Git, GitHub, and basic Bash worksheet

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What is Git?

Git is a version control software. Think of it like a long-standing and well-developed execution of something like the history in Google Docs, where you can see when and where and who changed something in a document. It allows you to keep track of and document your changes to files, keep different versions of files at the same time, and revert changes if necessary.

We won't go much into the functionality of git until later in the workshop. What we'll use a lot is…

GitHub

GitHub is a web-based implementation of git that provides cloud storage for git projects (called repositories or repos). It also facilitates multiple people working with a git repository at the same time. Again, think of it kind of like a series of files and folders in Google Drive, but much easier to integrate with the command-line and scripting tools that we use in this class and more broadly in bioinformatics.

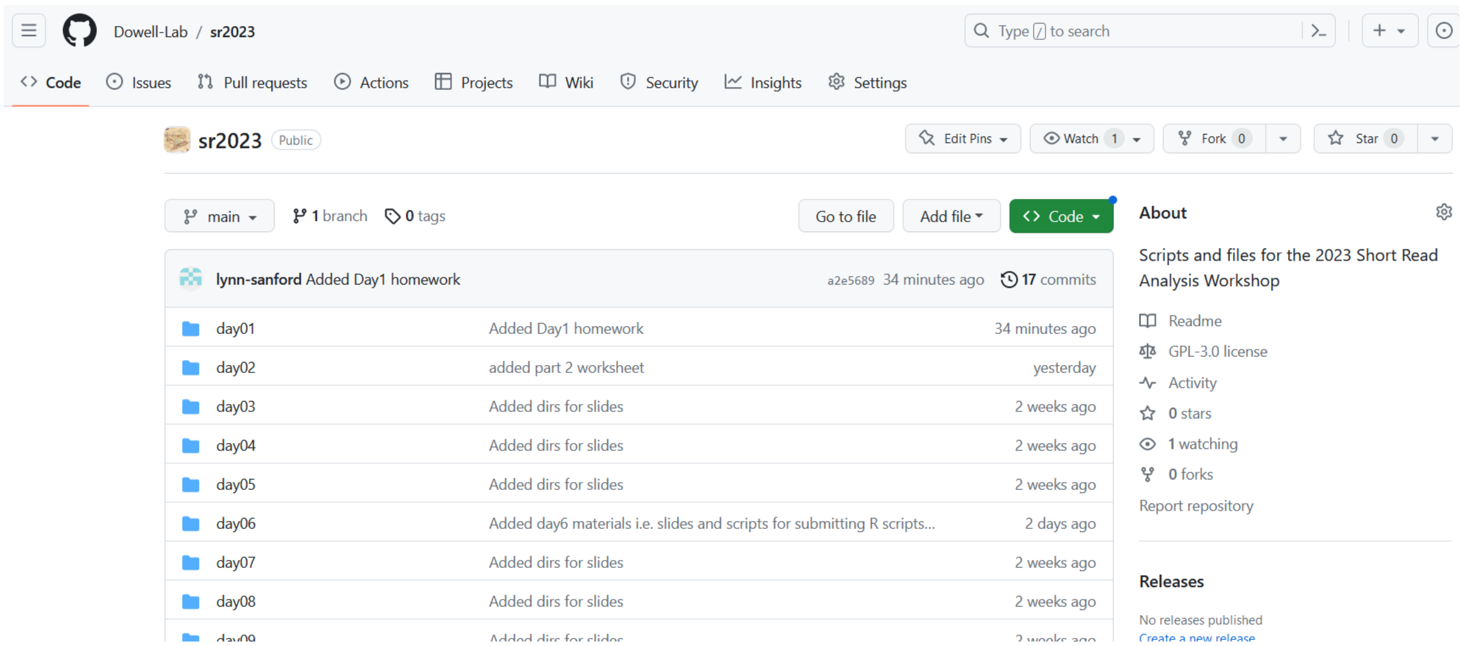
All of our class materials are on a class website, which isn't super easily accessed on the back end. It can and will be updated regularly throughout the class, but it's harder for every one of our teachers and TAs to fix typos or amend data files on the fly.

Unlike the website, anyone who has edit access (i.e. anyone in the DnA Lab) to the class GitHub repository can change a file in it at any time. For that reason, **the GitHub repository will be the primary source for class materials**. This worksheet will take you through the structure of the GitHub repo and how to interface with it.

This year's GitHub repository is here: https://github.com/Dowell-Lab/sr2023

1) In your browser, go to the GitHub repository

https://github.com/Dowell-Lab/sr2023



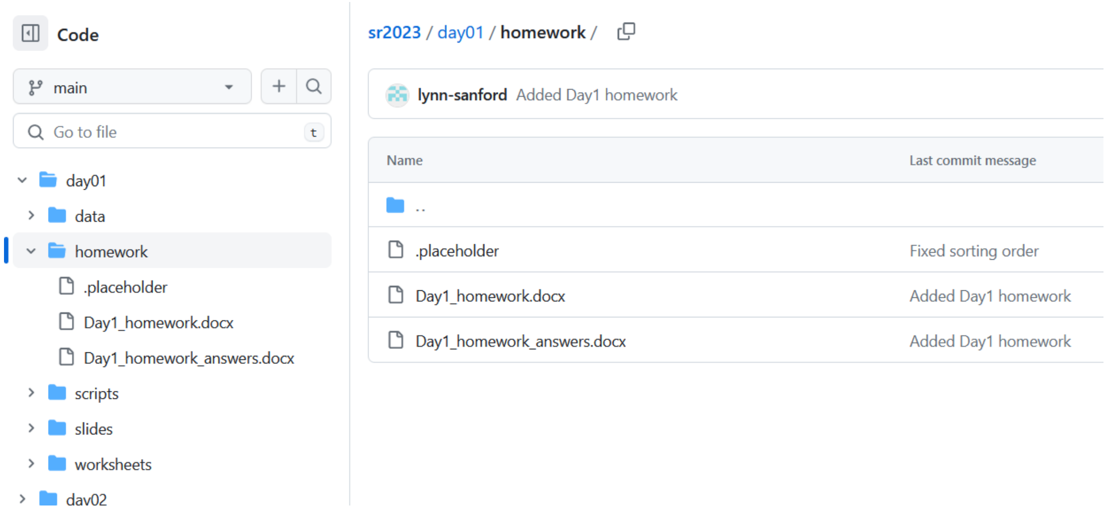
Scripts and files for the 2023 Short Read Analysis Workshop

lynn-sanford Added Day1 homework a2e5689 34 minutes ago 17 commits

day01	Added Day1 homework	34 minutes ago
day02	added part 2 worksheet	yesterday
day03	Added dirs for slides	2 weeks ago
day04	Added dirs for slides	2 weeks ago
day05	Added dirs for slides	2 weeks ago
day06	Added day6 materials i.e. slides and scripts for submitting R scripts...	2 days ago
day07	Added dirs for slides	2 weeks ago
day08	Added dirs for slides	2 weeks ago
day09	Added dirs for slides	2 weeks ago

There's a lot here, but the main thing to notice is that the repository is laid out in a way that's familiar. It looks like the filesystem on your computer. You can also navigate through the folders and subfolders (also called directories and subdirectories) like you would on your computer. Take a minute to explore.

Note that when you start going into subdirectories, an explorer sidebar pops up on the left and a **path** appears on the top. You can click on the path to navigate to higher (parent) directories, but also pay attention to its structure. It'll be similar on the command line.



lynn-sanford Added Day1 homework

Name	Last commit message
..	
.placeholder	Fixed sorting order
Day1_homework.docx	Added Day1 homework
Day1_homework_answers.docx	Added Day1 homework

2) Open a terminal and, if you can, log onto the AWS.

Open your terminal program.

If you successfully got onto the AWS previously, do so again with the command

```
ssh <github_username>@<aws_ip>
```

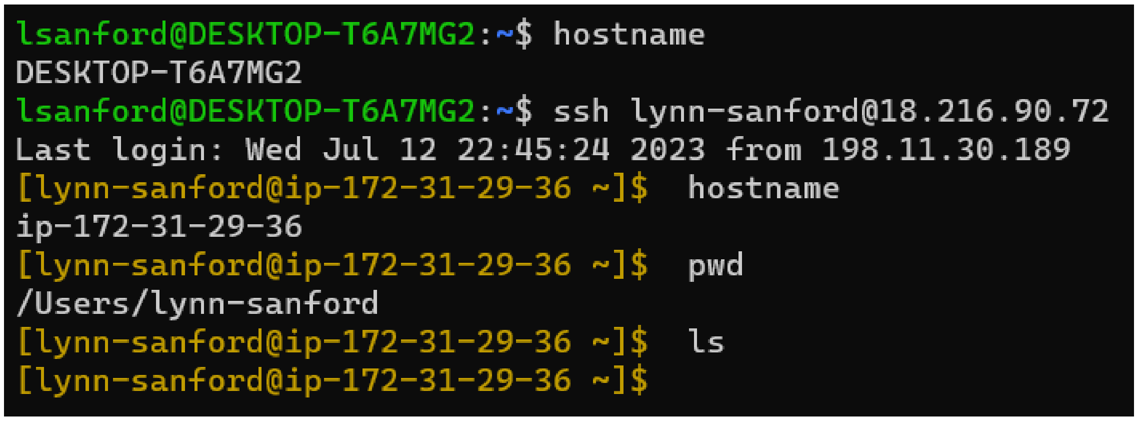
If you're still troubleshooting getting onto the AWS, it's fine to do this worksheet on your local computer within your terminal.

3) Do some basic looking around on the command line

In your terminal, whether on your computer or the AWS, type `hostname` and see what it outputs. The output will be different depending on which system you're on.

Type `pwd` → This shows you what directory you're currently in.

Type `ls` → This lists the contents of your current directory. Since you've created no files or folders, it should be empty, so nothing should display.

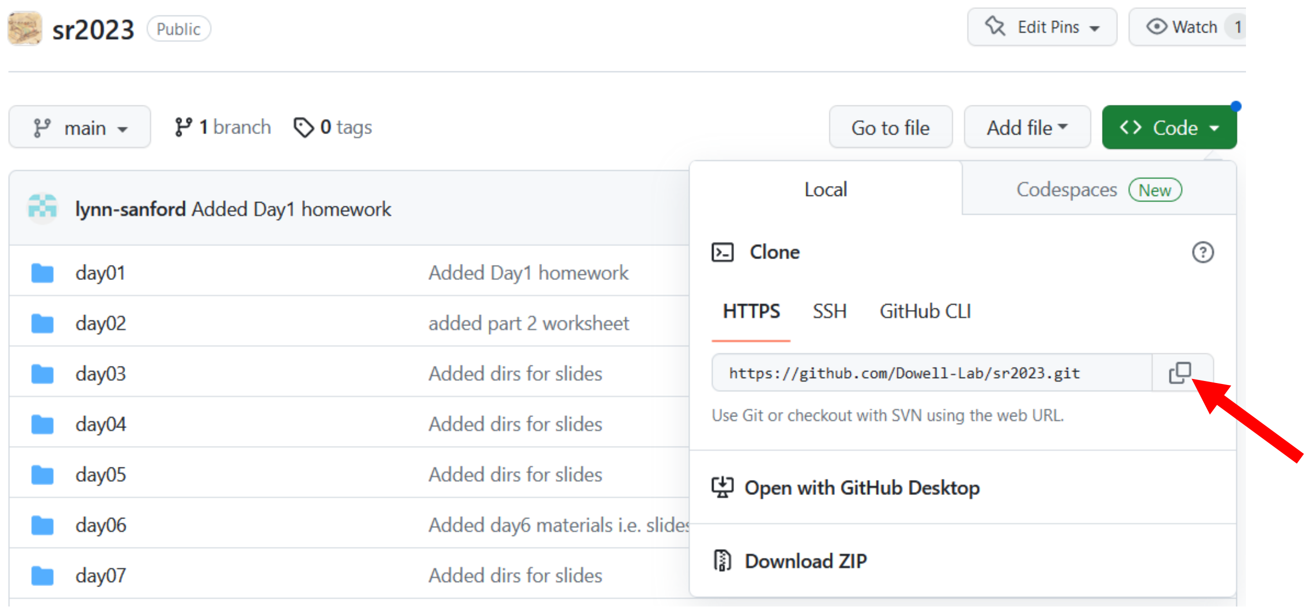


```
lsanford@DESKTOP-T6A7MG2:~$ hostname
DESKTOP-T6A7MG2
lsanford@DESKTOP-T6A7MG2:~$ ssh lynn-sanford@18.216.90.72
Last login: Wed Jul 12 22:45:24 2023 from 198.11.30.189
[lynn-sanford@ip-172-31-29-36 ~]$  hostname
ip-172-31-29-36
[lynn-sanford@ip-172-31-29-36 ~]$  pwd
/Users/lynn-sanford
[lynn-sanford@ip-172-31-29-36 ~]$  ls
[lynn-sanford@ip-172-31-29-36 ~]$
```

4) Clone the GitHub class repo

Navigate back to the top of the repo in your browser, or click the link above again.

Click on the green button that says "<> Code", make sure the dropdown has "HTTPS" highlighted, and copy the link it gives you. This is the easiest way to clone a repository that you don't have the rights to edit.



lynn-sanford Added Day1 homework

day01	Added Day1 homework
day02	added part 2 worksheet
day03	Added dirs for slides
day04	Added dirs for slides
day05	Added dirs for slides
day06	Added day6 materials i.e. slides
day07	Added dirs for slides

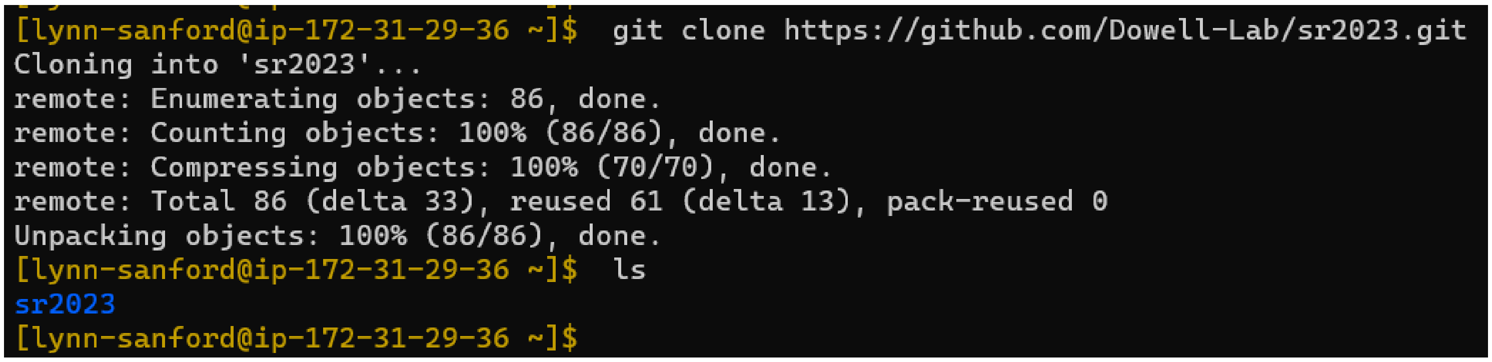
```
https://github.com/Dowell-Lab/sr2023.git
```

Use Git or checkout with SVN using the web URL.

Navigate back to your terminal and type `git clone` then paste the link and hit enter.

> **Note**: If you're using the Ubuntu WSL app on a PC, you cannot paste with Ctrl-V. By default pasting is through a right-click.

This command will then clone (create a copy of) the sr2023 repository in your current working directory.



```
[lynn-sanford@ip-172-31-29-36 ~]$  git clone https://github.com/Dowell-Lab/sr2023.git
Cloning into 'sr2023'...
remote: Enumerating objects: 86, done.
remote: Counting objects: 100% (86/86), done.
remote: Compressing objects: 100% (70/70), done.
remote: Total 86 (delta 33), reused 61 (delta 13), pack-reused 0
Unpacking objects: 100% (86/86), done.
[lynn-sanford@ip-172-31-29-36 ~]$  ls
sr2023
[lynn-sanford@ip-172-31-29-36 ~]$
```

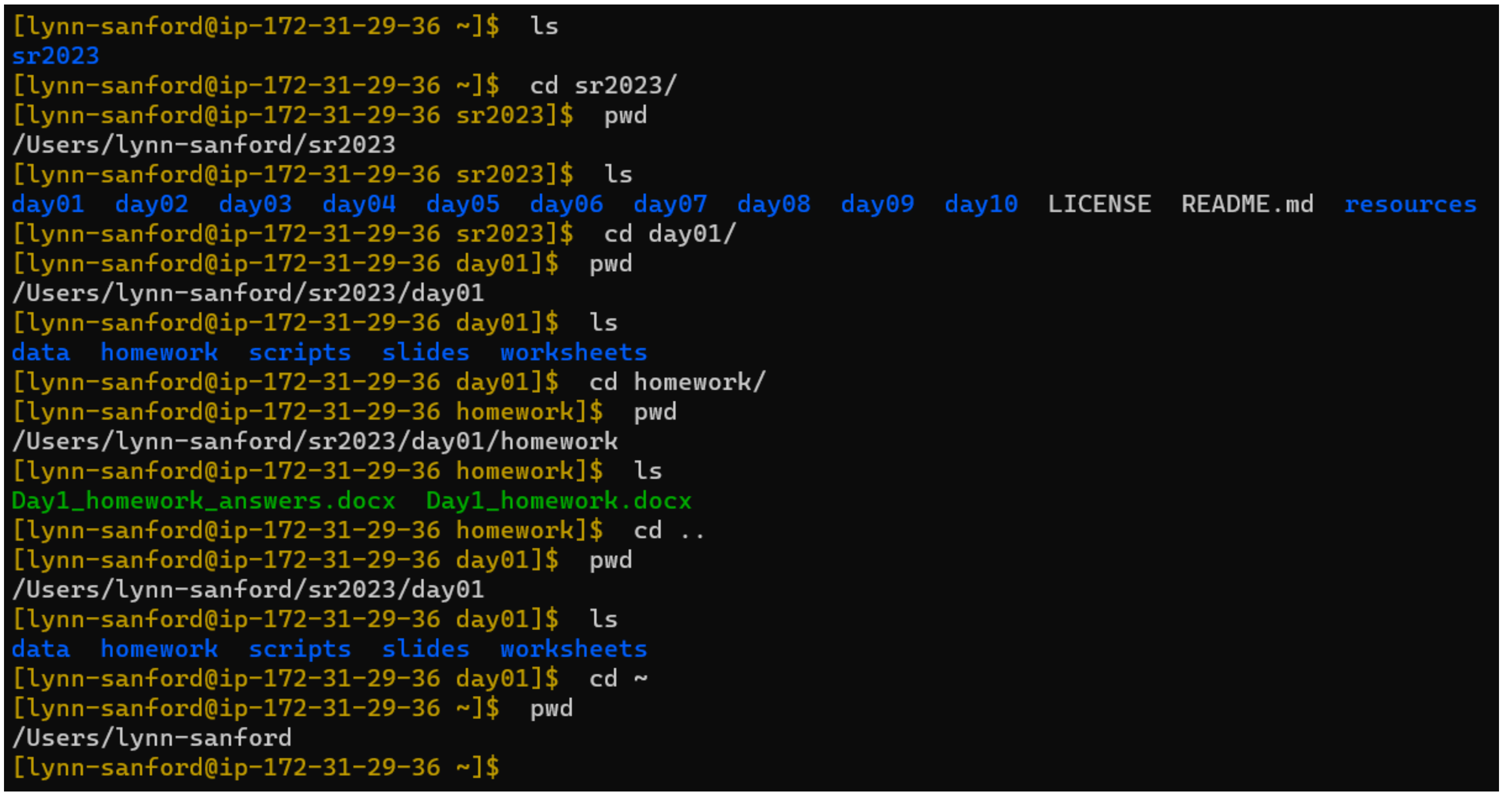
5) Navigate around the repository

Use the command `cd` (change directory) to navigate into the repository. If you're going into subdirectories, type the name of the subdirectory. If you want to go back to the previous parent directory (one higher in the directory structure), use two dots (`cd ..`).

You'll notice that directories are shown in color, usually blue, text files are in white, and other types of files may be other colors. Your color scheme may look different than mine.

If you get lost and you need to go back to your home directory, type `cd ~`

As you investigate, make use of the `pwd` command. Go back and forth between the paths that you see on the command line and the paths that you see when exploring the same repo in the browser.



```
[lynn-sanford@ip-172-31-29-36 ~]$  ls
sr2023
[lynn-sanford@ip-172-31-29-36 ~]$  cd sr2023/
[lynn-sanford@ip-172-31-29-36 sr2023]$  pwd
/Users/lynn-sanford/sr2023
[lynn-sanford@ip-172-31-29-36 sr2023]$  ls
day01  day02  day03  day04  day05  day06  day07  day08  day09  day10  LICENSE  README.md  resources
[lynn-sanford@ip-172-31-29-36 sr2023]$  cd day01/
[lynn-sanford@ip-172-31-29-36 day01]$  pwd
/Users/lynn-sanford/sr2023/day01
[lynn-sanford@ip-172-31-29-36 day01]$  ls
data  homework  scripts  slides  worksheets
[lynn-sanford@ip-172-31-29-36 day01]$  cd homework/
[lynn-sanford@ip-172-31-29-36 homework]$  pwd
/Users/lynn-sanford/sr2023/day01/homework
[lynn-sanford@ip-172-31-29-36 homework]$  ls
Day1_homework_answers.docx  Day1_homework.docx
[lynn-sanford@ip-172-31-29-36 homework]$  cd ..
[lynn-sanford@ip-172-31-29-36 day01]$  pwd
/Users/lynn-sanford/sr2023/day01
[lynn-sanford@ip-172-31-29-36 day01]$  ls
data  homework  scripts  slides  worksheets
[lynn-sanford@ip-172-31-29-36 day01]$  cd ~
[lynn-sanford@ip-172-31-29-36 ~]$  pwd
/Users/lynn-sanford
[lynn-sanford@ip-172-31-29-36 ~]$
```

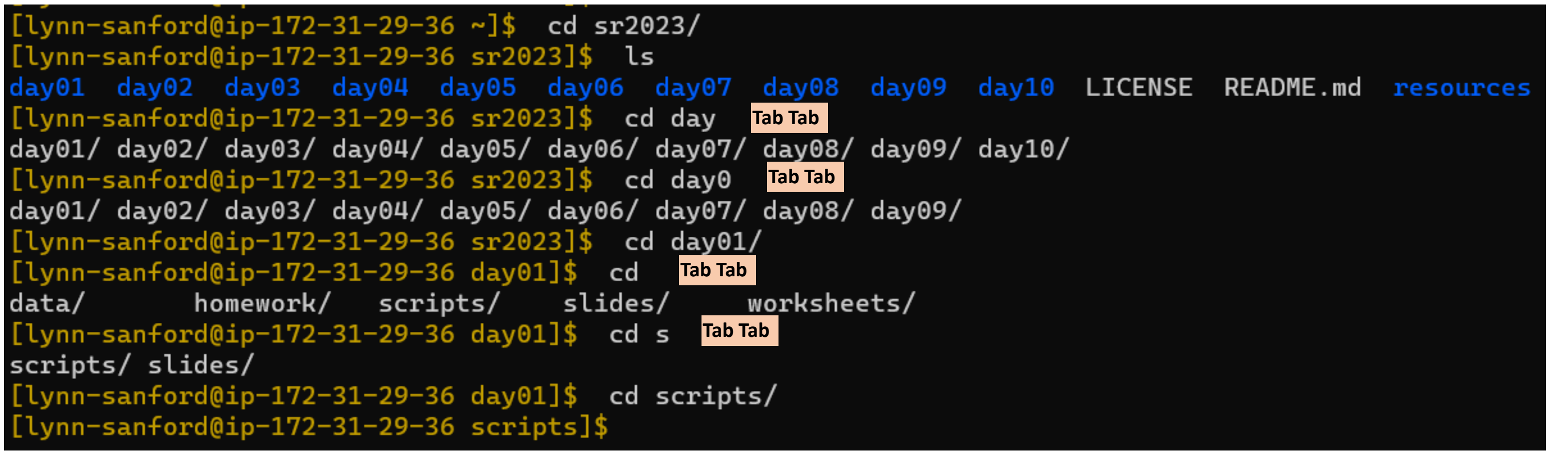
6) Tab complete

Go back to your home directory, then type `cd s` and hit Enter. What do you see? Now type `cd s` and before hitting Enter, hit Tab. What happens?

This is a beautiful feature of unix systems called Tab complete. **Tab complete is your friend**. The more you get comfortable with it, the less time it will take you to navigate around filesystems.

Tab complete will go to the next unique position in a string. So in your home directory, you only have one directory, `sr2023`, and Tab complete will automatically fill it in.

Navigate into `sr2023` again, and type `cd d`, then hit Tab. This completes until it hits a character with multiple options. If you hit Tab twice, a list of all options is displayed that start with what you've already typed/complete. Then input which characters you want, and you can hit Tab again.



```
[lynn-sanford@ip-172-31-29-36 ~]$  cd sr2023/
[lynn-sanford@ip-172-31-29-36 sr2023]$  ls
day01  day02  day03  day04  day05  day06  day07  day08  day09  day10  LICENSE  README.md  resources
[lynn-sanford@ip-172-31-29-36 sr2023]$  cd day  Tab Tab
day01/ day02/ day03/ day04/ day05/ day06/ day07/ day08/ day09/ day10/
[lynn-sanford@ip-172-31-29-36 sr2023]$  cd day0  Tab Tab
day01/ day02/ day03/ day04/ day05/ day06/ day07/ day08/ day09/
[lynn-sanford@ip-172-31-29-36 sr2023]$  cd day01/
[lynn-sanford@ip-172-31-29-36 day01]$  cd  Tab Tab
data/       homework/   scripts/    slides/     worksheets/
[lynn-sanford@ip-172-31-29-36 day01]$  cd s  Tab Tab
scripts/ slides/
[lynn-sanford@ip-172-31-29-36 day01]$  cd scripts/
[lynn-sanford@ip-172-31-29-36 scripts]$
```

7) Copy a file from the repository

When starting out using the command line, you may get confused about what computer you are currently running commands on. The prompt that you get at the beginning of a line should help you (i.e. the `[lynn-sanford@ip-172-31-29-36 ~]$`), but we're going to make it one step easier.

You may notice that while my command prompt is a brownish color, yours is most likely white. Let's change that – it'll make the next few days easier on you.

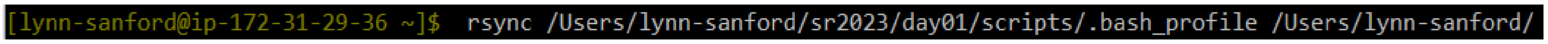
In the repository, under day01/scripts/, there's a file called `.bash_profile`. You will not be able to see this file with only the `ls` command, since the `.` at the start indicates it's a hidden file. You can see it by typing `ls -al` (more on that tomorrow).

In order to get a colored command prompt, you need to copy this file to your home directory on the AWS. For this you use the `rsync` command, which has the syntax:

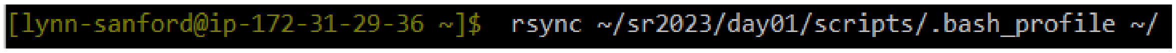
```
rsync <source_directory> <destination_directory>
```

You can use this command in a number of ways:

- With absolute paths (your current working directory is irrelevant):
    - Note: these are functionally equivalent, since ~ is a shortcut for your home directory

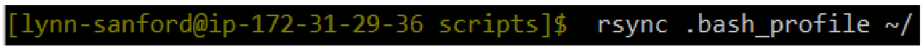


```
[lynn-sanford@ip-172-31-29-36 ~]$  rsync /Users/lynn-sanford/sr2023/day01/scripts/.bash_profile /Users/lynn-sanford/
```



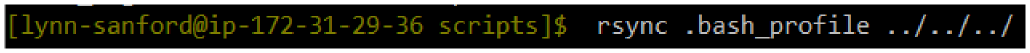
```
[lynn-sanford@ip-172-31-29-36 ~]$  rsync ~/sr2023/day01/scripts/.bash_profile ~/
```

- From the ~/sr2023/day01/scripts/ directory:
    - Absolute path:



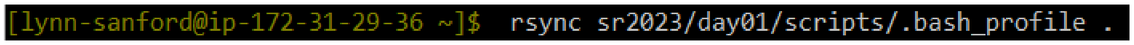
```
[lynn-sanford@ip-172-31-29-36 scripts]$  rsync .bash_profile ~/
```

    - Relative path (your home directory is 3 parent directories above this



```
[lynn-sanford@ip-172-31-29-36 scripts]$  rsync .bash_profile ../../../
```

- From your home directory (remember `.` indicates your current directory):



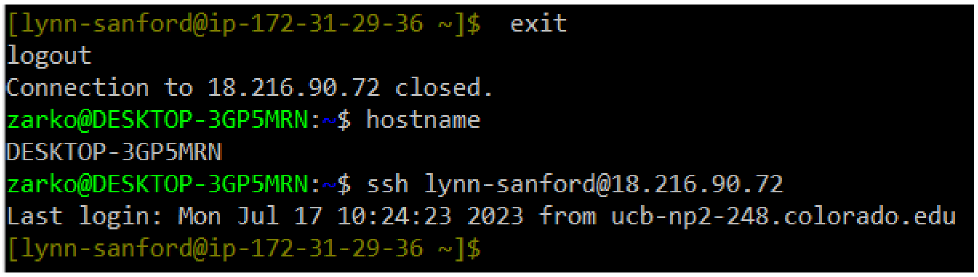
```
[lynn-sanford@ip-172-31-29-36 ~]$  rsync sr2023/day01/scripts/.bash_profile .
```

8) Logout and log back on

Now you have a copy of the `.bash_profile` file in your AWS home directory, and the next time you log on, your prompt color will automatically change. Let's do that now.

Either `logout` or `exit` will log you out of the AWS. Once you run that command, you will be back on your personal computer. Use the `hostname` command to verify.

Now, log back onto the AWS. The easiest way to do this is by using the up key on your keyboard. Up and down scroll through your command history. Hit up until you find your version of the `ssh <github_username>@<aws_ip>` command and hit enter. You should log back onto the AWS and see a brown prompt, indicating you are now back on the super computer.

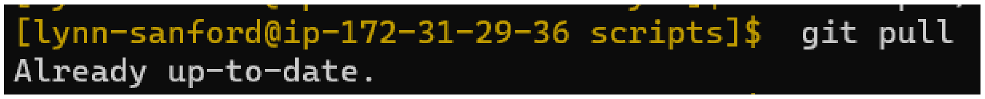


```
[lynn-sanford@ip-172-31-29-36 ~]$  exit
logout
Connection to 18.216.90.72 closed.
zarko@DESKTOP-3GP5MRN:~$ hostname
DESKTOP-3GP5MRN
zarko@DESKTOP-3GP5MRN:~$ ssh lynn-sanford@18.216.90.72
Last login: Mon Jul 17 10:24:23 2023 from ucb-np2-248.colorado.edu
[lynn-sanford@ip-172-31-29-36 ~]$
```

Once you're familiar enough with Vim to edit files (later this day), you can come back and edit the `.bash_profile` file if you'd like to change the prompt color from brown to something else. Instructions will be in an extra section at the end of this worksheet.

9) Pull from the repository

When content on the remote repo (the one hosted on Github) changes, you'll need to update the copy on your computer or on the AWS. To do this, make sure you're somewhere in the repo (`cd` into `sr2023/`) and type `git pull`. If nothing has changed, it will tell you you're up to date. If something has changed, it'll let you know what has.



```
[lynn-sanford@ip-172-31-29-36 scripts]$  git pull
Already up-to-date.
```

You will regularly pull over the two weeks of the course.

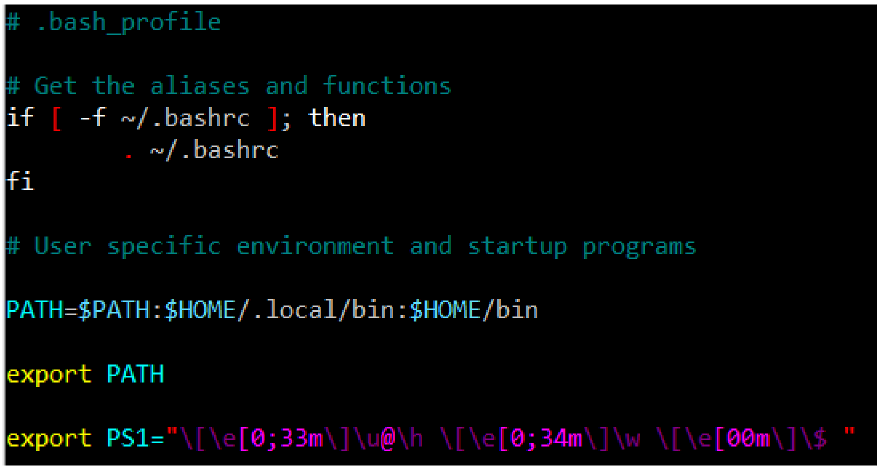
10) Log out from the AWS

When you're done with your session on a super computer, log out before you close the window, just as you did above.

Extra: Change the prompt color:

The `.bash_profile` file contains instructions for initiation of your instance on the AWS super computer. For your personal computer or a different super computer, you may need to edit a `.bashrc` file instead, but ignore that for the AWS.

Opening the `.bash_profile` file that I've provided to you shows the following:



```
# .bash_profile

# Get the aliases and functions
if [ -f ~/.bashrc ]; then
        . ~/.bashrc
fi

# User specific environment and startup programs

PATH=$PATH:$HOME/.local/bin:$HOME/bin

export PATH

export PS1="\[\e[0;33m\]\u@\h \[\e[0;34m\]\w \[\e[00m\]\$ "
```

Each of these lines does something different, but the one at the bottom is the one that specifies how your command prompt looks. The text color for the username@hostname is encoded by the `33` toward the beginning of the line, and the text color for the current working directory is encoded by the `34` a little farther in. You can change the color to whatever you want by editing the number based on the following table.

30	=	black
31	=	red
32	=	green
33	=	orange
34	=	blue
35	=	purple
36	=	cyan
37	=	grey
90	=	dark grey
91	=	light red
92	=	light green
93	=	yellow
94	=	light blue
95	=	light purple
96	=	turquoise
97	=	white