CS 392 – Systems Programming

CS/SES

Spring 2022

Instructor: Philippos Mordohai

Canvas Course Address: https://sit.instructure.com/courses/56671

Course Schedule: Monday-Wednesday-Friday, 12:00-12:50 pm

Contact Info: pmordoha@stevens.edu

Virtual Office Hours: Monday 5:30-6:30, Thursday 5:30-6:30, and by appointment on https://stevens.zoom.us/my/mordohai

Virtual session URL: https://stevens.zoom.us/j/96434833814 (passcode: 1234)

Prerequisite(s): CS 382 and CS 385

Corequisite(s): N/A

Cross-listed with: N/A

COURSE DESCRIPTION

Introduction to systems programming in C on UNIX. Students will be introduced to tools for compilation, dynamic linking, debugging, editing, automatic rebuilding, and version control. Some aspects of the UNIX system call interface will be studied, drawn from this list: process creation, signals, terminal I/O, file I/O, inter-process communication, threads, network protocol stacks, programming with sockets, and introduction to RPC. Style issues to be covered include: naming, layout, commenting, portability, design for robustness and debugability, and language pitfalls. X programming and GUI design will be covered, if time allows.

STUDENT LEARNING OUTCOMES

After successful completion of this course, students will be able to:

1. use the Linux system, including the terminal and Linux commands. [Development]

2. create C programs that conform to the specification of Linux platform, including C grammars, compiling, and linking. [Development]

3. create makefiles and perform debugging with tools like gdb. [Development]

4. develop applications that perform files accesses. [Development]

5. create a client/server based application using sockets. [Design]

6. develop applications that create new processes and allow them to communicate with each other through channels like signals, pipes, or shared memory. [Development]

7. understand memory management, permissions (such as setUID/setGID), and how a system call works. [Development]

COURSE FORMAT AND STRUCTURE

This course is on-campus, subject to guidelines from Stevens administration. To access the course, please visit stevens.edu/canvas . For more information about course access or support, contact the Technology Resource and Assistance Center (TRAC) by calling 201-216-5500.

Course Logistics

The most important policies in this course are the following.

Collaboration Policy. Assignments will be done individually: each student must hand in their own answers. It is acceptable for students to collaborate in understanding the material but not in solving the problems or programming. Use of the Internet is allowed, but should not include searching for existing solutions.

Under absolutely no circumstances code can be exchanged between students. If some code was shown in class, it can be used, but it must be obtained from Canvas, the instructor or the TA.

Assignments from previous offerings of the course must not be re-used. Violations will be penalized appropriately.

Late Policy. No late submissions will be allowed without consent from the instructor. If urgent or unusual circumstances prohibit you from submitting a homework assignment in time, please e-mail the instructor.

Material on Canvas. All material shown in class will be posted on Canvas before they are shown.

Instructor's Online Hours

I continuously check email and I will respond to all email within 24 hours. If this does not happen, something unusual must be going on.

I strongly prefer email to Canvas messaging.

Virtual Office Hours

See above.

Online Etiquette Guidelines

If the course is moved online, please keep in mind the following guidelines:

- Do not dominate any discussion. Allow other students to join in the discussion.
- Do not use offensive language. Present ideas appropriately.
- Be cautious in using Internet language. For example, do not capitalize all letters since this suggests shouting.
- Avoid using vernacular and/or slang language as it could lead to misinterpretation.
- Keep an "open-mind" and be willing to express even your minority opinion.
- Think and edit before you push the "Send" button.
- Do not hesitate to ask for feedback.

TENTATIVE COURSE SCHEDULE

Week Starting	Topic(s)	Readings	Assignment
Jan 17 (Jan 17 is a holiday)	Using the Linux terminal		
Jan 24	Programming in Bash	tldp website	Assignment 1
Jan 31	Working with pointers/strings in C, void*, malloc, free	K&R Chapter 5	
Feb 7	Working with C source and header files, compiling with make		Assignment 2

Feb 14	Performing I/O with read/write system calls	APUE Chapter 3	
Feb 21 (Tue Feb 22 on Monday schedule)	Reading directories, stat-ing files, permissions, and IDs	APUE Chapter 4	**Midterm 1** Assignment 3
Feb 28	Processes	APUE Chapter 8	
Mar 7	Processes (cont.)	APUE Chapter 8	Assignment 4
Mar 21	Pipes	APUE Chapter 15	
Mar 28	Signals and alarms	APUE Chapter 10	Assignment 5
Apr 4	Pthreads and synchronization via mutexes	APUE Chapter 11	**Midterm 2**
Apr 11 (Fri Apr 15 is a holiday)	Condition variables and the producer/consumer model	APUE Chapter 12	Assignment 6
Apr 18	Working with sockets using TCP/IP	APUE Chapter 16	
Apr 25	Shared memory and semaphores	APUE Chapter 17	Assignment 7
May 2 (Wed May 4 on Friday schedule)	Creating and linking with static and dynamic libraries		

COURSE MATERIALS

Textbook(s):

W. Richard Stevens & Stephen A. Rago, Advanced Programming in the UNIX Environment, 3rd ed., 2013, Addison-Wesley Professional.

Other Readings:

Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, 1988, Prentice Hall, ISBN: 0-13-110362-8.

Programming in BASH

- Beginning - https://www.tldp.org/LDP/Bash-Beginners-Guide/html/
- Advanced - http://tldp.org/LDP/abs/html/

COURSE REQUIREMENTS

Attendance and Participation: Students are expected to attend all lectures in person or on zoom, depending on the pandemic. Attendance quizzes and ungraded submissions of in-class programming activities will be used to assess attendance and participation.

Homework: There will be a total of seven programming assignments, mostly in C.

 Exams: There will be two midterms and a final exam. The midterms will cover 5-6 weeks of material, while the final will be cumulative. The exams may be open or closed-book depending on whether they are held online or on campus. The midterms will be held during class time. See also the section on accommodations below.

TECHNOLOGY REQUIREMENTS

Baseline technical skills necessary for online courses

* Navigating Canvas

Technology skills necessary for this specific course

* Live web conferencing using Zoom

Required Equipment

* Computer: laptop with Virtual Machine installed. Instructions will be provided.
* Webcam: built-in or external webcam, fully installed
* Microphone: built-in laptop or tablet mic or external microphone

GRADING PROCEDURES

Grades will be based on:

Class Attendance and Participation	4%
Homework assignments (7)	56%
Midterms (2)	20%
Final exam	20%

Academic Integrity

Undergraduate Honor System

Enrollment into the undergraduate class of Stevens Institute of Technology signifies a student's commitment to the Honor System. Accordingly, the provisions of the Stevens Honor System apply to all undergraduate students in coursework and Honor Board proceedings. It is the responsibility of each student to become acquainted with and to uphold the ideals set forth in the Honor System Constitution. More information about the Honor System including the constitution, bylaws, investigative procedures, and the penalty matrix can be found online at http://web.stevens.edu/honor/

The following pledge shall be written in full and signed by every student on all submitted work (including, but not limited to, homework, projects, lab reports, code, quizzes and exams) that is assigned by the course instructor. No work shall be graded unless the pledge is written in full and signed.

"I pledge my honor that I have abided by the Stevens Honor System."

Reporting Honor System Violations

Students who believe a violation of the Honor System has been committed should report it within ten business days of the suspected violation. Students have the option to remain anonymous and can report violations online at www.stevens.edu/honor.

EXAM CONDITIONS

Exam conditions will depend on whether exams are held on campus or online. They will be announced as early as possible.

LEARNING ACCOMMODATIONS

Stevens Institute of Technology is dedicated to providing appropriate accommodations to students with documented disabilities. The Office of Disability Services (ODS) works with undergraduate and graduate students with learning disabilities, attention deficit-hyperactivity disorders, physical disabilities, sensory impairments, psychiatric disorders, and other such disabilities in order to help students achieve their academic and personal potential. They facilitate equal access to the educational programs and opportunities offered at Stevens and coordinate reasonable accommodations for eligible students. These services are designed to

encourage independence and self-advocacy with support from the ODS staff. The ODS staff will facilitate the provision of accommodations on a case-by-case basis.

For more information about Disability Services and the process to receive accommodations, visit https://www.stevens.edu/office-disability-services. If you have any questions please contact: Phillip Gehman, the Director of Disability Services Coordinator at Stevens Institute of Technology at pgehman@stevens.edu or by phone 201-216-3748.

Disability Services Confidentiality Policy

Student Disability Files are kept separate from academic files and are stored in a secure location within the Office of Disability Services. The Family Educational Rights Privacy Act (FERPA, 20 U.S.C. 1232g; 34CFR, Part 99) regulates disclosure of disability documentation and records maintained by Stevens Disability Services. According to this act, prior written consent by the student is required before our Disability Services office may release disability documentation or records to anyone. An exception is made in unusual circumstances, such as the case of health and safety emergencies.

INCLUSIVITY

Name and Pronoun Usage

As this course includes group work and class discussion, it is vitally important for us to create an educational environment of inclusion and mutual respect. This includes the ability for all students to have their chosen gender pronoun(s) and chosen name affirmed. If the class roster does not align with your name and/or pronouns, please inform the instructor of the necessary changes.

Inclusion Statement

Stevens Institute of Technology believes that diversity and inclusiveness are essential to excellence in academic discourse and innovation. In this class, the perspective of people of all races, ethnicities, gender expressions and gender identities, religions, sexual orientations, disabilities, socioeconomic backgrounds, and nationalities will be respected and viewed as a resource and benefit throughout the semester. Suggestions to further diversify class materials and assignments are encouraged. If any course meetings conflict with your religious events, please do not hesitate to reach out to your instructor to make alternative arrangements.

You are expected to treat your instructor and all other participants in the course with courtesy and respect. Disrespectful conduct and harassing statements will not be tolerated and may result in disciplinary actions.

MENTAL HEALTH RESOURCES

Part of being successful in the classroom involves a focus on your whole self, including your mental health. While you are at Stevens, there are many resources to promote and support mental health. The Office of Counseling and Psychological Services (CAPS) offers free and confidential services to all enrolled students who are struggling to cope with personal issues (e.g., difficulty adjusting to college or trouble managing stress) or psychological difficulties (e.g., anxiety and depression). Appointments can be made by phone (201-216-5177).

EMERGENCY INFORMATION

In the event of an urgent or emergent concern about the safety of yourself or someone else in the Stevens community, please immediately call the Stevens Campus Police at 201-216-5105 or on their emergency line at 201-216-3911. These phone lines are staffed 24/7, year round. For students who do not reside near the campus and require emergency support, please contact your local emergency response providers at 911 or via your local police precinct. Other 24/7 national resources for students dealing with mental health crises include the National Suicide Prevention Lifeline (1-800-273-8255) and the Crisis Text Line (text "Home" to 741-741). If you are concerned about the wellbeing of another Stevens student, and the matter is *not* urgent or time sensitive, please email the CARE Team at care@stevens.edu. A member of the CARE Team will respond to your concern as soon as possible.