Scientific Computing and Productivity
PHYS 213

Spring 2025, FHSU

Meeting Time: MWF 10:30 (Central Time), Meeting Room: TH 209/Zoom Room: See Bb for link (Passcode: Tigers312)

Instructor: Dr. C.D. Clark III
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Office: TH 251
Office Hours: MWF 12:30 - 14:30 or by appointment

Textbook: *The Linux Command Line: A Complete Introduction*; William E. Shotts Jr.
ISBN: 1593273894
URLs: https://www.amazon.com/Linux-Command-Line-Complete-Introduction/dp/1593273894

Course Description:

Scientists and engineers use computers in every aspect of their work. Open source software and the Linux operating system are powerful tools used by many scientists and engineers for technical work, from collecting and analyzing data to running large-scale simulations on high performance computing clusters. While the general public has only only recently become aware of Linux, it has been a staple of the scientific / engineering community for years.

This class is an introduction to open source software and the Linux operating system, with an emphasis on the tools used by scientists and engineers. The goal is to give the student experience using these tools through hands-on demonstrations, in-class tutorials, and a variety of practice problems.

The class assumes that the student is familiar with computers, but does not have any experience using Linux or the command line. After taking the class, the student should feel comfortable enough working on a Linux machine to put it on their résumé.

Required Software:

This class requires several pieces of software that will be required to complete the course.

- Linux
- Zoom
- Microsoft Teams
- Web Browser

All required software is free, and available on multiple platforms.

Learning Outcomes:

After taking this course, students will be able to:

- Use a Linux computer for day-to-day technical work.
- Use standard command-line utilities to process and analyze data files.
- Build custom commands to automate common tasks and data analysis.
- Use gnuplot to generate publication quality graphs of data.
- Write a technical document, that includes math and graphics, using LaTeX
- Write python scripts to process data.
- Access a remote computer and use its resources from the command line.
- Use git to version control simple projects, such as data analysis scripts, or LaTeXdocuments.

Textbook:

The textbook for this class is titled "The Linux Command Line: A Complete Introduction" (for more information, see the top of the syllabus). The textbook for this class does not contain material for every topic that will be covered in this class and the course schedule will not follow the organization of the book. However, it is a great introduction to the Linux command line, which is the tool that most beginners struggle with. Use the book as a reference and tutorial resource.

Communication:

Zoom:

A zoom meeting room will be setup for the class. Zoom is a video conferencing application for online meetings that supports screen sharing (visit the Zoom website for more information: https://www.zoom.us). It is simple to use and runs on Windows, Mac, Linux, iOS, and Android. If the student has questions that are difficult to discuss via email, they may schedule a zoom meeting with the instructor. Meetings should be scheduled with the instructor via email.
The link to the zoom meeting room for this class can be found on Blackboard.
Each lecture will be live-streams, recorded, and made available online. If you are taking this class virtually, you may join the live-stream or watch recorded lectures.

MS Teams:

The instructor will set up a dedicated MS Team for this class. Class announcements and links to the lecture videos will be posted here, and you are encouraged to use the team as a means of discussing the course material with your classmates and instructor. If you have a general question, please consider posting it to one of the Team channels and tagging the instructor so that other students can see the discussions.
The class Team is restricted, you must request access. So you should follow the instructions in Blackboard for joining the Team as soon as possible.

Course Content:

Course content will be divided into learning modules, with each module covering a specific topic or tool and spanning roughly one week. At the completion of each module, students will be assigned homework that uses the topics or tools covered by the module, and possibly additional tools that the student should research on their own.
The purpose of this course is to teach students how to use the command line and command-line tools. Most students have little or no prior experience with the command line, and may find it confusing and difficult at first. Rather than reading about how to use the command line, students will be shown how to use the command line. Each learning module will include several tutorial style videos that demonstrate how to use the tools introduced by the module. The student should watch these videos and *follow along with the demonstration.*
The textbook is a good secondary reference for many of the basic command-line operations that are required to use the command line effectively. The student is encouraged to follow the examples given in the textbook in addition to the demonstrations posted by the instructor.

Learning Modules:

Module Name	Learning Objectives
00 Installation/Setup	• Demonstrate ability to install a Linux operating system on a Virtual Machine or physical computer. • Become familiar Blackboard and Teams, and demonstrate the ability to post comments on a Teams channel.
01 Intro. to the Command Line	• Demonstrate the ability to navigate a directory struction using the command line and complete simple file system tasks. • Recall the commands for moving, copying, and deleting files and directories. • Recall the purpose of commonly used options for basic file system commands.

02 Working with Text	• Edit plain text files from the command line. • View the contents of plain text files from the command line. • Filter and manipulate the contents of plain text files from the command line.
03 Shell Scripts	• Write a simple Bash script to print "Hello World" (required) • Write a shell script to automate simple tasks, such as downloading files, creating backups, and automatically naming tarballs.
04 Gnuplot	• Create graphs of data saved in plain text files. • Create graphs of simple functions. • Use gnuplot to fit a function to one or more data sets and report the values for each fit parameter. • Create gnuplot scripts to save graph settings and quickly graphs of functions or data.
05 Data Analysis	• Use common command-line utilities (such as head, tail, sort, etc.) to quickly perform simple analysis on data sets stored in plain text files. • Identify valid options for many command-line utilities and recall their function. • Build custom pipelines from common command-line utilities to quickly perform custom analysis on data sets.
06 Python	• Write a simple python script to print "Hello World" (required). • Use python as a simple calculator. • Use 3'rd party python modules to perform unit conversions and error propagation.

07 LaTeX	• Write and compile a basic LaTeXdocument. • Create LaTeXdocuments with formatted math equations using LaTeXmath mode and the equation environment. • Include images as figures in a simple LaTeXdocument. • Create references for equations, figures, and tables in a LaTeXdocument using the label and ref commands. • Create a bibliography and insert source citations into a LaTeXdocument using bibtex. • Create a reference database using JabRef.
08 vim	• Student will be able to demonstrate that they can exit vim without rebooting their computer.
09 git	• Create a new git repository from an existing directory. • Create commits to a git repository to save/track the history of a directory. • Create backups of git repositories using remote repositories.
10 ssh	• Log into a remote machine from the command line. • Create copies of files and directories to/from a remote machine from the command line. • Configure ssh keys to allow password-less logins to a remote machine.

Lectures:

The majority of information in this class will be delivered as a hands-on tutorial-style lectures. It is absolutely necessary that the student watch each lecture in its entirety, as they will contain many bits of information not necessarily found anywhere else, including practice problem and information required to complete the homework.
Lectures will be live-streamed as a Zoom meeting during the Meeting Time listed at the top of the syllabus. The student may watch the lectures live using the Zoom meeting link posted in the "Course Materials and Resources" section of Blackboard. Lectures will also be recorded and made within one day of their recording. The links to lecture videos will be posted in the class Team.

Assessment:

The course grade will be based on three grading categories: Homework, Projects, and Exams.

Course Grade:

The weighting for each category is listed in the table below. Exams will be taken in class, on a computer, and will be scheduled for the full class period.
Attendance will not be graded, but it is critical that the student stays current with the course material and participate in the group activities. It is very easy to get behind and become lost in the class. Much of class time will be spent on follow-along tutorials or example sessions. If the student misses class it is their responsibility to learn the material that was missed.

Homework	40%
Projects	20%
Exams	40%

A letter grade will be assigned to the final score according to the cutoffs listed in the table below:

$88 \leq$	A	
$76 \leq$	B	< 88
$60 \leq$	C	< 76
$44 \leq$	D	< 60
	U	< 44

Homework:

Homework will be assigned for each learning module. For a typical homework assignment, the student will:

- Download the Homework PDF (the link will be posted in Blackboard) containing a description of the tasks to be performed.
- Download the Homework Tarball (the link will be posted in Blackboard) and perform the homework tasks.
- Take a Blackboard quiz after completing the tasks that will ask questions about the tasks performed.
- Upload the Homework Tarball to Blackboard after completing the task.

The answers to all homework quiz questions will automatically be releases after they due date of the quiz. Therefore, it is not possible to take the quizzes late. Homework tarballs may be uploaded after the due date with a penalty (see "Late Work" below for more details).

Projects:

One or more projects will be assigned during the semester which will require the student to turn in one or more items that will use tools and concepts from multiple modules. For example, the student may be required to write a script that analyzes some data set and then write a paper describing the data analysis with graphs and tables. Details about each project will be posted throughout the semester.

Exams:

Exams will be similar to homework, but will be under a time constraint. Students are allowed to use any resource available to them. Instructions for completing tasks for the exam will be given in a Blackboard quiz that will be available for 1 hour after it is opened. The student must perform all exam tasks and answer the exam questions within this allotted time. As with homework, the student will be required to upload a tarball that will be graded.
To complete an exam, the student will:

- Open the exam quiz on Blackboard.
- Download the exam tarball.
- Complete the tasks listed in the exam quiz and answer the exam quiz questions.
- Upload a tarball of the exam sandbox.

The exam timer does not include the time required to upload the exam tarball. The tarball will be due at 17:00 (central time) on the day the exam is taken. Taking the exam late, or uploading the tarball late will result in a penalty (see "Late Work" below for more details).

Late Work:

Assignments may be turned in late with a penalty, with one exception. Homework quizzes taken on Blackboard cannot be taken late because the answers to all quiz questions will be automatically released after the quiz is due.
Late penalties for late work are listed in the table below.

Days Late	Penalty		
	Homework (uploads)	Quiz	Exam
1 day	10%	5%	5%
2 - 7 days	20%	15%	10%
7 - 14 days	50%	30%	20%
more than 14 days	100%	100%	75%

Technical Support:

Issues with Blackboard, FHSU email, Office 365, accessing the FHSU network, and TigerNet ID should be directed to TigerTech

Phone: 785-628-3478 / 800-628-3478
Website: https://www.fhsu.edu/tigertech/

Issues with Linux should be posted on the class Team.

Title IX:

FHSU is committed to fostering a safe and productive learning environment. Title IX makes it clear that violence and harassment based on sex, gender, and gender identity are Civil Rights offenses subject to the same kinds of accountability and the same kinds of support applied to offenses against other protected categories such as race, national origin, etc. This includes all types of gender and relationship violence, sexual harassment, sexual misconduct, domestic and dating violence, and stalking. If you wish to report an incident or have questions about school policies and procedures regarding Title IX issues, please contact Amy Schaffer, University Compliance Officer and the FHSU Title IX Coordinator, at alschaffer@fhsu.edu or (785) 628-4175. The Compliance Officer can help connect you to campus and outside resources, discuss all of your reporting options, and assist with any concerns you may have