

CSCI 2021: Finale

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*Last Updated:
Mon May 1 12:08:32 PM CDT 2023*

Logistics

Goals

- ▶ Final Exam Logistics
- ▶ Evaluations
- ▶ Review

P4

- ▶ matsquare: optimize code
- ▶ showsym: Memory Mapping ELF Files

Date	Event
Mon 01-May	Last Lecture, Review SRTs due by 1:25pm P4 Due Unified OH - Lind 316 8am-1:30pm - Lind 326 1:30pm-5pm
Fri 05-May	10:30a-12:30pm Final Exam for 1:25pm Lec 001
Sat 06-May	10:30a-12:30pm Final Exam for 3:35pm Lec 010

Final Exam Logistics

- ▶ Final Exam in person, normal lecture location
- ▶ ~1.5 pages F/B like 3rd Midterm Exam
Proc Architecture, Memory System, Code Optimization,
Virtual Memory / Linking / Object Files, P4 Material
- ▶ ~1.5 page F/B Comprehensive Review, tie together concepts
that pervaded the semester
(F/B = Front/Back)
- ▶ 2 hours to take Final Exam in person

Course Feedback

Course Exit Survey on Canvas

- ▶ Opens on Canvas Wed 24-Apr, Due Tue 02-May
- ▶ 1 Engagement Point for Completing it

Official Student Rating of Teaching (SRTs)

- ▶ Official UMN Evals are done online this semester
- ▶ Available here: <https://srt.umn.edu/blue>
- ▶ **EVALUATE YOUR LECTURE SECTION: 001 or 010**
Optionally evaluate lab section
- ▶ **Due** Mon 01-May by 1:25pm
- ▶ Response Rate $\geq 80\%$ in **both sections** → One Final Exam Question Revealed

What have we done?

C Programming

Lowest of the “high-level” languages, gives fairly direct control over capabilities of the machine at the expense of coding difficulty and ease of mistakes

Assembly Programming

Tied directly to what a processor can do, studied x86-64 specifically, exposes processor internals like registers, instructions, operand sizes, etc.

Computing Architecture

Basics of how CPUs + Memory are built, transistors/gates to do “work” and performance ramifications on code

Processing Systems/Environment

Programs exist in an environment including file formats for executables, specifics of loading, virtual memory system to catch errors/link libraries

Did I miss anything?

Further Coursework / Activities

- ▶ **CSCI 4061 Intro to Operating Systems:** Direct successor, required for CS majors, builds on 2021 content to develop the shape of an operating system.
- ▶ **CSCI 4203 Computer Architecture:** Develops hardware/software interface in more detail, study pipelines + superscalar features in more detail, examine multi-core systems
- ▶ **CSCI 5103 Operating Systems:** Study internal design issues associated with operating systems, handling hardware, tradeoffs on different approaches to management, theoretical algorithms around resource coordination.
- ▶ **CSCI 4271W Development of Secure Software Systems:** Focus on security issues, methods to circumvent OS/hardware protections and how ensure safety in programs, incorporating security features into system design.
- ▶ **UMN Kernel Object (Student Group):** Discusses development and internals of the Linux Kernel, stuff like the Page Table implementation, OS Scheduler, C alternatives like Rust

<https://github.com/UMN-Kernel-Object>

Survey Says ...

SRTs Response Rate

Final Exam Question

See Video Discussion

Practice Final

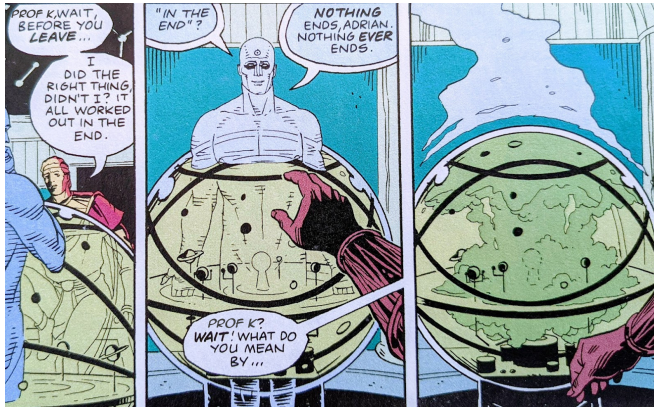
- ▶ Take a few minutes to look this over on your own then together
- ▶ Kauffman will answer a few questions on it and post solutions later today

Summer Practice

Students often ask what they could do during a break to keep up their computing skills. Here are a few ideas.

- ▶ READ: [The Art of Unix Programming](#) by Eric S. Raymond
Fantastic philosophical and pragmatic discussion of how to build systems that work especially in the Unix environment.
(free online)
- ▶ COMPLETE: If you didn't finish a project in this course or another, take some time to do so.
- ▶ EXTEND: If you use VS Code, [Write an Extension for it](#) that does something interesting. This will teach you MUCH about modern software development
- ▶ BUILD: Buy an Arduino Microcontroller (\$10) and get a “Blinky” routine to run; it's C code! [Adafruit](#) has tons of fun toys with accompanying tutorials.
- ▶ REST: Take some time away from the screen for fun. Recharging is as important for people as for phones. Play outside. See some people in person. Breathe.

Nothing Ever Ends



- ▶ What you learned will recur in your career at some point and demonstrate whether you learned it well the first time or need another pass.
- ▶ Some of it will change in the future and make you feel old.
- ▶ Expect this and stay determined.

Conclusion

It's been a hell of a semester.
I'm proud of all of you.
Keep up the good work.
Stay safe. Happy Hacking.



CSCI 4061 or bust Why yes, I do know assembly.

valgrind: got my
back on memory!

Submission
accepted

> make

nothing to be done

gdb: yeah

you know me!

Stack or Heap?
I know which!

Oh linker,
I'll
soothe you



C code: I know this!

My code is full of
shift, bit shift!

movq \$0, %eax

retq #success!

10/10 Tests Passed

I struggled and
built skills

Debugging
complete!

You're STILL filled with
DETERMINATION!

Whew,
time for
a snack

chaotichero