Lab 0: Intro and Setup

Deadline: Friday, September 10, 11:59:59 PM PT

Hello! Welcome to CS61C! We're excited to have you on board :D ~~Please pay attention as we demonstrate the safety features of this aircraft.~~

This lab may be a little long, but please read carefully; it covers many important things that will prepare you for the rest of the course!

Goals

Each lab will begin with a few goals; use them to reflect on your learning and guide your thinking! Here are the goals for this lab:

- Describe and adhere to all course policies.
- Set up accounts for GitHub, Gradescope, hive machines, Piazza, and other course-related services.
- Get familiar with command line tools and Git commands.

Jargon

A quick clarification on some terms:

- TA/GSI/uGSI: Teaching Assistant (sometimes called Graduate/Undergraduate Student Instructor).
- AI: Academic Intern, also part of course staff. You'll see them in Lab, OH, and sometimes Piazza.
  - In this course, AI generally stands for this, and not "artificial intelligence".
- OH: Office Hours, where you can meet course staff in (virtual) meetings and ask questions.
- hive/"hive machines"/"the hive": a group of instructional servers. More details later in the lab.
- CLI: Command Line Interface, or the interface you see in terminals
- GUI: Graphical User Interface
- OS: Operating System (commonly macOS, Windows, Linux, FreeBSD, etc.)

Exercise 1: Course Policies

Please take a moment to review the course policies. You are responsible for understanding and adhering to all policies throughout the course of the semester.

Action Items

- Once you've finished reviewing the policies, take the Lab 0: Course Policies Quiz on Gradescope.

Exercise 2: Accessing Services

Unfortunately, assignments in this course do require some (sometimes boring) setup. Let's get that out of the way.

Note: If you were enrolled recently, it will take up to 24 hours to automatically get access to everything. If you're still having access issues after that, please reach out to us on Piazza, but please wait until 24 hours have passed before reaching out. You can contact us through Piazza (preferred) or email (`cs61c@`).

Accessing Services

CS 61C primarily uses a couple services for distributing assignments, receiving work, and grading. There's a brief overview of the important ones in the sections below.

▶ Note for students with internet access restrictions

Note: Non-standard Enrollment

If you're enrolled CS 61C normally, you should already be added to everything.

If you're resolving an incomplete and received an email this semester about it, you should also already be added to everything.

If you're a concurrent enrollment student, in CS 47C, or in some other non-standard enrollment for CS 61C, you might not be able to access some of the resources below. If that is the case, please fill out this form so we can add you.

CalNet ID (and Berkeley Google accounts)

Most students should have a CalNet ID (and therefore, email ending in `@berkeley.edu`).

- If a service allows CalNet ID login, use that whenever possible.
- If a service prompts you to sign in with Google, log in using your `@berkeley.edu` email if possible. This is your "Berkeley Google account" (or bConnected account, but nobody says that).
- If you would like to use an existing account on a service, try to add your Berkeley email as the primary email.

Piazza

Piazza is a discussion forum that we'll be using as the main method of communication for this course. All announcements will be made here, and almost all questions or comments you may have should be posted here (unless we say otherwise).

We automatically email invites to the 61C Piazza course every 24 hours. If you were enrolled recently, please wait 24 hours before contacting us about access issues.

Please read through the Discussion Forum section of our policies. Please remember and follow the Piazza Etiquette!

Gradescope

Gradescope is the platform we use for submitting and grading programming assignments.

We automatically email invites to the 61C Gradescope course every 24 hours. If you were enrolled recently, please wait 24 hours before contacting us about access issues.

> **Warning**: Please ensure you set your `@berkeley.edu` email as your **primary** email. If not, we might not be able to find your Gradescope account for grading!

PrairieLearn

PrairieLearn is the platform we use for homework and quizzes.

Visit PrairieLearn and make sure you can see the 61C Fall 2021 course. If not, try the `Add or remove courses` button.

GitHub

GitHub is a hosted Git service we use for code distribution.

If you have an existing GitHub account, feel free to use that; repositories created in this course are private, and anything you do for this course shouldn't affect the rest of your GitHub account.

If you don't have a GitHub account or want to make a separate one for schoolwork, sign up at GitHub.

OH Queue

Office Hours (OH) will be scheduled and managed through the OH Queue. Please use your Berkeley Google account when logging in; non-Berkeley Google accounts will not be able to use the OH Queue properly.

Please review the blue info box on the OH Queue page. If you're having issues, let staff know using the ticket chat. Please note that due to the high volume of tickets, each ticket will be limited to about 15 minutes of help. If you are unable to get your question answered in those 15 minutes, you may rejoin the queue. This is to help ensure that we can give at least some help to every student.

If you are in a lab section, please set the ticket location as the lab section's room number and not `"Online"`, even if you are attending remotely. Lab staff will be filtering based on location, so lab tickets in `"Online"` may get handled as OH tickets. Remote-only lab sections use the `"Remote-only Lab"` location.

When your ticket is called:

- If you are in-person, course staff will call out your name in the room. Wave at them, and they'll come over to you.
- If you are remote, a `Join Call` button will appear. Clicking that will take you to a Zoom room with a staff member.

YouTube & Kaltura

Recordings of discussions and lectures, as well as other video resources, will be uploaded to either YouTube or Kaltura.

Kaltura: Under the bCourses site for this course, there is a `Media Gallery` page. Kaltura uploads will be visible here.

YouTube: YouTube uploads will be linked on the course website. You will need to be signed into YouTube using your Berkeley Google account to view our YouTube uploads. If you're unable to view a video on YouTube, make sure you're using your Berkeley Google account (click your avatar on the top-right corner and `Switch Accounts`, or try the YouTube Channel Switcher page).

Note: If you can't view the videos on YouTube, usually:

- You might be using a personal Google account on YouTube.
- You might be using your Berkeley Google account, but you have 2 or more YouTube channels on that account.

If you see a "More accounts" button when switching accounts, try that. If not, try the channel switcher, or try a private browsing/incognito window.

Zoom

Although we are trying to offer as much of the course in-person as possible, we are still providing options for students to participate in the class virtually. We strongly recommend that students attend lab, discussion, and office hours in-person because we have found that students tend to learn much better in person, especially because this gives them a chance to connect with their peers.

We will be holding remote meetings (lab/project/general OH, lectures, discussions, etc.) through Zoom. When signing in, use the `Sign in with SSO` option, enter `berkeley.zoom.us`, and sign in with your CalNet ID.

Note: If you get an error saying "Unable to sign up with your email address" or "Cannot sign up with email address ending with @berkeley.edu", make sure you are using "Sign in with SSO" and not another method to sign in.

Regularly scheduled meetings (e.g. OH, discussions) will be held in standing Zoom rooms. The links for these can be found in the Zoom Links post on Piazza.

Instructional Accounts and Servers (the hive!)

The EECS department has several instructional computer labs in Soda 271, 273, 275, 277, and 330. Most of the software we'll be using is already pre-installed on these computers, so you use these to work on assignments. As a student in a CS course, you should have 24/7 cardkey access to the labs.

These computers are also accessible remotely, using SSH (more on that later). Later in the semester, we may have assignments that must be complete on "hive machines"; this refers to the group of computers in Soda 330. You can find a list of hive machines at Hivemind (**only** the names starting with `hive`).

You will need to sign up for a `cs61c` instructional account on WebAccount. You'll use this account to access the instructional computers.

Note: If you can't create an account for whatever reason, don't worry! See the Non-standard Enrollment section, and continue without an account for now.

Action Items

- Sign up for and log into all the services described above.
    - Piazza: Make sure you can access the course Piazza. If you haven't already, take a moment to review the Piazza Etiquette on our policies.
    - GitHub: Make sure you can log into the GitHub account you plan to use for this course.
    - Gradescope: Make sure you can log in and see the `Fall 2021` version of the `CS 61C` course.
    - PrairieLearn: Make sure you can log in and see the `Fall 2021` version of the `CS 61C` course.
    - OH Queue: Make sure you can log in without errors. If you haven't already, take a moment to review the info box on the OH Queue.
    - YouTube/Kaltura: When lecture 1 is uploaded, make sure that you can view the video. If it's not uploaded yet, you can come back to this later.
    - Zoom: Follow the login instructions in the Zoom section above. Make sure you can join the various OH rooms.
    - Instructional Account: If you haven't already, visit WebAccount and create a `cs61c` instructional account

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Exercise 3: Command Line Essentials

If you took CS61A and CS61B, you likely have some experience with a command line interface (CLI) and terminal commands. We'll be using the CLI a lot in this course, so let's take a moment to review some of the basics.

Example commands will be formatted like:

```
$ echo Hello world
```

In this case, `echo` is the command, and `Hello` and `world` are arguments. Typing that line in your terminal will run the command. In this case, it just prints `Hello world` to your terminal.

Flags are commonly used to specify program options or alter behavior. They usually begin with one or two dashes, and can optionally take an argument.

```
$ git --version | ok
$ python3 -c 'print("Hello world")'
```

It's generally recommended to wrap strings that should be a single argument in single quotation marks (e.g. `'longer string with *&)_@#(&$! symbols'`), or you may run into unintended behavior -- many of those symbols actually do something if left unquoted/unescaped!

You may find it helpful to review 61B's list of common CLI commands.

CLI Keyboard Shortcuts

When typing commands or file paths:

- `Tab` will try autocomplete the current term based on what you wrote so far
  - If the current directory has `filename1.txt` and `filename2.txt`, `f` `Tab` `1` `Tab` will result in `filename` after the first tab, and `filename1.txt` after you type `1` and the second tab
- `Up Arrow` and `Down Arrow` will allow you to move through commands you've used previously, so you don't need to type them again.
- `Ctrl` + `a` will move the cursor to the beginning of the current line (helpful for fixing mistakes)
- `Ctrl` + `e` will move the cursor to the end of the current line (also helpful for fixing mistakes)
- `Ctrl` + `r` will let you search through your recently used commands

Hello World

`echo` repeats whatever arguments you give it.

```
$ echo Hello World
```

Working With Files

`touch` will create a blank file with the file name you provided.

```
$ touch example.txt
```

This will create a file named `example.txt` with nothing inside.

If you'd like to create a file and add text in one go, you can use:

```
$ echo 'Your contents here' > example.txt
```

This will create a file with the name `example.txt` in your current directory. If the file already exists, it will be overwritten. The file will contain `Your contents here`, without the quotation marks. The `>` symbol takes one argument which redirects where data printed to stdout is sent. Here, we are redirecting the output of `echo` to a file named `example.txt`.

You can view the contents of a file with the `cat` or `less` commands.

```
$ cat example.txt
$ less example.txt
```

`cat` print the contents of `example.txt` to your terminal. `less` opens a basic viewer which allows you to scroll and search.

File Paths

You can provide a relative or absolute path to point to files that are not in the current directory:

```
$ cat ../other-folder/file-in-other-folder
$ cat ~/file-in-home-folder
$ cat /creeper/awww_man
```

In relative paths, `.` refers to the current directory, and `..` refers to the parent directory. Given a folder structure:

```
root-dir/
    sub-dir-1/ (current directory)
        file-1.txt
    sub-dir-2/
        file-2.txt
```

- `.` refers to `sub-dir-1`, the current directory (e.g. `./file-1.txt`)
- `..` refers to `root-dir`, the parent directory (e.g. `../sub-dir-2/file-2.txt`).
- To open `file-2.txt`, you can run `vim ../sub-dir-2/file2.txt`, or `cd ../sub-dir-2` and `vim file-2.txt`.

`man` - Manual Pages

The manual pages ("man pages") are great UNIX resources that are often underused; while not as versatile as Google, they contain documentation on UNIX components from program usage, language standards and conventions, and more. They also work offline, so they can be handy if you're ever stuck in a North Alaskan woodland cabin in the middle of a snowstorm basking in the dying glow of a ThinkPad ~~which BTW runs Arch Linux~~.

While your favorite search engine probably also has the answers you're looking for, in this course, we'd still like you to get comfortable with using `man`, especially for C and UNIX-related questions.

If you want the man page for a single program/command, you can run:

```
$ man command_name | less
```

The man page for a program typically contains information about what the program is used for, what certain flags do when you invoke the program with them, and where to go for more information. Since we piped the man page into `less`, this page is scrollable (use your arrow keys or the space bar). Hit `q` to exit the man page and get back to your terminal prompt.

```
$ man echo | less
```

The above command should bring up the man page for the `echo` command.

If you want to search the man pages for a command that pertains to a keyword:

```
$ man -k single_keyword | less
```

This command will search the manual pages for a command with the keyword `single_keyword`. Forget how to open files in Vim? You can search for `editor` and get a list of all editor-related commands on your system.

`ssh` - "Secure Shell"

For this class, we'll expect you to test most of your projects, homeworks, and labs on the hive machines. To access the hive machines remotely, you'll be using the SSH protocol and programs.

Note: If you weren't able to get an instructional account, you can come back here later!

You can find a list of hive machines at [Hivemind](). There are 30 of them, named `hive1`, `hive2`, ..., `hive30`. If its name starts with `hive`, it is a hive machine. If it doesn't start with `hive` (sorry `ashby`), it's not a hive machine. Using a non-hive machine may lead to weird setup/runtime errors.

Sometimes, a hive machine may be down or overloaded. If you're getting "`Connection refused`" or "`Connection timeout`" or other connection errors, check Hivemind and pick another machine to use.

Once you have an instructional account, you can SSH into an instructional server with the following command:

```
$ ssh cs61c-???@hive#.cs.berkeley.edu
```

Remember to replace `cs61c-???` with your instructional account username, and `hive#` with a hive machine's name. Your default password is displayed by [WebAccount]() when creating the account, and you can reset your password on WebAccount if you forgot it.

Troubleshooting:

- If nothing happens for a long time: check your internet connection. Some network firewalls, including `CalVisitor` on campus, block SSH. Try another network (`eduroam` if you're on campus).
- `Permission denied, please try again`: if you're copy-pasting the password, try typing it out manually.
- `Connection refused` or other weird errors: the hive machine you picked might be down. Try another one
- `Reserved for cs61c staff`: try another hive machine :)

When your connection succeeds, you should be able to interact with and run commands on your chosen hive machine! To exit this SSH session, simply run:

```
$ exit
```

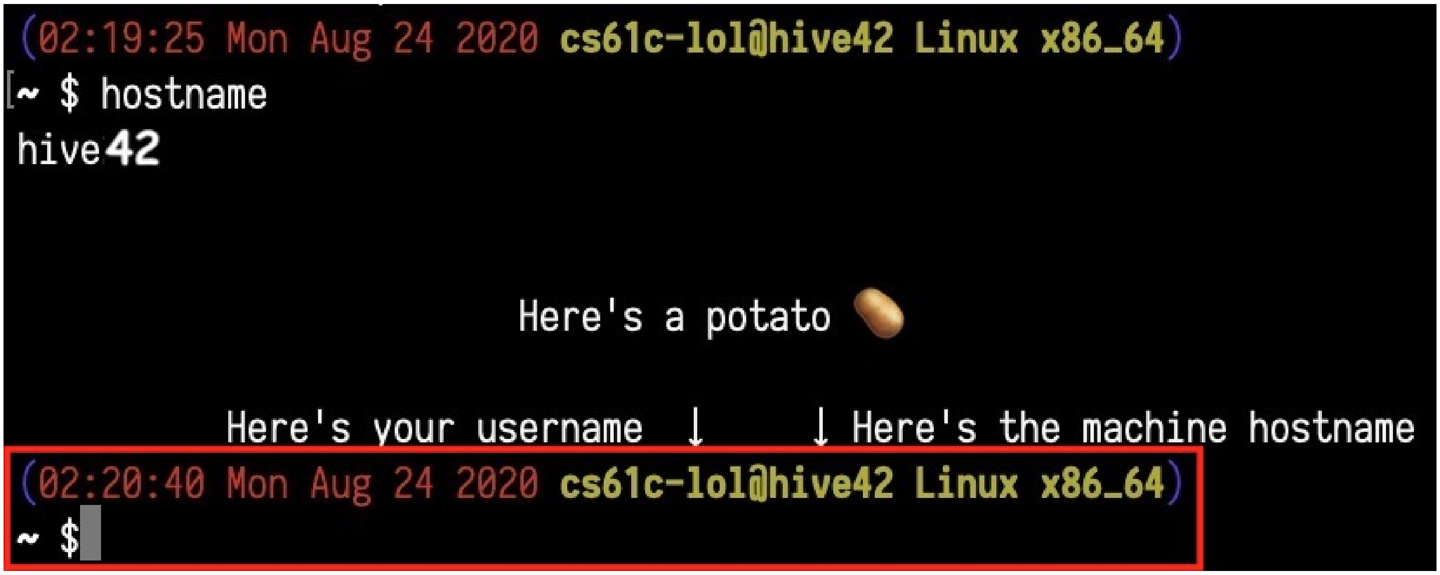
Files on the hive machines are stored on a network drive, so your account will have the same files on all 30 hive machines (and other instructional lab computers).

If you want to change your instructional account password, you can SSH into the update server:

```
$ ssh cs61c-???@update.cs.berkeley.edu
```

Sanity Check

When you're in a SSH session, your prompt should look similar to this (the area *inside*, but not including, the red box):



```
(02:19:25 Mon Aug 24 2020 cs61c-lol@hive42 Linux x86_64)
~ $ hostname
hive42


                         Here's a potato 🥔

         Here's your username  ↓      ↓ Here's the machine hostname
(02:20:40 Mon Aug 24 2020 cs61c-lol@hive42 Linux x86_64)
~ $
```

If it looks very different (e.g. the prompt is white text instead of red and yellow text), try running `/home/ff/cs61c/bin/fix-dotfiles`.

```
$ /home/ff/cs61c/bin/fix-dotfiles
```

If your prompt still looks very different, contact course staff on Piazza.

`scp` - "Secure Copy"

The `scp` program is used for copying files between computers using the SSH protocol.

Sometimes, you may want to get individual files or entire folders from the hive machines onto your local system, or vice versa. You can do this by using `scp`:

```
$ scp <source> <destination>
```

To specify a remote source or destination, use `username@host:path`. To specify a local destination, just use `path`. As an example:

```
$ scp cs61c-???@hive3.cs.berkeley.edu:~/some-folder/example.txt ~/Downloads/
```

Assuming my username is `cs61c-???`, the above command would connect to `hive3` and copy `~/some-folder/example.txt` on my instructional account to `~/Downloads/example.txt` on my local machine.

If I wanted to copy the other direction (from my local machine to a hive machine) I would use:

```
$ scp ~/Downloads/example.txt cs61c-???@hive4.cs.berkeley.edu:~/some-folder/
```

`scp` by default only works with files. To copy folders, you need to tell scp to "recursively" copy the folder and all its contents, which you can do with the `-r` flag:

```
$ scp -r cs61c-???@hive5.cs.berkeley.edu:~/some-folder ~/Downloads/
```

Pay attention to the slashes: writing `some-folder` will copy the folder itself and files inside, while `some-folder/` will only copy the files inside.

Warning: Running `scp` on the hive machines (e.g. when you're in a SSH session) is usually not desired behavior. Running `scp example.txt cs61c-???@hive14.cs.berkeley.edu:~/example.txt` on a hive machine will copy `example.txt` to... the same place. You probably want to run it in a local terminal session!

Vim Basics

`vim` is a text editor included on the hive machines and many UNIX-based distributions.

Note: We'll be using Vim in most of our examples and documentation, but we have no hard requirement on which text editor you use; you're welcome to pick whatever you're comfortable with, but you should know how to use at least one terminal-based text editor.

To open a file from your current directory, pass the file name to Vim:

```
$ vim filename
```

To open a file from another directory, use a relative or absolute path:

```
$ vim ../other-folder/filename
```

Some useful Vim commands:

Command	**Explanation**
`Esc` `:q`	Closes (quits) Vim without saving
`Esc` `:wq`	Closes Vim after saving
`Esc` `:w`	Saves your file
`Esc` `:q!`	Force-quit Vim (for when you've made changes but do not wish to save them)
`Esc` `i`	Insert mode, allows you to type into the file
`Esc` `/cats`	Searches your file for the nearest occurrence of the string "cats". Press `n` to go to the next occurrence or `N` to go to the previous
`Esc` `:set nu`	Shows line numbers within your file

Note: these commands are preceded by `Esc` because you'll need to press the escape key on your keyboard to switch you out of your current mode. For example, if I'm inserting (typing) into a file and want to save, I'd have to hit `Esc` to get out of insert mode, then type `:w` to save my file. If you aren't in a mode (i.e. you've just opened your file) you don't need to hit escape first, but it won't hurt :)

By default, Vim doesn't enable mouse support or line numbers. If you want these:

1. Open up `~/.vimrc` (`vim ~/.vimrc`)
2. To enable your mouse, add a new line containing `set mouse=a`
3. To enable line numbers, add a new line containing `set number`
4. Save and quit. Try opening your vimrc file again

Vim has many more configuration options available -- feel free to experiment with Vim resources you find online!

We also have a Vim for CS61C guide that you can reference. Thanks Yijie!

Action Items

SSH into any hive machine. Then:

- If there is a prompt asking you to enter some information:
  - Last name (family name)
  - First name (given name) and any middle name(s)
  - Student ID
  - Email address: please use your Berkeley email
  - Code name: just pick something random. Ignore the "posting grades" bit, we don't use this system for any grades
- If there was a prompt, run `check-register`, and verify that your name, email, and student ID are correct. If anything is incorrect, run `re-register`.
  - The first email address shown **must** be your primary email on your Gradescope account.
- If there wasn't a prompt, follow the previous bullet point anyway.
- If you're getting tired of reading, try taking a short break (Minesweeper, anyone?)

Exercise 4: Setting Up Programs

We're going to be using a couple programs and tools, outlined below:

- CLI (command line interface)
  - `git` for distributing and managing code
  - `python3` 3.6+ for running various scripts
  - `gcc` 7+ for compiling C programs
  - `java` 9+ for RISC-V simulation (Venus) and circuit simulation (Logisim)
- GUI (graphical user interface)
  - A browser
  - A terminal program
  - Java 9+ for visual circuit simulation, and other interactive simulations

CLI: the hive machines provide a Linux environment with all CLI tools already pre-installed and set up. We strongly recommend that you use the hive for assignments that use CLI tools to avoid annoying setup issues (especially on Windows). If you must work locally, note that we may not be able to help with local setup issues.

GUI: You will have to run GUI programs locally (screen forwarding over SSH is difficult and buggy). However, there are less complexities and potential issues with the GUI programs than with the CLI programs.

OS-specific Setup

The following sub-sections contain information and tips for specific OSes. Pay attention to the OS name; commands for one OS may break things on another OS!

As noted above, please remember that we strongly recommend that you do most of your work on the hive machines. The staff may not be able to help you troubleshoot issues if you choose to use another machine.

Ubuntu Linux

Ubuntu 18.04+ has the required programs in the default APT repositories. The following command will install them automatically:

```
$ sudo apt update
$ sudo apt install build-essential cgdb curl default-jre git python3 python3-pip valgrind
```

The built-in terminal can be used for CLI programs.

macOS

The built-in `Terminal` app can be used for CLI programs.

Recommended installation:

- Open the `Terminal` app
- Install the Xcode Command Line Tools:
  ```
  $ xcode-select --install
  ```
- If you do not have Python 3.6+ installed (`python3 --version` should say `3.6` or higher):
  - Download and install the [latest version of Python 3 (64-bit)]()
- If you do not have Java 9+ installed (`java -version` should say `1.9` or higher):
  - Download an OpenJDK 9+ build from [Microsoft]() (yes, seriously).
    - The `.pkg` installer is much easier to install than the `.tar.gz` version.
    - If you have a M1-based computer, you will probably need OpenJDK 16.
  - Open the `.pkg` installer and follow the instructions.

Notes:

- (C)GDB and Valgrind are difficult to get working on macOS. LLDB is available, but its syntax is somewhat different from GDB's.

- Most of our stuff that runs on Intel-based Apple computers should also run on M1-based computers. If it doesn't, try reaching out on Piazza.

Windows

This one is a bit tricky. Developing in C on Windows works better in Windows Subsystem for Linux (WSL), but GUI support in WSL is spotty. WSL by default has its own set of accounts and files, separate from your Windows user data.

Recommended installation:

- Install Windows Subsystem for Linux (WSL)
  - WSL 1 or 2 works, but we have observed less issues with WSL 2
  - We recommend Ubuntu 18.04, since that is the OS on the hive machines so the experience will be similar
  - This should install a terminal called `Ubuntu Bash` or similar. Note that `Ubuntu Bash` and `Git Bash` are very different!
- Inside WSL (open `Ubuntu Bash`) and run the following:

```
$ sudo apt update
$ sudo apt upgrade
$ sudo apt dist-upgrade
```

- Still in WSL (`Ubuntu Bash`), install the CLI programs:

```
$ sudo apt install build-essential cgdb default-jre gdb git python3 python3-pip valgrin
```

- Now, outside WSL (in regular Windows), download and install the latest version of Python 3 (64-bit)
  - Make sure to **select the "Add Python 3.x to PATH" option**
- Still outside WSL, download and install Git Bash
  - Make sure to **select the "Use Windows' default console window" option** instead of "Use MinTTY"
- Still outside WSL, download and install Microsoft OpenJDK
  - You can skip this if you have an existing install of Java 9+

Tips:

- With the recommended installation, `Ubuntu Bash` is a terminal that runs inside WSL, and `Git Bash` is a terminal that runs outside WSL. Assignments involving `gcc` or RISC-V should be done in WSL, and assignments involving Logisim should be done outside WSL.
- By default, you can access your Windows files from WSL, but not vice versa (e.g. `C:\Users\Herobrine\Documents\cs61c` on Windows is `/mnt/c/Users/Herobrine/Documents/cs61c` in

WSL). We recommend that you work in a Windows user directory (like `Documents` from the example) so you can swap between WSL and Windows.

- On Windows (not WSL), Python 3 may not be installed as `python3`. Try the following commands -- if you find a command that returns Python 3 (not Python 2), use that instead of `python3` for the rest of this lab and in future assignments:

  ```
  $ python3 -V
  $ python -V
  $ py -V
  ```

Other OSes

If you're using another Linux distribution (Alpine/Arch/Debian/Fedora/etc.), most of our programs should run fine, but we don't have resources to test on distros other than Ubuntu. If you're having trouble, you can try reaching out on Piazza or visit OH, but please note that staff has limited experience with these.

If you use *BSD, HaikuOS, TempleOS, or anything else, we unfortunately don't have the resources to support these platforms. If programs don't work, you can use the instructional computers (or other supported platforms).

Action Items

- To test your GUI environment, download Logisim here. Open a terminal in your GUI environment, `cd` to the download location, and run the JAR:

  ```
  $ java -jar logisim-evolution.jar # replace the filename with the one you downloaded
  ```

  If the Logisim GUI interface pops up, you're all set! We won't be using it further, so you can close Logisim after checking that it works.

- To test your CLI environment, open a terminal in your CLI environment and run the following:

  ```
  $ git --version
  $ python3 --version
  $ gcc --version
  $ java -version
  ```

  Make sure none of the commands throw errors!

Exercise 5: Fun with Git

In this exercise, you'll get your labs Git repository ("repo"), use Vim, and work with a variety of Git commands. By the end of it, you should feel comfortable using SSH, editing files, pulling/committing/pushing, and resolving merge conflicts. If you'd like to review your Git commands before beginning, you can check out this guide.

Getting Your Lab Repo

Visit Galloc. Log in, connect your GitHub account, and start the lab assignment. A GitHub repo will be created for you; this will be your personal repo for any lab work you do throughout the semester.

Configuring Git

Before we start, let's tell Git who you are. This information will be used to sign and log your commits. You may not need to do this if you've set up Git before, but if you're on the hive machines it's likely a step you'll need to take.

First, run the following commands on your local machine (make sure to change the name and email to match your information):

```
$ git config --global user.name "John Doe"
$ git config --global user.email johndoe@example.com
```

If you have an instructional account, SSH into a hive machine, and run the same commands.

Cloning Your Repo

Git has the concept of "local" and "remote" repositories. A local repo is located wherever your terminal session is; if you're in a SSH session, the local repo is a folder on a hive machine; if your terminal session on your local machine, the local repo is located on your local machine's filesystem. A remote repo (e.g. GitHub repo) is typically hosted on the Internet.

You have a lab repository on GitHub, but not locally (it would be a little worrying if a website could automatically access your local files). To get a local copy of this repository, you can use `git clone`, which will create a local repository based on information from a remote repo.

If you have an instructional account, SSH into a hive machine. On the hive clone the repository into a folder called `labs`:

```
$ git clone GITHUB_REPOSITORY_URL labs
```

Note: Make sure you replace `GITHUB_REPOSITORY_URL` with the actual URL!

If you don't have an instructional account, that's fine! Clone the repository into a folder called `labs_hive`. For the rest of this exercise, any reference to your repository on the hive is referring to this repository.

```
$ git clone GITHUB_REPOSITORY_URL labs_hive
```

Exploring Your Repo

`cd` into this new folder. List all hidden files (`ls -a`). Do you see a hidden file/folder?

There is indeed a folder called `.git`. Its presence indicates that the current folder (folder containing `.git`) holds a Git repository.

Take a look at your repo's current remotes and status:

```
$ git remote -v
$ git status
```

`git clone` has already worked a bit of magic here; there's a remote called `origin`, and its URL points to your labs repo on GitHub! You're on a local branch called `main`, which is "tracking" `origin/main` (the `main` branch on the `origin` remote).

> **Note**: GitHub now uses `main` as the default branch name, not `master`

Throughout the semester, course staff may make updates to starter code to fix bugs or release new labs. To receive these updates, you'll need to add another remote.

```
$ git remote add starter https://github.com/61c-teach/fa21-lab-starter.git
```

If you ever want to pull **updated** starter code, you'd execute the following command:

```
$ git pull starter main
```

Try it out now! Since you just started lab, there might not be any updates to pull yet.

Fizzing and Buzzing

1. `cd` into the `lab00` folder in your repo, and take a look at the files present (`ls`).
2. Run `git fetch --tags --force starter && bash setup.sh` to set up this exercise. After that, don't pull until the pull instruction in step 4.
3. Use Vim to open up `code.py` and look through the `fizzbuzz(num)` function. It should:

   - Print `"num: fizz"` if num is a multiple of 3
   - Print `"num: buzz"` if num is a multiple of 5
   - Print nothing if the num is not a multiple of 3 or 5

   However, if you run the program (`python3 code.py`), that doesn't seem to happen! Try to fix this bug by only editing the `if` and `elif` statements. After fixing the code, save, add, and commit your work using `git add` and `git commit`.

4. After committing your fix, push your work.

   Or at least, try to push your work. You should encounter an error:

   ```
    ! [rejected]        main -> main (non-fast-forward)
   error: failed to push some refs to 'github.com:61c-student/fa21-lab-username.git'
   hint: Updates were rejected because the tip of your current branch is behind
   hint: its remote counterpart. Integrate the remote changes (e.g.
   hint: 'git pull ...') before pushing again.
   hint: See the 'Note about fast-forwards' in 'git push --help' for details.
   ```

   Let's break that down:

   - `"failed to push some refs to REPO_URL"`: the push failed
   - `"the tip of your current branch is behind its remote counterpart"`: the remote repo (on GitHub) has commits that your local repo doesn't
   - `"Integrate the remote changes (e.g. 'git pull ...') before pushing again"`: we need to tell Git how to integrate the mysterious commits

   Try pulling the remote changes with `git pull`. If you get a `"fatal: Not possible to fast-forward, aborting"`, try `git pull --ff`. You should encounter another error:

   ```
   Auto-merging lab00/code.py
   CONFLICT (content): Merge conflict in lab00/code.py
   Automatic merge failed; fix conflicts and then commit the result.
   ```

   Uh oh, a merge conflict:

   - `"Merge conflict in lab00/code.py"`: both the remote repo and local repo have commits that made changes to `lab00/code.py`
   - `"Automatic merge failed"`: Git tried to figure out how to integrate the commits, but couldn't
   - `"fix conflicts and then commit the result"`: Looks like we need to manually resolve the merge conflict!

   You can check `git status`:

   ```
   On branch main
   Your branch and 'origin/main' have diverged,
   and have 1 and 1 different commits each, respectively.
     (use "git pull" to merge the remote branch into yours)

   You have unmerged paths.
   ```

```
  (fix conflicts and run "git commit")
  (use "git merge --abort" to abort the merge)

Unmerged paths:
  (use "git add <file>..." to mark resolution)
  both modified:   code.py
```

Open the conflicted file in Vim. You should see something like:

```
def fizzbuzz(num):
<<< HEAD
  "your code"
===
  "not your code"
>>> remote-commit-hash

for i in range(0, 20):
```

It looks like your imaginary partner, Oski, also tried to fix the bug, without telling you. *Dangit Oski*! Oski's code seems rather... inefficient, so you want to keep your fix. However, Oski did do something useful: there's another `if` case, so multiples of 15 will print 1 line with "fizzbuzz" rather than 2 lines with "fizz" and "buzz". In other words, Oski and you have both made changes you would like to keep!

Now, with that in mind, fix the `fizzbuzz(num)` function by integrating both versions into one, and then removing extra merge conflict markers (`<<< HEAD`, `===`, `>>> commit-hash`). The fixed function should look something like:

```
def fizzbuzz(num):
  if multiple of 15:
    # print num: fizzbuzz
  elif multiple of 3:
    # print num: fizz
  elif multiple of 5:
    # print num: buzz
```

When you're done, save, add, and commit your work. Now, if you push, there shouldn't be a conflict anymore. One merge conflict defeated!

5. Still on your local machine, `cd` into the `lab00` folder if you're not there already. If your system uses non-default commands (e.g. `python` instead of `python3`), open `gen-debug.sh` and edit the commands as appropriate. Then, run the following command:

   ```
   $ bash gen-debug.sh
   ```

   This creates a file called debug.txt that records a bit of debugging information for the autograder. Add, commit, and push this file.

Submission

To submit your work, push your work to your lab repository on GitHub.

Every lab will have autograded exercise(s). To submit to the autograder, you'll need to push your work to your lab repository on GitHub. Then go to the corresponding assignment on Gradescope (**Lab 0** for this lab), select your lab repository, and submit. After a short wait, the page should show your autograder score for the lab.

Remember, to get credit for a lab, make sure you have finished all the exercises and passed all the autograder tests by 11:59:59 PM PT!

Checkoff

You made it! That was quite a bit of reading and head-scratching, but you're now somewhat more familiar with the tools you'll be using for the rest of the semester. Worth it!

Please check that you (and your partner, if you have one) have:

- Completed the course policies quiz from Exercise 1.
- Registered for the services from Exercise 2.
- Registered and checked your information on the hive in Exercise 3.
- Installed the tools from Exercise 4.
- Completed the Git exercise in Exercise 5.
- Passed the `Lab Autograder` for this lab

Take a moment to familiarize yourself with the CLI keyboard shortcuts (e.g. tab complete) and commands described in exercise #. For checkoff, we'll ask you to demonstrate navigating around your lab repo using those commands and shortcuts.

Checkoff Procedure

On the OH Queue, make a ticket. If you are checking off with a partner, only one partner should make the ticket. The ticket should have:

- Assignment: Lab # that you want checkoff for.
- Question: `Checkoff` (one word, no space).
- Location: the lab room for the section you are checking off in. Even if you are attending remotely, please put the section room and not `"Online"` -- staff will be filtering by location so

checkoffs in `"Online"` might get skipped or handled as normal OH tickets. Remote-only sections use the `"Remote-only Lab"` location.

- Description: put `in person` or `remote`, depending on where you are. If you are checking off with a partner, also write your partner's name.

When your ticket is called:

- If you are in-person, course staff will call out your name in the room. Wave at them, and they'll come over to you.
- If you are remote, a `Join Call` button will appear. Clicking that will take you to a Zoom room where you can continue the checkoff.

When the checkoff is complete, the staff member will ask for your hive account username (`cs61c-xxx`), and record the checkoff.

Appendix

These are some tools you may find helpful, but are by no means required for this course :)

Text Editors and IDEs

CS61C doesn't endorse any particular text editor or IDE. Many people get by in this course using a text editor with no frills (think: Vim/Emacs/Nano). We'll expect you to know how to use at least one CLI-based text editor, since you'll be dealing with the command line a lot.

The majority of students do their work in a local editor (Sublime, VSCode, CLion) and use Git to copy their files from their local machine to the hive. Some students also set up Cyberduck, Filezilla, VSCode Remote SSH, or other SFTP programs to make editing remote files easier. Again, we can't provide course-official support for every program under the sun, but you're welcome to do what works best for you.

Quick SSH (Recommended)

Tired of typing up an entire SSH command and password? 15 minutes could save you 15% of the time you spend on the command line! Follow the instructions here to set up SSH keys for GitHub and hive machines.

○ Dark Mode