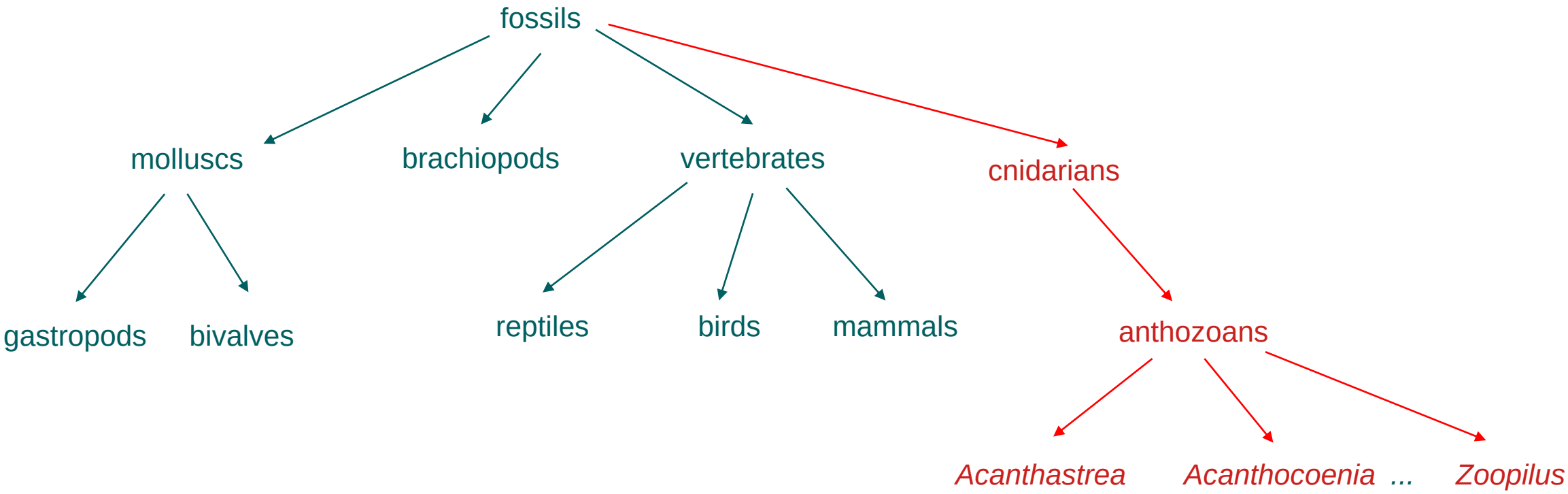
echo␣-e␣"Terebratula\nAthyrida"␣>>␣genera.txt

Appending to files

- Use the –e option!
- Our file is messed up. Options:
  - 1. Redo our file
  - 2. Use an editor to correct
- Delete the bad line!
- Better, next time: go back in time

e.g. use version control!



Joint Exercise

- Create the directory structure here!