cpe357 — Systems Programming (Nico)
Fall 2023

Administrivia

Professor: Dr. Phillip Nico
`pnico@calpoly.edu`
Office: 14-205

Office Hours:

Monday:	2:10pm–3:00pm[1]
Tuesday:	10:10am–11:00am[1]
Wednesday:	2:10pm–3:00pm[1]
Thursday:	—
Friday:	2:10pm–3:00pm[1]

or by appointment

Texts: Brian W. Kernighan and Dennis M. Ritchie, *The C Programming Language*, Second edition, Prentice-Hall, 1989.

W. Richard Stevens and Stephen A. Rago, *Advanced Programming in the UNIX Environment,* Third edition, The Addison-Wesley Professional Computing Series, Addison-Wesley, 2013.

Webpage: http://www.csc.calpoly.edu/~pnico/class/now/cpe357

Lecture:

Section 5:	MWF 9:10am–10:00am	21-237
Section 6:	MWF 11:10pm–1:00pm	14-301

Lab:

Section 7:	MWF 11:10am–noon	186-c101
Section 8:	MWF 3:10pm–4:00pm	14-232a

Quiz on C: Wednesday, October 18th, 2023 (subject to change)

Midterm: Monday, November 6th, 2023 (subject to change)

Final[2]: (Verify with published final exam schedule):

Section 1:	Wednesday, December 13th, 2023	7:10am–10:00am
Section 3:	Friday, December 15th, 2023	10:10am–1:00pm

Grading: The approximate grading breakdown (subject to change) is:

Programs	25%
Labs/Problem Sets	10%
C Language Quiz	10%
Midterm	25%
Final	30%

[1] Office hours are guaranteed until the earlier of the posted end time or the time at which there are no more students. If you know that you will be coming later in the time, let me know in advance.

[2] There is a very good chance that the final will be moved to one of the common final times this quarter.

Course Objectives

The purpose of this course is to gain experience with low-level programming in the UNIX environment. In the process, you will:

- Learn to read and write complex programs in the C programming language.
- Become familiar with standard UNIX user-level commands and the UNIX software development environment.
- Learn about the architecture of the UNIX operating system from a system-programmer's perspective and be able to write programs that use operating system services (system calls) directly.

What you learn, principally, is more about the inner workings of any complex computer system. System services need to be provided and managed, and at some level, someone has to "know" about the actual implementation.

You also learn to distinguish the language from the operating system.

These skills will serve beyond programming on UNIX to help with software development wherever you are working.

Prerequisites

The prerequisites for this course are csc/cpe 203 and cpe 225 or cpe 233. If you have any doubts, come talk to me.

Course Format

The course consists of three lectures and three labs a week. The labs will not meet formally every time—possibly not ever—but I reserve the right to call lab meetings for demos or exercises, etc. The time, however, is intended to be used for the Labs/Problem Sets described below. You are responsible for all material covered in either lecture or lab. If you miss a class, consult a classmate for any missed materials.

The purpose of the class is for everyone to understand C and UNIX systems programming. To this end, if you don't understand something during class, ask. If you are confused, it is likely that a few dozen of your classmates are as well. Also, listen to others' questions. Many times you'll think you understand a concept until you hear someone else's question about it. Dialogue is the best way to learn things, so don't be afraid to speak up.

Office Hours

Office hours are as listed above **or by appointment.** If you are unable to come to the posted office hours, contact me and we can arrange to meet. There is no reason why any of you should be unable to see me if you need to.

Other Resources

I will maintain a class web page at http://www.csc.calpoly.edu/~pnico/class/now/cpe357. On it I will keep information, assignments, announcements, etc. If there any class announcements, corrections, etc., to be made, I will post them in the Announcements section of the class web page, or, for important announcements, distribute them by email. Please check the web page and your email regularly. I will try to make any announcements in class as well, but I cannot guarantee it, and you don't want to miss anything.

I usually post my lecture notes on the web. These are guaranteed to be incomplete and are not a substitute for class attendance. They will, I hope, provide a framework for your own notes and emphasize what I think is important about the class.

Depending on how much time I have, I will also maintain a FAQ on the class page of questions from office hours or the newsgroup that seem to be of general interest.

Laboratory Exercises and Programming Assignments

Programs:

There will be a number of programming assignments over the quarter. Together they will comprise 25% of the total final grade for the course. Because the total number is not known at this point, the individual program weights will not be determined until the end of the quarter. I expect there to be 6–7 programming assignments, but this may vary.

Programming assignments will be distributed on the web, and each assignment will specify both when it is due and whether or not partnerships are allowed.

Labs/Problem Sets:

Most weeks of the quarter there will be a set of laboratory exercises intended to supplement the coursework. These will consist of written exercises and/or experimental work to be performed in the lab. Submission requirements will be posted with each

Late Policy:

Each student will be allowed three (3) discretionary late days to be applied over the quarter. I will keep track of each person's late day balance and charge one for each calendar day (not work day) or portion thereof after the due date. To submit work after the submission directory for an assignment has been closed, use the `latedays` program to reopen it for you. Instructions will be provided on the class web site.

Note: There may be some assignments for which the use of late days will not be allowed. This would be to facilitate the posting of solutions before the midterm or some other reason like that. It will be noted on these assignments that late days are not permitted.

If you are unable to complete an assignment by the specified time and do not have any more late days, turn in what you have for partial credit. **Late assignments will receive no credit.**

Partnerships:

On some of the assignments you may be working with partners. Collaboration tends to help with figuring out difficult concepts and generally makes the whole process more pleasant. A word of caution, though: While it is tempting to just divide up the work, be sure each partner understands the whole project. Concepts learned on the assignments will show up on exams which are worth far more than the individual assignments in the final analysis. Even if your partner bails you out of a tight spot, be sure you understand the work, or it will come back to haunt you. Be absolutely certain that both partners' names appear on all assignments. Credit will be given only to students whose names appear on the assignment.

Each assignment will specify whether working with a partner is permitted.

Submitting Written Work:

Written work should be submitted in class on the day due (as modified by late days) or in the CSC Department drop box outside of (14-254). If you use the drop box, be sure that the names of the instructor, course, section, and assignment (in addition to your own name) are written clearly. Also be aware that materials dropped in the box after it has been collected for the day will be recorded the next day as late. If you are unsure whether the box has been emptied for the day, ask in the office.

For all written work, in order to facilitate grading:

- Start a new page for a new problem if you will not be able to complete it on the current page.
- Place the problems in the order assigned.
- Do not write in red.
- Use proper English grammar and punctuation.
- Write legibly.

Neatness will not necessarily help you, but sloppiness will definitely hurt. If I can't read it, I can't grade it, and I will not guess at what you meant. (This also applies to exams.)

These rules may seem extreme, but they are intended to make grading easier so I can return your papers more quickly.

Submitting Programs:

Programming assignments will be submitted online on the CSL computers using the `handin` program. Instructions for submitting programs are provided on the class web page.

When turning in programming assignments, be careful to submit your final version and to have tested it before submitting.

Programs that fail to compile will receive no credit.

Exams

There will be a midterm and a final. The midterm will be worth 25% of the final course grade and the final will be worth 35%. Exams will emphasize insight and problem solving ability rather than memorization.

Missed Exams: Makeup exams will only be given for the gravest of reasons. If you must miss an exam due to extreme illness, etc., contact the instructor (phone or email is fine) or leave a message with the Department of Computer Science office (805-756-2824) *before* the exam. Be sure to leave both the reason for missing the exam and how to reach you.

Grading Policy

The final grade for this course will be constructed of the following components in the given proportions:

Programs	25%
Labs/Problem Sets	10%
C Language Quiz	10%
Midterm	25%
Final	30%

In general, letter grades will be computed according to the scale:

Minimum A−:	90%
Minimum B−:	80%
Minimum C−:	70%
Minimum D−:	60%

That is, if you score 90% on an exam you will be guaranteed at least an A- for that exam. On some assignments and exams the minimum cutoffs may (and probably will) be lowered to account for difficulty.

Note: I reserve the right to take other circumstances into account when assigning final grades. These include, but are not limited to, such things as substantial improvement over the quarter, significant differences between exam and homework performance, missing homeworks, etc.

Nothing would make me happier than to give everyone an A.

Missing Assignments: Unless special arrangements have been made in advance, a good-faith effort is required of each student for every program. Failure to submit a homework disqualifies the student from the top grade level possible for a final grade. Failure to submit two disqualifies from the top two levels, etc.

Regrades: In general, papers to be considered for regrades must be submitted within one week of the time they become available for picking up. The same is true for misrecorded grades. They must be reported within a week of their posting. Grade feedback will be mailed out periodically as things are graded, and a snapshot of my gradebook for each of you will be available linked from the class web page. Please check them to be sure they agree with your own records.

Collaboration and Cheating

Policy on Collaboration

Programming assignments in this class are intended to be demonstrations of individual or partnership abilities. To this end, programs are to be written only by the designated authors.

High-level discussion of problems and problem-solving techniques, however, is beneficial to all involved. You are encouraged to discuss approaches so long as those with whom you consult are given due credit in your program headers.

> It is *never* acceptable to allow someone else to have your work for reference or to refer to someone else's work while writing your own.

In this case, "someone else's work" means not only other students' programs, but also materials from any other source, including, but not limited to, the world wide web, other reference books, or previous course materials. Also, "not giving your work to others" includes taking reasonable precautions to prevent them from taking it.

Collaboration that goes beyond general approaches or that is uncredited will be considered cheating. If you are unsure about what constitutes proper or improper collaboration, consult the instructor for guidance.

Policy on Cheating

Don't. I consider academic dishonesty a serious offense. Any instances of cheating or plagiarism will be referred to the Office of Student Rights and Responsibilities. The Cal Poly rules and policies are listed in the catalog as well as at the OSRR web site, `http://www.osrr.calpoly.edu`. The general policy, however, is very simply stated in the Campus Administrative Manual (C.A.M. 684):

> **Cheating requires an "F" course grade**

Turning in work is presumed to be a claim of authorship unless explicitly stated otherwise.

If the course rules are unclear or you are unsure of how they apply, ask the instructor *beforehand.*

Feedback

One of the frustrations of teaching is that the instructor rarely gets any feedback on the course until the teaching evaluations at the very end when it is too late to do anything about it. If you like, dislike, or don't understand something I'm doing with the course, please stop by my office hours, send me email, or paste together a note from newspaper clippings and drop it in my mailbox. I won't always change things, but I will always explain why I'm doing them the way I am.

Tentative class schedule

The tentative schedule for the course is given below. This is what we hope to accomplish and when we hope to accomplish it. There may be changes, but this is a rough roadmap for the quarter.

Fall 2023 Preliminary Course Outline

(Subject to Change)

Week	Lecture	Topic	Reading	Date
	1	Introduction and Background	K&R Ch. 1	September 22
2	2	Getting started with C	K&R Ch. 2–4	September 25
	—	*I got sick*		September 27
	3	Getting started with Unix		September 29
3	4	Pointers and Arrays in C	K&R Ch. 5	October 2[2]
	5	Complex Data in C	K&R Ch. 6	October 4
	6	Dynamic Data Structures		October 6
4	7	Wrapping Up C		October 9
	8	Unix from 30,000 feet	Stevens Ch. 1	October 11
	9	System Overview, cont.	(skim Ch. 2)	October 13
5	10	Unix File IO		October 16
	11	**C Language Quiz**		October 18
	12	File IO	Stevens Ch. 3	October 20
6	13	Unbuffered vs. Buffered IO		October 23
	14	The Unix Filesystem	Stevens Ch. 4	October 25
	15	Filesystem, cont.		October 27
7	16	Filesystem wrapup		October 30
	17	Signals	Stevens Ch. 10	November 1
	18	POSIX Signals, Timers, and Alarms		November 3
8	19	**Midterm**		November 6
	20	Terminal IO	Stevens Ch. 18	November 8
	—	*Veterans' Day*		November 10
9	21	Terminal IO, cont.	Stevens Ch. 7,8	November 13
	22	Processes		November 15
	23	Processes, cont.		November 17
10	—	*Thanksgiving*		November 20
	—	*Thanksgiving*		November 22
	—	*Thanksgiving*		November 24
11	24	Loading a Program: the execs		November 27
	25	Building A Shell	Stevens Ch. 15.2	November 29
	26	Shells, cont.		December 1
12	27	Managing Concurrency		December 4
	28	Wrapping Up		December 6
	29	(if needed)		December 8
Final Exam		Section 5: Wednesday, December 13th, 7:10am–10:00am Section 7: Friday, December 15th, 10:10am–1:00pm (*Verify with published schedule)*		

[2]Last day to drop classes is Monday, October 2.

The Last Page

This page is so I can gather a little information about you at the beginning of the class. Please fill it out, tear it off and leave it with me on the way out.

Who are you?

Name: _____
Section: _____
Major: _____
Email: _____

Class Expectations?

Please take a minute to write out what your goals and expectations are for cpe357. This helps me to know where people are coming from and helps to guide the course.

I hate to do this, but to be sure there's no confusion on the matter...

Below, please copy the two boxed text segments from page 5 about academic dishonesty and sign the pledge (assuming you will comply, of course). Without this you will automatically receive a grade of zero for all assignments.

1)

2)

Pledge

I will do my own work in this class. That is, unless it is explicitly permitted by the assignment, I will neither use others' work as my own nor make my work available for others to use. I understand that either of these actions constitutes cheating sufficient to merit a grade of F *for the course.*

Signature Date