COMP_SCI 213: Introduction to Computer Systems

Syllabus – Fall 2026

Location and Time

University Hall, 122. Monday & Wednesday, 11 AM – 12:20 PM.

Class Webpage

- https://knsmith.github.io/nucs-213-f26.html

Course Staff

Instructor: Kate Smith, kns@northwestern.edu

- Office hours by appointment, Mudd 3504

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PMs:

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Overview

This course introduces the lower levels of computer systems. We will peel back the abstractions you have grown accustomed to from CS111 and CS211, and look "under the hood," so to speak, to see how they work. Critically, this is a learn-by-doing course. You will write code, compile it, debug it, measure its performance, optimize it, etc. You will learn by developing and evaluating real code on real machines.

The course serves four purposes. First, you will learn about the hierarchy of abstractions and implementations that comprise a modern computer system. This will provide a conceptual framework that you can then flesh out with courses such as compilers, operating systems, databases, networks, security, real-time systems, and others. Second, we will demystify the machine, and the tools that we use to program it. This includes telling you the little details that students usually have to learn by osmosis. In combination, these two purposes will give you the background to understand many different computer systems. Third, this course will bring you up to speed in doing systems programming in a low-level language (C) in the Unix (Linux/GCC/GDB/etc.) environment. Finally, this course will prepare you for upper-level courses in systems.

As a note, COMP_SCI 213 is a ***required course*** for the CS major (and minor) and one of the ***fundamental courses*** in CE. Most 300-level systems courses have COMP_SCI 213 as a prerequisite, including COMP_SCI 322 (Compilers), 323 (Code Analysis and Transformation), 368/468 (GPU Programming), 339 (Databases), 340 (Networking), 343 (Operating Systems), 350 (Security), 441 (Virtualization), and many others.

Prerequisites

- COMP_SCI 211
- Experience with C/C++
- Experience with Unix environment and command line

Textbook

Bryant & O'Hallaron, *Computer Systems: A Programmer's Perspective*, Prentice Hall, **3rd edition.**

It is important that you have the 3rd edition of the book. Earlier editions focus on 32-bit architectures, which differ in significant ways from modern 64-bit architectures, which is our focus. Note that the international edition of the book can have differences from the U.S. version.

Grading

- 20% Homework (3, completed individually)
- 40% Lab assignments (4, completed in pairs)
- 20% Midterm Exam (in-person written exam during class)
- 20% Final Exam (in-person written exam, during finals week)

The instructor is the one to assign final scores and grades. If you have an issue with a score on an assignment or exam, you may discuss with a PM, TA, or instructor, but only the instructor is able to change the score.

Schedule (could adjust during the quarter)

Date (Class Number)	**Subject**	**Notes**	**HW/Lab**
Wed. Sept. 23 (1)	**Introduction and Class Overview**		
Thurs. Sept. 24			Pack Lab Out
Mon. Sept. 28 (2)	**Data Representations, Binary, and Hexadecimal**		
Tues. Sept. 29		Last day to add course / change sections	HW 1 Out
Wed. Sept. 30 (3)	**Data Representation, Memory, and Encoding**		
Mon. Oct. 5 (4)	**Integer Encodings**		
Wed. Oct. 7 (5)	**Data Operations, Fractions in Binary, Binary Operations, and Floating Point**		
Mon. Oct. 12 (6)	**Smaller Floating Point, FP Arithmetic, Intro to Assembly Languages**		
Tues. Oct. 13			Pack Lab In / Bomb Lab Out
Wed. Oct. 14 (7)	**Registers and x86 Assembly**		
Thurs. Oct. 15			HW 1 In
Mon. Oct. 19 (8)	**Arithmetic Instructions**		
Wed. Oct. 21 (9)	**Control Flow Instructions and Midterm Review**		

Mon. Oct. 26	**MIDTERM EXAM**		
Wed. Oct. 28 (10)	**Pointers, Arrays, and Structs**		
Thurs. Oct. 29			Bomb Lab In / Attack Lab Out
Fri. Oct. 30		Last day to drop a class	
Mon. Nov. 2 (11)	**Procedures**		
Tues. Nov 3			HW 2 Out
Wed. Nov. 4 (12)	**Memory Security**		
Mon. Nov. 9 (13)	**Memory Hierarchy**		
Wed. Nov. 11 (14)	**Cache Memories**		
Mon. Nov. 16 (15)	**Cache Performance**		
Tues. Nov 17			Attack Lab In / SETI Lab Out
Wed. Nov. 18 (16)	**Concurrency**		
Thurs. Nov 19			HW 2 In / HW 3 Out
Mon. Nov. 23, (17)	**Compiler Optimizations**		
Wed. Nov. 25 (18)	**Virtual Memory**		
Mon. Nov. 30 (19)	**Processes**		
Wed. Dec. 2 (20)	**Networks**		
Thurs. Dec. 3			HW 3 In / SETI Lab In
Mon. Dec. 7	**FINAL EXAM**	9 – 11 AM	

Communication

Piazza will be used for course discussion and questions. All questions should be sent via Piazza rather than email. The link is https://piazza.com/class/mtnchvvpcei7fy . We will also have a course Slack. The Slack link is https://nucs213.slack.com (link to join is found on Canvas).

Office hours will be made available. Outside of lecture, the order for asking questions should be Slack, PMs, TAs, then the instructor.

Exams

The final exam will take place during the scheduled time on Monday, December 7, 2026 from 9 AM – 11 AM. The midterm exam will take place approximately halfway through the quarter in class. ***You need to have a passing grade (64% or higher) averaged between the two exams to pass the course, regardless of your performance in the homework and lab assignments.*** There are no exceptions to this rule.

Labs

There will be four programming labs as part of the course. Labs will be done in pairs. Look for a partner ASAP.

Homework

Homework will be a valuable resource to prepare for exams. Three homework assignments will be completed during the quarter, and they should be completed individually.

Resources

Machines at Northwestern will be available for remote login. You will have access to several server machines that can support many users simultaneously, and we expect most students will use those servers. We will test your labs on those machines. You should also be able to work on labs on your own machine provided it is running a reasonably recent Linux.

Late Policy

For each calendar day after the due date for a lab, 10% is lost. After 1 day, the maximum score is 90%, after 2 days, 80%, etc., for a maximum of 10 days. ***No late homework assignments will be accepted unless previously discussed with the instructor.***

If you are having a major issue, please contact the instructor as soon as possible, and we will work together on a solution. Particularly for issues outside of the student's control, such as major injury or sickness, deadlines can be shifted without penalty, but it is required that you contact the instructor in advance.

Course Details Subject to Change

Please note that the specifics of a course syllabus are subject to change in the case of unforeseen circumstances. The instructor will notify students of any changes as soon as possible. Students will be responsible for abiding by the changes.

Cheating, AI, and Sharing Course Materials

You will get out of this class what you put into it. We encourage collaboration and discussion to learn course material, but the use of AI is highly discouraged when completing homework assignments and labs.

If you put your work in a public / cloud-based platform, make sure permissions are set so that only you and your lab mates can view the materials. Class materials should not be shared on public sites – they should remain on the class web pages. ***Discussions on Piazza and Slack and materials from the course servers should not be shared publicly.***

It is the student's responsibility to be familiar with the Academic Integrity policies of Northwestern University and the McCormick School of Engineering: https://www.mccormick.northwestern.edu/students/academic-integrity.html . If it is suspected that there is a violation, it will be reported. Keep this in mind, especially with regard to the labs and homework assignments. During and after the quarter, lab materials and assignments should not be shared. If you have questions, ask your instructor.

Accessibility

Northwestern University is committed to providing the most accessible learning environment as possible for students with disabilities. Should you anticipate or experience disability-related barriers in the academic setting, please contact AccessibleNU to move forward with the university's established accommodation process (e: accessiblenu@northwestern.edu; p: 847-467-5530). If you already have established accommodations with AccessibleNU, please let the instructor know as soon as possible, preferably within the first two weeks of the term, so we can work together to implement your disability accommodations. Disability information, including academic accommodations as part of a student's educational record, is confidential under FERPA regulations.

Policy on Academic Accommodations for Religious Observance

Northwestern is committed to fostering an academic community respectful and welcoming of persons from all backgrounds. To that end, the policy on academic accommodations for religious holidays stipulates that students will not be penalized for class absences to observe religious holidays. If you will observe a religious holiday during a class meeting, scheduled exam, or assignment deadline, please let the instructor know as soon as possible, preferably within the first two weeks of class. If exams or assignment deadlines on the syllabus fall on religious holidays you observe, please reach out so that coursework can be discussed. More information can be found here:

https://www.northwestern.edu/provost/policies-procedures/classwork-curricular-policies/accommodations-for-religious-holidays.html .