CSCI2467: Systems Programming Concepts

Slide set 0: Introduction to the course

Course Instructors:

Matthew Toups
Caitlin Boyce

Course Assistants:

Saroj Duwal
David McDonald

Spring 2020

THE UNIVERSITY of NEW ORLEANS

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Today's Overview

1. Welcome
   - Topics
   - The labs
2. Syllabus
   - Administrivia
   - Important Resources
   - Student Responsibilities
   - Student Evaluation
   - Academic Integrity
   - Student Support
   - Culture
3. Intro lab

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Welcome to CSCI 2467 Systems

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Our objective

This course is an introduction to systems programming, specifically using the C programming language in the UNIX environment.

Students in this course will become stronger computer scientists by mastering the basic concepts underlying all computer systems. You will learn what really happens "under-the-hood" when your programs run, so that when things (inevitably) go wrong you will have the intellectual tools to solve these problems.

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Prerequisites

- CSCI 2120 (Software Design and Development II)
- CSCI 2450 (Machine Structure and Assembly Language Programming)

In this course you will be expected to make use of your experience both in high-level programming (Java or other object-oriented languages) and low-level programming (machine instructions represented by assembly language).

The course should strengthen your knowledge and skills in both of these areas, as well as give you insight into how computers actually work. This insight should serve you in many ways as you continue your studies in Computer Science and beyond.

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Knowledge you will acquire

1. Low-level data representations (hands-on bit manipulation)

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3. How running programs really work (function call stack)

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2. How C programs become machine instructions
3. How running programs really work (function call stack)
4. Exceptional control flow (signals and process control)

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2. How C programs become machine instructions
3. How running programs really work (function call stack)
4. Exceptional control flow (signals and process control)
5. How programs interact with the Operating System (and run concurrently)

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Skills you will develop

1. Using the Unix command-line: *bash*, *make*, text editors, *gcc*

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1. Using the Unix command-line: *bash*, *make*, text editors, *gcc*
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4. Executing a buffer overflow and using code injection to take control of a program

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4. Executing a buffer overflow and using code injection to take control of a program
5. Mastering process control by writing your own shell

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The lab work

Hands-on lab assignments will be the most important part of this course.

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- Introductions

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-  Introductions
-  The Data Lab

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-  Introductions
-  The Data Lab
-  The **Bomb** Lab

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The lab work

Hands-on lab assignments will be the most important part of this course.

-  Introductions
-  The Data Lab
-  The **Bomb** Lab
-  The Attack Lab

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The lab work

Hands-on lab assignments will be the most important part of this course.

-  Introductions
-  The Data Lab
-  The **Bomb** Lab
-  The Attack Lab
-  The Shell Lab

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The work

The workload for this class will be *significant*. Be prepared to invest many hours both in and outside of class.

We expect this to be both challenging and fun for all students!

Though it can be difficult, lots of help will be available and everyone willing to invest the time should be able to earn a good grade.

Please talk to the course staff after class if you are concerned about how this will work with your schedule this semester.

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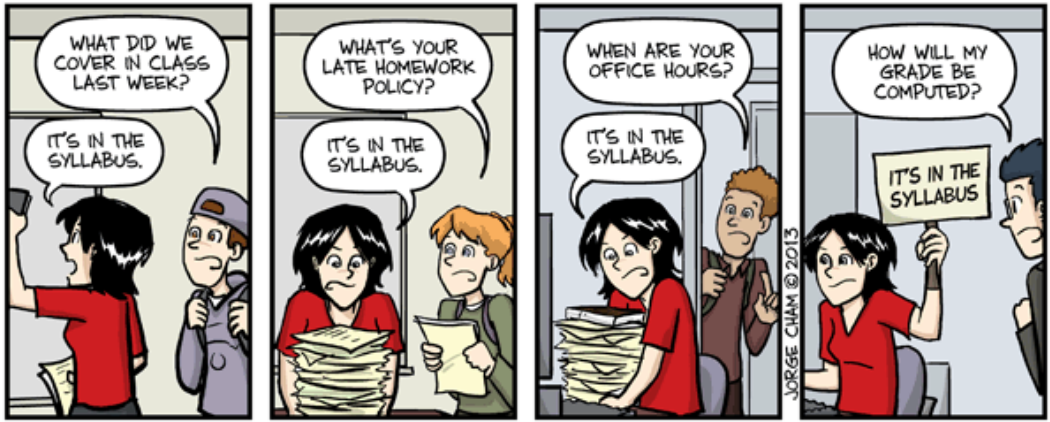

IT'S IN THE SYLLABUS

This message brought to you by every instructor that ever lived.

WWW.PHDCOMICS.COM

The Syllabus

Instructor: Matthew Toups	Office	Math 335
	Email	mtoups@cs.uno.edu
	Phone	504-280-7360

Class meetings: 10:00am–10:50am Mon/Wed/Fri

Systems course hours Tuesdays/Thursday 1-4pm
Held lab space with course staff (Math 209)

web page: `http://2467.cs.uno.edu`
Contains class schedule, lecture slides, and other materials. Check this often!

AutoLab: `http://autolab.cs.uno.edu`
Lab assignments are based around Autolab - more about this soon!

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The Course Staff

For most issues contact all of us: `staff@2467.cs.uno.edu`

Course instructors: Matthew Toups (section 001), Caitlin Boyce (section 002)
Course assistants: Saroj Duwal, David McDonald

Systems course hours Tues/Thurs 1-4pm
Held in lab space with course staff (Math 209)

Additional help available from CS Tutoring Center (help desk)
MATH 319 / M-F, schedule will be posted

Course staff email: `staff@2467.cs.uno.edu`
This email goes to all of us.

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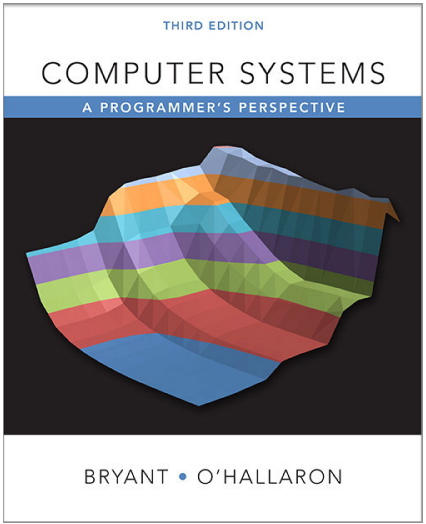
Required textbook



Primary, **required** textbook:

Randal E. Bryant and David R. O'Hallaron, **Computer Systems: A Programmer's Perspective, Third Edition (CS:APP3e)**, Pearson, 2016.

ISBN: 013409266X

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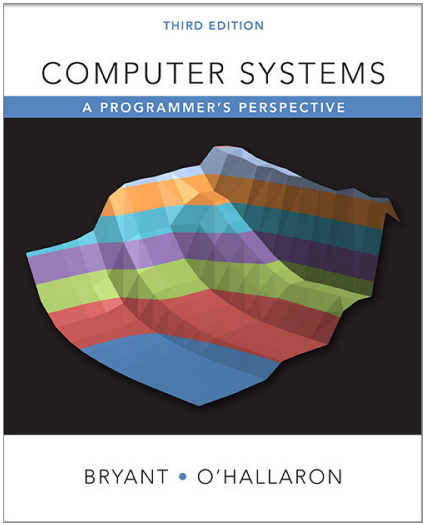

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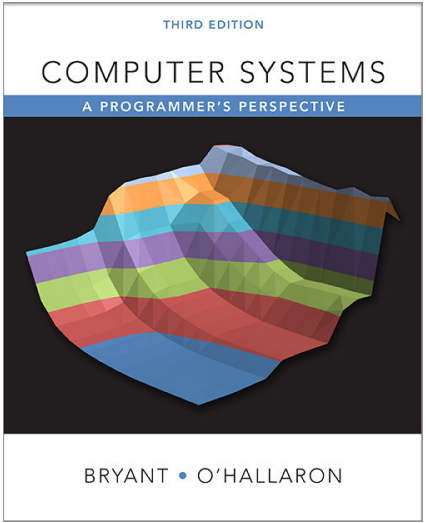

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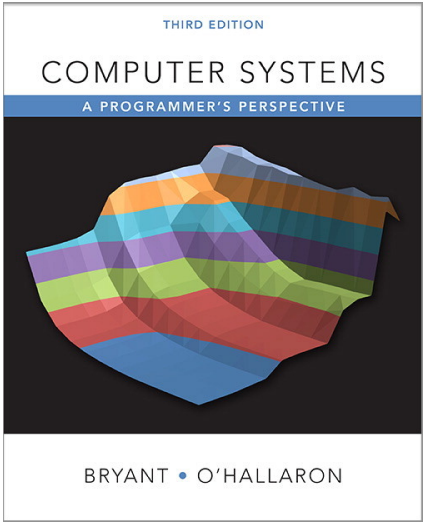

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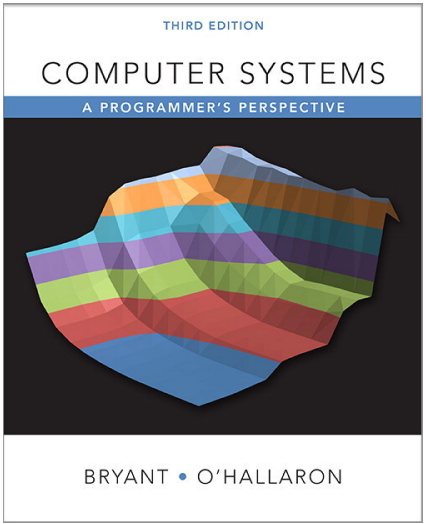

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- How to solve labs
- Practice problems similar to or identical to exam problems.
- Worth keeping
- High resale value

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Textbook access

- Available as *course reserve* at Earl Long Library.
  - Must be during library hours, must not leave library.
  - Maximum 4 hour checkout. (fine: 50¢ *per hour*!)
  - Inquire at ciruclation desk, bring your UNO ID.
- 1st edition (2003) available in the stacks for longer checkout.
  - Fine for Chapters 1 and 2
  - Chapter 3 is much different

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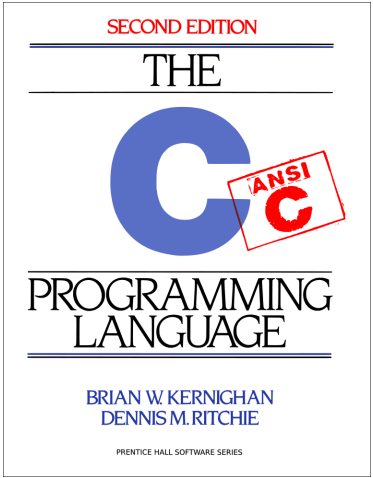
Optional text



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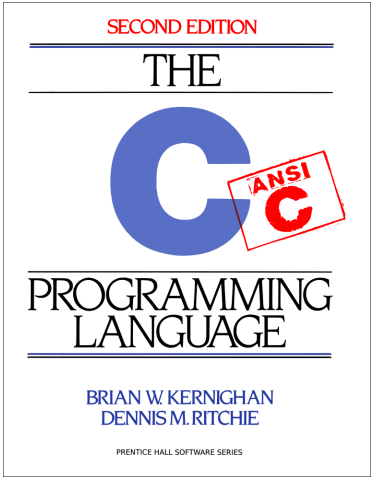

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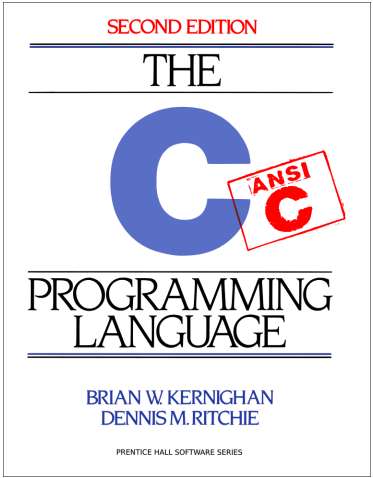

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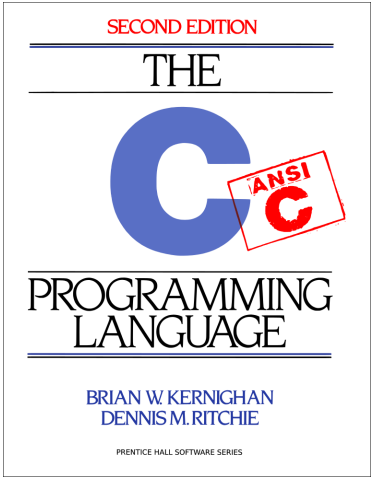

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- authoritative standard co-written by one of the creators of C and UNIX
- not required for this course, but is widely considered an essential part of every computer scientist's library

Initial readings, free to download

Finally, the following two PDF files are **required downloads**. They are **freely available** from Stanford University. The first is a concise primer on the C programming language. Most of what you'll need to know about the mechanics of the language should be found here.

> *Parlante, Nick,* Essential C, *Stanford CS, 2003*
> *http://cslibrary.stanford.edu/101/EssentialC.pdf*

The second is a similar short introduction to the tools used to compile and debug programs written in C in the UNIX environment.

> *Parlante, Zelenski, et al.,* Unix Programming Tools, *Stanford CS, 2001*
> *http://cslibrary.stanford.edu/107/UnixProgrammingTools.pdf*

See links in syllabus or simply visit `http://cslibrary.stanford.edu`

How to succeed in this course

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How to succeed in this course

1. Attend class: two lectures per week
   (additional help sessions optional but encouraged for *all* students)

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3. Complete laboratory assignments.

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How to succeed in this course

1. Attend class: two lectures per week
   (additional help sessions optional but encouraged for *all* students)
2. Read the text.
3. Complete laboratory assignments.
4. Take exams.

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Classroom etiquette

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- Only use computers (classroom or personal) for relevant activities (labs, slides, testing code)

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- Only use computers (classroom or personal) for relevant activities (labs, slides, testing code)
- If you need to make a phone call/text/email/conversation, you may quietly leave the room

Grades

Grading scale:

A 360-400 points
B 320-359 points
C 280-319 points
D 240-279 points
F $\leq$ 239 points

Final exam date:
Friday May 10
10:00am–12:00pm

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- Extra credit points will be available for particularly challenging sections, so >400 points will be available

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Timeliness

Late policy: 10 points (25 percent) will be deducted for each day after the due date. (See syllabus for specifics)

This is a large penalty, so students should avoid this at all costs by staying ahead of deadlines.

Don't fall behind! After each lab is due, the next one will be out.

Any extensions must be requested **in writing** with explanation.

1 "grace day" allowed per student per semester (automatically applied)

Academic integrity: no cheating, no plagiarism

Cheating has serious, real consequences

source: http://www.uno.edu/student-affairs/documents/academic-dishonesty-reporting-form-current-rev2014.pdf

Academic Dishonesty Report Form

Please read document carefully. When complete it constitutes an agreement between you and the University community.

To be completed by the complainant

Complainant's Name (please print): _____ Department: _____

Email: _____ Telephone Number: _____

Accused Student's Name (please print): _____ and ID #: _____

I believe the student named above has committed academic dishonesty, as I next describe (**include documentation such as plagiarized sources, SafeAssign report, or similar documents** when submitting to the Office of Student Accountability and Advocacy):

_____

_____

_____

_____

_____

Date of the offense: _____ Course name & number: _____

Check all that apply

_____ I have imposed a grade of Zero (or F) on the above assignment.

_____ I have assigned an "F" for the course. If a student is found guilty of academic dishonesty as a result of the student accountability process, an "F" will be recorded as that student's grade.

_____ I believe this act of Academic Dishonesty requires a greater sanction and I request a Resolution Conference.

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- Looking at a solution from any of these sources

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- Coaching: helping a friend with their lab line-by-line

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- Coaching: helping a friend with their lab line-by-line
- Cutting and pasting, retyping... doesn't matter
- All are *easily* detected!

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- Explaining how to use systems or tools

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- Using help given by the course staff or textbook (again, must be cited)
- Asking a classmate for help logging in, using a text editor, or asking what an error message means
- Explaining how to use systems or tools
- Using google to look up a manual page for a C function, or for help using `gdb`

Use the lab in MATH 209!

- In-class activities

Use the lab in MATH 209!

- In-class activities
- Lab assignment work outside class time

Use the lab in MATH 209!

- In-class activities
- Lab assignment work outside class time
- Can also work remotely via `ssh` to `systems-lab.cs.uno.edu`

Support for students with disabilities

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- Americans with Disabilities Act (ADA) affects everyone somehow, someday

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- Americans with Disabilities Act (ADA) affects everyone somehow, someday
- Talk to me or UNO Office of Disability Services (ODS)

How to get help

Everybody will get stuck at some point! The sooner you ask for help, the better.

- Ask questions in class

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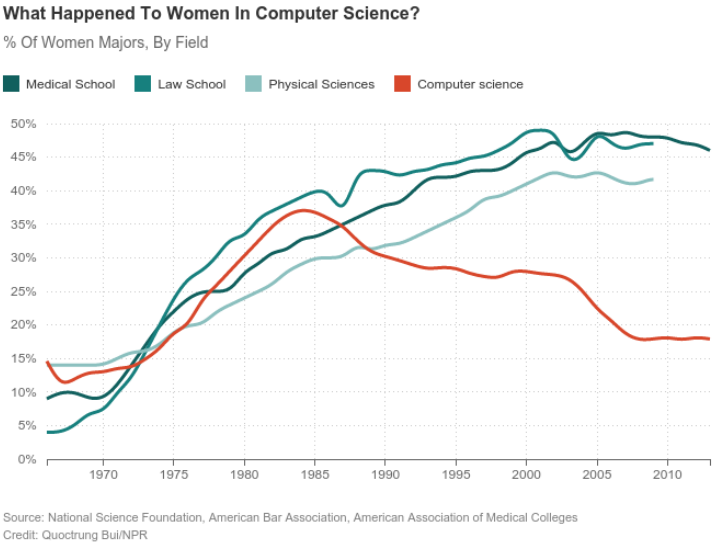
- When appropriate, utilize ODS (see syllabus)

Class culture

- Computer Science has a problem

Class culture



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- Get involved in events and organizations

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- Your actions and words matter
- It begins here: respect
- Get involved in events and organizations
- We can all make UNO CS welcoming and inclusive

Today's Overview

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3. Intro lab

Your first lab assignment

CSCI 2467, Spring 2020

Lab 0: Introductions to C and Unix

Due: Wednesday, January 22, 11:59PM

2467 Instructors: M. Toups & C. Boyce
Assistants: D. McDonald & S. Duwal
staff@2467.cs.uno.edu