

CSCI 2021: Finale

Chris Kauffman

*Last Updated:
Mon May 1 03:09:40 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

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>

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.

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

Survey Says ...

SRTs Response Rate

Lec	Responded	Invited	%Response
001	209	170	82%
010	105	82	80%

SUCCESS!

- ▶ Thanks to all that have responded; SRTs stay open until 11:59pm last day of classes

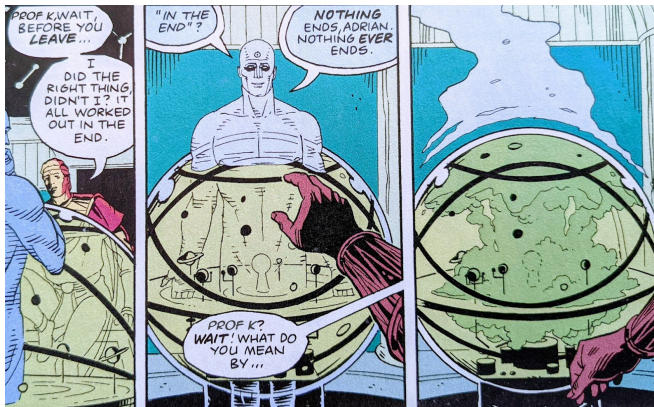
Final Exam Question

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

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!

C code: I know this!

Submission
accepted

My code is full of
shift, bit shift!

```
movq $0, %eax  
retq #success!
```

> make
nothing to be done

10/10 Tests Passed

gdb: yeah
you know me!

I struggled and
built skills

Stack or Heap?
I know which!

Debugging
complete!

Oh linker,
I'll
soothe you

You're STILL filled with
DETERMINATION!

Whew,
time for
a snack



chaotichero