



**BROWN**  
Center for  
Biomedical Informatics



Advance  
Rhode Island  
Clinical & Translational Research  
CIR-1549P0007

## CCV Bootcamp 2023

### Health Informatics:

### Health Data and Computing Basics

Friday, June 9, 2023 9:00am-12:00pm

Brown AMS Room 270 | Zoom

## 1. Overview

### Instructor/TA Team

- [Liz Chen, PhD, FACMI](#) (Contact: [liz\\_chen@brown.edu](mailto:liz_chen@brown.edu))
- [Neil Sarkar, PhD, MLIS, FACMI, ACHIP](#)
- [Karen Crowley, MS, PhD](#)
- [Ashlin Harris, PhD](#)
- [Farahnaz Maroof, MS](#)
- [Mounika Thakkallapally, MS](#)

### Description

This hybrid session during [CCV Research Computing Bootcamp 2023](#) will cover basic processing and analysis of an openly-available demo of a de-identified electronic health record (EHR) dataset using Unix commands, SQL, Julia, Python, and R in Oscar.

Note: Brown University provides several computing services that can be used for storage and analysis of electronic health data depending on the [Data Risk Classification](#) and requirements of the health data provider. This includes the [Oscar](#) high performance computing environment and [Stronghold](#) secure computing environment. The [Unified Research data Sharing and Access \(URSA\) Initiative](#) can be leveraged to determine the appropriate environment for a particular health dataset.

### Tentative Schedule

|                 |                              |
|-----------------|------------------------------|
| 9:00am-9:30am   | Introduction and Data Review |
| 9:30am-10:00am  | Unix Commands                |
| 10:00am-10:30am | SQL                          |
| 10:30am-10:45am | Break                        |
| 10:45am-11:45am | Julia, Python, and R         |
| 11:45am-12:00pm | Wrap Up                      |

## 2. Prerequisites

Familiarity with skills covered in the following CCV Bootcamp sessions is recommended but not required:

| Tuesday, June 6, 2023                                                                                          | Thursday, June 8, 2023                                                                                                             |
|----------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------|
| Getting Started on Oscar<br>Using Oscar: Open OnDemand and VSCode<br>Working on the Command Line<br>Basic Bash | Introduction to Julia<br>Python Programming Basics Part I<br>Python Programming Basics Part II<br>An Introduction to R Programming |

### 3. Health Data

Learn more about the Medical Information Mart for Intensive Care (MIMIC) and demo dataset that will be used in this session.

- Johnson AEW, Bulgarelli L, Shen L, Gayles A, Shammout A, Horng S, Pollard TJ, Hao S, Moody B, Gow B, Lehman LH, Celi LA, Mark RG. [MIMIC-IV, a freely accessible electronic health record dataset](#). Sci Data. 2023 Jan 3;10(1):1.
- [MIMIC-IV Clinical Database Demo](#)
- [MIMIC-IV Documentation](#)

### 4. Oscar Setup

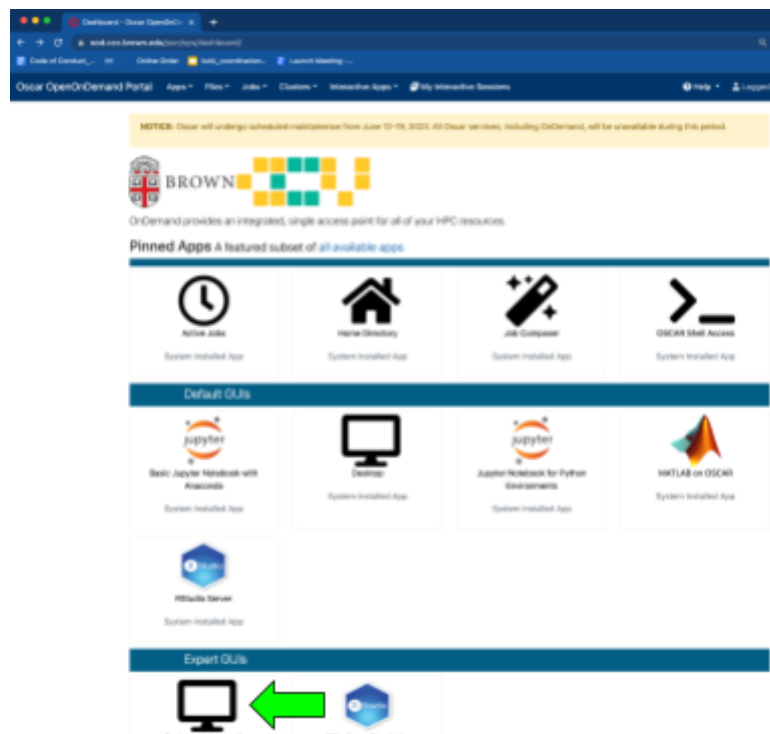
#### Get Oscar Account

- Register for Oscar Account: <https://docs.ccv.brown.edu/oscar/>
  - *Note: It may take a few days to process the request.*
- Learn about Oscar: [Oscar - Brown University's Cluster](#)
- Adhere to Brown IT Policies: [CCV User Policies](#) and [OIT Policies](#)
- Review [Quickstart Guide](#)
  - OSCAR
  - What username and password should I be using?
  - Connecting to Oscar for the first time
- Watch [Short "How to" Videos](#)
- Troubleshoot with [Common Problems](#) and [FAQ](#)

#### Login to Oscar using Open on Demand (OOD)

Go to: <https://ood.ccv.brown.edu/>

Click on "Desktop (Advanced)" under "Expert GUIs"



Configure interactive desktop (use default values except for the following) and then click “Launch”

- Number of hours: 4
- Num cores: 1
- Memory: 7 GB

Home / My Interactive Sessions / Desktop (Advanced)

**Interactive Apps**

- Default GUIs
- Basic Jupyter Notebook with Anaconda
- Desktop
- Jupyter Notebook for Python Environments
- MATLAB on OSCAR
- RStudio Server
- Expert GUIs
- Desktop (Advanced)**
- RStudio on Singularity

**Desktop (Advanced) version: v0.2.2**

This app will launch an interactive desktop on one or more compute nodes. You will have full access to the resources these nodes provide. This is analogous to an interactive batch job.

**THIS APP IS STILL IN BETA**

**Account**

You can leave this blank if you are not using a conda else enter the conda name here for example `cbc--conda`

**Desktop Environment**

xfce

Choose xfce unless you have been asked to use something else

**Number of hours**

4

**partition**

batch

Choose the partition to run this job

**Num Cores**

1

Indicate the number of cores you need. The default is 1

**Num Gpus**

0

Indicate the number of gpus you need. A valid partition with GPUs need to be specified. Enter 0 for batch, debug or bigmem partitions. Entering 0 for gpu, gpu-debug and gpu-he partitions will result in job failure.

**Memory (GB) (optional)**

7

Amount of memory to allocate

**Reservation**

Enter the reservation name here. Leave it blank if you are not using a reservation for submitting jobs.

**Slurm Features**

This field is optional. Enter any required Slurm feature here. To see an exhaustive list of Slurm features, please click [here](#).

☐ I would like to receive an email when the session starts

**Launch**

Click “Launch Desktop (Advanced)” once created

Home / My Interactive Sessions

**Interactive Apps**

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- MATLAB on OSCAR
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- Expert GUIs
- Desktop (Advanced)**
- RStudio on Singularity

**Desktop (Advanced) (10143377)** 1 node | 1 core | Running

**Host:** node1322.oscar.ccv.brown.edu Delete

**Created at:** 2023-06-05 11:33:58 EDT

**Time Remaining:** 3 hours and 59 minutes

**Session ID:** ee7300a8-0c34-41ed-b6f3-7188e62e2cfa

**Compression**

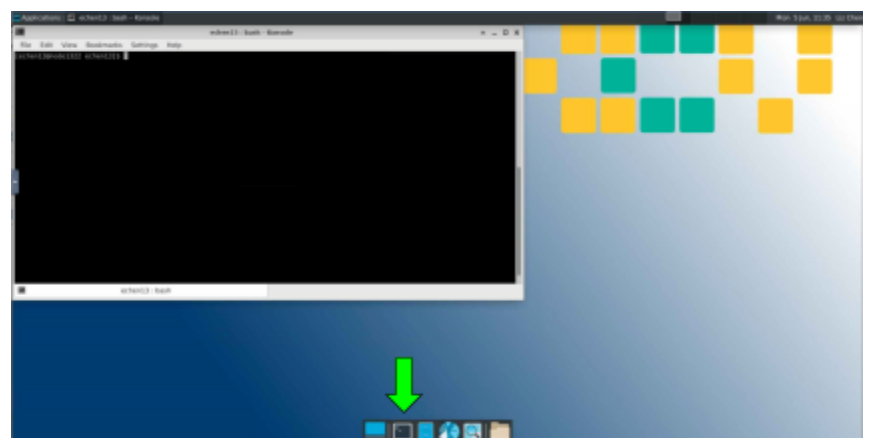
0 (low) to 9 (high)

**Image Quality**

0 (low) to 9 (high)

**Launch Desktop (Advanced)** View Only (Share-able Link)

Click on “Terminal Emulator” Application in the Launch Bar on the bottom once desktop is launched



## 5. Computing Environment Setup

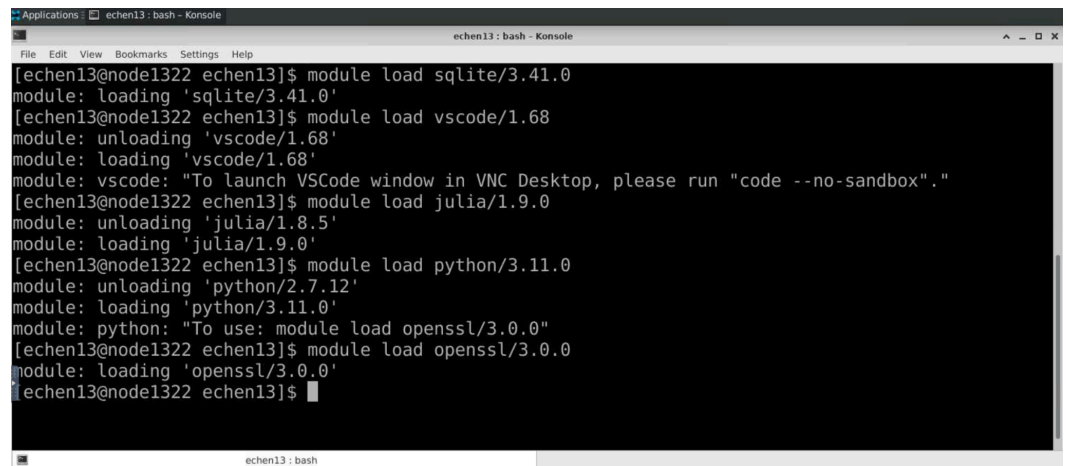
### Modules in Oscar

- Help manage the software environment on Oscar
- Can “load” and “unload” modules to configure your computing environment
- Documentation (Using Modules): <https://docs.ccv.brown.edu/oscar/software/modules>
- Short Video (How to Use Modules in Oscar): <https://docs.ccv.brown.edu/oscar/short-videos>

### Load and Test Modules

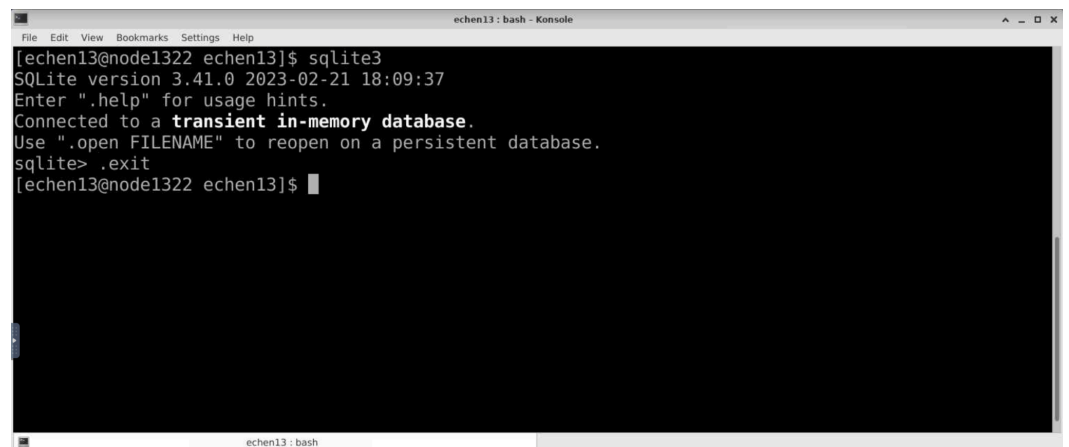
- Modules: SQLite, VS Code, Julia, and Python
- Load and test in advance of Friday if possible (more details about each can be found below)

#### Load Modules



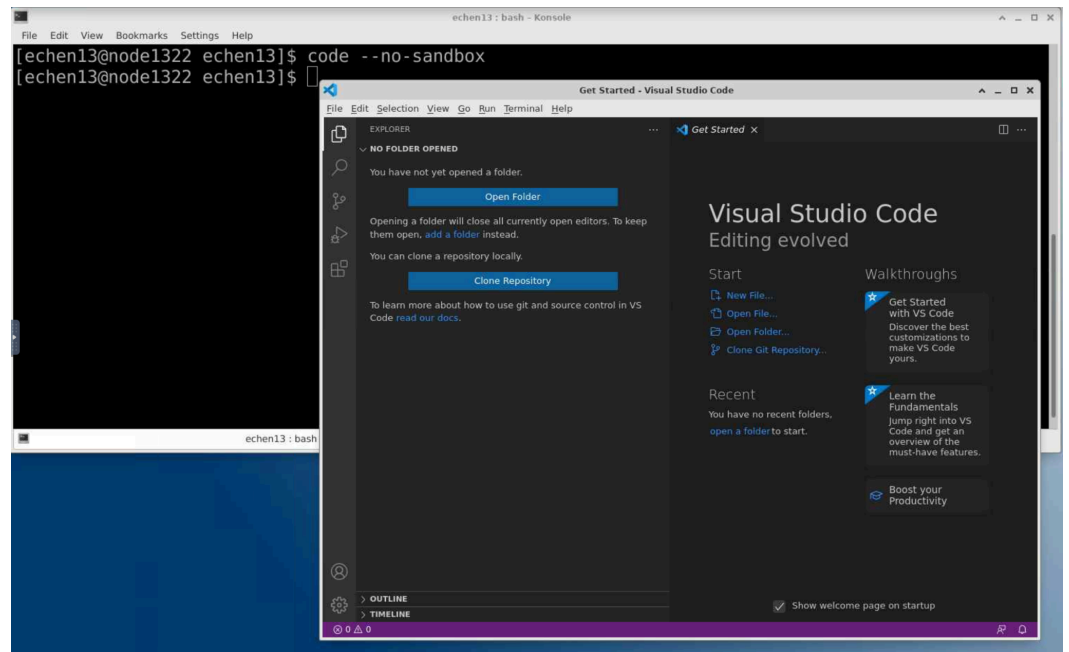
```
[echen13@node1322 echen13]$ module load sqlite/3.41.0
module: loading 'sqlite/3.41.0'
[echen13@node1322 echen13]$ module load vscode/1.68
module: unloading 'vscode/1.68'
module: loading 'vscode/1.68'
module: vscode: "To launch VSCode window in VNC Desktop, please run "code --no-sandbox"."
[echen13@node1322 echen13]$ module load julia/1.9.0
module: unloading 'julia/1.8.5'
module: loading 'julia/1.9.0'
[echen13@node1322 echen13]$ module load python/3.11.0
module: unloading 'python/2.7.12'
module: loading 'python/3.11.0'
module: python: "To use: module load openssl/3.0.0"
[echen13@node1322 echen13]$ module load openssl/3.0.0
module: loading 'openssl/3.0.0'
[echen13@node1322 echen13]$
```

#### Test SQLite3

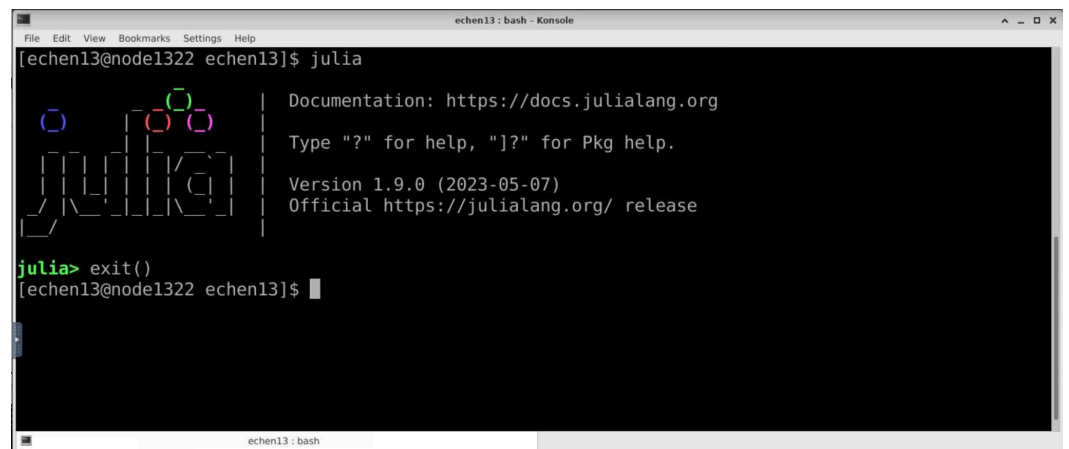


```
[echen13@node1322 echen13]$ sqlite3
SQLite version 3.41.0 2023-02-21 18:09:37
Enter ".help" for usage hints.
Connected to a transient in-memory database.
Use ".open FILENAME" to reopen on a persistent database.
sqlite> .exit
[echen13@node1322 echen13]$
```

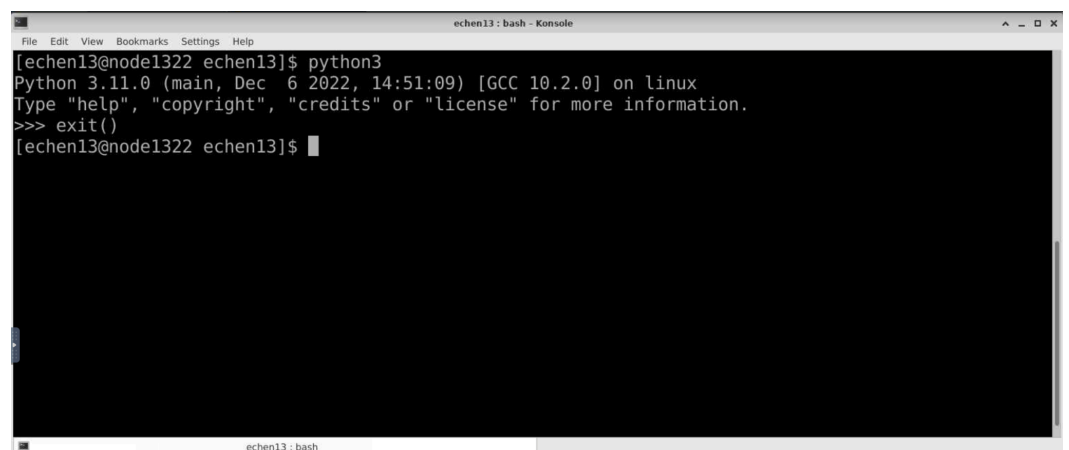
## Test VS Code



## Test Julia REPL



## Test Python



# SQLite

## What is SQLite?

- <https://www.sqlite.org/index.html>
- Written in C programming language
- Small, fast, self-contained, high-reliability, full-featured, SQL database engine

## Getting Started with SQLite on Oscar

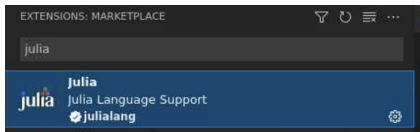
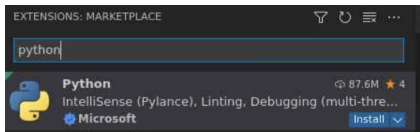
|                     |                                                                                                                                                                                                                 |
|---------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Find SQLite         | <pre>\$ which sqlite3 /usr/bin/sqlite3</pre>                                                                                                                                                                    |
| Check version       | <pre>\$ sqlite3 --version 3.7.17 2013-05-20 00:56:22 118a3b35693b134d56ebd780123b7fd6f1497668</pre>                                                                                                             |
| Load latest version | <pre>\$ module avail sqlite ~~~~~ name: sqlite*/* ~~~~~ sqlite/3.25.2  sqlite/3.41.0  \$ module load sqlite/3.41.0 module: loading 'sqlite/3.41.0'</pre>                                                        |
| Check version       | <pre>\$ sqlite3 --version 3.41.0 2023-02-21 18:09:37 05941c2a04037fc3ed2ffae11f5d2260706f89431f463518740f72ada350866d</pre>                                                                                     |
| Open SQLite         | <pre>\$ sqlite3 SQLite version 3.41.0 2023-02-21 18:09:37 Enter ".help" for usage hints. Connected to a transient in-memory database. Use ".open FILENAME" to reopen on a persistent database. sqlite&gt;</pre> |
| Exit SQLite         | <pre>sqlite&gt; .exit</pre>                                                                                                                                                                                     |

## VS Code

### What is Visual Studio Code (VS Code)?

- <https://code.visualstudio.com/>
- Source code editor developed by Microsoft for Linux, MacOS, and Windows
- Support for debugging, syntax highlighting, intelligent code completion, snippets, code refactoring, etc.

### Getting Started with VSCode on Oscar

|                                    |                                                                                                                                                                                                                                                                                                                                                        |
|------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Load latest version                | <pre>\$ module avail vscode ~~~~~ name: vscode*/* ~~~~~ vscode/1.22  vscode/1.48  vscode/1.68  \$ module load vscode/1.68 module: loading 'vscode/1.68' module: vscode: "To launch VSCode window in VNC Desktop, please run "code --no-sandbox". "</pre>                                                                                               |
| Check version                      | <pre>\$ code --version 3.41.0 2023-02-21 18:09:37 05941c2a04037fc3ed2ffae11f5d2260706f89431f463518740f72ada350866d</pre>                                                                                                                                                                                                                               |
| Open VSCode                        | <pre>\$ code --no-sandbox</pre>                                                                                                                                                                                                                                                                                                                        |
| Turn on Julia Syntax Highlighting  | <p>In VS Code,</p> <ul style="list-style-type: none"><li>• Click Extensions ()</li><li>• Search for Julia</li><li>• Choose Julia v1.47.2</li><li>• Click Install</li></ul>      |
| Turn on Python Syntax Highlighting | <p>In VS Code,</p> <ul style="list-style-type: none"><li>• Click Extensions ()</li><li>• Search for Python</li><li>• Choose Python v2023.8.0</li><li>• Click Install</li></ul>  |
| Exit VSCode                        | In VSCode, File -> Exit                                                                                                                                                                                                                                                                                                                                |

# Julia

# What is Julia?

- <https://julialang.org/>
- Development started in 2009 at MIT and first appeared in February 2012
- High-level, high-performance dynamic programming language for numerical computing
- Free and open-source
- Provides ease and expressiveness for high-level numerical computing (similar to R, MATLAB, and Python), but also supports general programming

# Julia Documentation

- [Julia 1.8 Documentation](#)
- [Think Julia](#)
- [BIDSS Manual - Numbers and Math in Julia](#)
- [BIDSS Manual - Control Flow](#)

## Getting Started with Julia on Oscar

- Login to Oscar using OOD and open Terminal
- In Terminal

|                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Load latest version of Julia | <pre>\$ module avail julia ~~~~~ name: julia*/* ~~~~~ julia/0.5.1  julia/1.0.2  julia/1.5.0  julia/1.6.0  julia/1.7.1  julia/1.8.5 julia/0.6.1  julia/1.1.0  julia/1.5.1  julia/1.6.1  julia/1.7.2  julia/1.9.0 julia/0.6.4  julia/1.2.0  julia/1.5.2  julia/1.6.2  julia/1.7.3 julia/0.7.0  julia/1.4.1  julia/1.5.3  julia/1.6.3  julia/1.8.0 julia/1.0    julia/1.4.2  julia/1.5.4  julia/1.7.0  julia/1.8.2  \$ module load julia/1.9.0 module: unloading 'julia/1.8.5' module: loading 'julia/1.9.0'</pre> |
| Check version                | <pre>\$ julia --version julia version 1.9.0</pre>                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Open Julia REPL              | <pre>\$ julia        _   _  _(_)_   (_)   (_)_     _ _ _   _ _ _                 / _ \         _       (_      _/   \ _ ' _   \ _ ' _     _/  Documentation: https://docs.julialang.org Type "?" for help, "]" for Pkg help. Version 1.9.0 (2023-05-07) Official https://julialang.org/ release  julia&gt;</pre>                                                                                                                                                                                                |
| Exit Julia REPL              | <pre>julia&gt; exit()</pre>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |



# Python

## What is Python?

- <https://www.python.org/>
- High-level, general-purpose programming language
- Emphasizes code readability with use of significant indentation
- Supports multiple paradigms: structured, object-oriented, and functional programming

## Python Documentation

- [Python 3.11.2 Documentation](#)
- [Think Python: How to Think Like a Computer Scientist](#)
- [BIDSS Manual - Intro to Python](#) (includes side-by-side comparison with Julia)

## Getting Started with Python on Oscar

- Login to Oscar using OOD and open Terminal
- In Terminal

|                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|--------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Load latest version of Python3 | <pre>\$ module avail python ~~~~~ name: python*/* ~~~~~ python/2.7.12          python/3.5.2          python/3.7.4 python/2.7.12_clean   python/3.6.6          python/3.8.12_gcc8.3 python/2.7.16         python/3.6.6_test     python/3.9.0 <b>python/3.11.0</b>        python/3.6.8_gcc8.3   python_igraph/0.7.1  \$ module load python/3.11.0 module: unloading 'python/2.7.12' module: loading 'python/3.11.0' module: python: "To use: module load openssl/3.0.0"  \$ module load openssl/3.0.0 module: loading 'openssl/3.0.0'</pre> |
| Check version                  | <pre>\$ python3 --version Python 3.11.0</pre>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Open Python                    | <pre>\$ python3 Python 3.11.0 (main, Dec  6 2022, 14:51:09) [GCC 10.2.0] on linux Type "help", "copyright", "credits" or "license" for more information. &gt;&gt;&gt;</pre>                                                                                                                                                                                                                                                                                                                                                               |
| Exit Python                    | <pre>&gt;&gt;&gt; exit()</pre>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |