

GMU Fall 2017
CS 531 - Fundamentals of Systems Programming
Instructor: Hal Greenwald (hgreenwa@gmu.edu)

This course is a hands-on in-depth introduction to the structure of the Unix operating system with emphasis on the system libraries using ANSI C. It is appropriate for students who want to learn the principles of how to design and implement system applications. The course begins with an accelerated introduction to the C programming language and continues with the basic Unix Operating System data structures and Application Programming Interface (API). Unix Signals, Process/thread management, and interprocess communication (IPC) are covered in some depth.

Goals

- Demystify systems programming
- Focus on principles, methods, and tools
- Sound application design principles
- Efficient and secure implementation strategies
- Concepts and mechanics of secure programming.
- UNIX operating system programming environment.
- Develop applications using popular tools and systems including C, UNIX, Signaling, IPC, and threading.



Textbooks

Required:

- *The C Programming Language, Second Edition* by [Kernighan and Ritchie](#). (ISBN 0-13-110362-8) [[Prentice Hall](#)] [[Amazon](#)]
- *Advanced Programming in the UNIX Environment, 3rd Edition* by W. Richard Stevens (Author), Stephen A. Rago (ISBN-13 978-0321637734)

Supplemental Texts: (not required, but helpful C references)

- *UNIX Systems Programming: Communication, Concurrency and Threads, 2 Ed.* by Kay Robbins and Steve Robbins. San Antonio, Texas, Prentice Hall ISBN-10:0130424110, ISBN-13: 978013042411
- *Practical C Programming, Third Edition* by Steve Oualline. (ISBN 1-56592-306-5) [[Amazon](#)][[OReilly](#)]
- *Mastering Algorithms with C* by Kyle Loudon. (ISBN 1-56592-453-3). [[Amazon](#)][[OReilly](#)]
- *C How To Program, Fourth Edition* by Harvey and Paul Deitel. (ISBN 0-13-142644-3). [[Prentice Hall](#)][[Amazon](#)]

Grading:

- Homework 1: *10 points*
- Homework 2: *15 points*
- Midterm Exam: *30 points*
- Final Project: *15 points*
- Final Exam: *30 points*



Course Schedule

(Subject to adjustment)

	<u>Topic</u>	<u>Assigned Reading</u> In addition to posted lecture notes	<u>Assignment</u>
Lecture 1	Greetings, Course overview, C Programming Language overview: Variables, Expressions, Operators, Control Flow	Read: TCPL Chapters 1, 2, 3	
Lecture 2	Header files, Functions, Pointers, Arrays & Strings, Typedef, Unions, Structures, C standard library	Read: TCPL Chapters 4, 5, 6	Homework 1 assigned
Lecture 3	Pointers <i>cont</i> , Memory Management, Standard I/O Library, Buffering, Strings, Math, Utilities, Bitwise Operators	Read: TCPL Chapters 7, 8 APUE Chapter 5	
Lecture 4	Modularity, Files & Directories, Process Environment	Read: APUE Chapters 3, 4, 7, 9	Homework 1 Due Homework 2 assigned
Lecture 5	Byte Ordering (Big/Little) Endian, Process Control, Daemon Processes, Signals	Read: APUE Chapters 8, 10, 13	
Lecture 6	Daemon Processes, Signals <i>cont</i> <u>Midterm review</u>		
Lecture 7	System Data Files Introduction to Concurrency	APUE Chapter 6, 15, 16	
Lecture 8	Midterm Exam		

Lecture 9	POSIX Threads	APUE Chapter 11,12	Homework 2 Due Final Project Assigned
Lecture 10	POSIX Threads <i>cont</i>	APUE Chapter 11,12	
Lecture 11	Interprocess Communication	APUE Chapter 15,16,17	
Lecture 12	Advanced Interprocess Communication	APUE Chapter 15,16,17	
Lecture 13	Advanced Interprocess Communication <i>cont</i> Project Presentations		
Lecture 14	Project Presentations Review for Final Exam		Project Report <u>Due</u>
12/13 – 12/20	Final Exam Period		

Grading:

- A+ at least 97.5 points
- A: at least 90 points
- B+: at least 87.5 points
- B: at least 80 points
- C: at least 70 points
- D: at least 60 points