

CS331

Advanced Operating Systems

12:30—1:50 Tu/Th, Ry 276

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<https://www.classes.cs.uchicago.edu/archive/2022/spring/33100-1/index.html>

Outline

- An overview of 331
 - Who am I
 - What this class will be about
- Introduce yourself
- A brief history of OS
- Administrative stuff

Who am I

- Shan
 - Research
 - Software reliability & efficiency
 - Distributed systems, web applications, ML systems, end-user programming ...
 - Teaching
 - I enjoy discussion
 - We will use chalk board a lot
 - Thanks in advance for your feedback

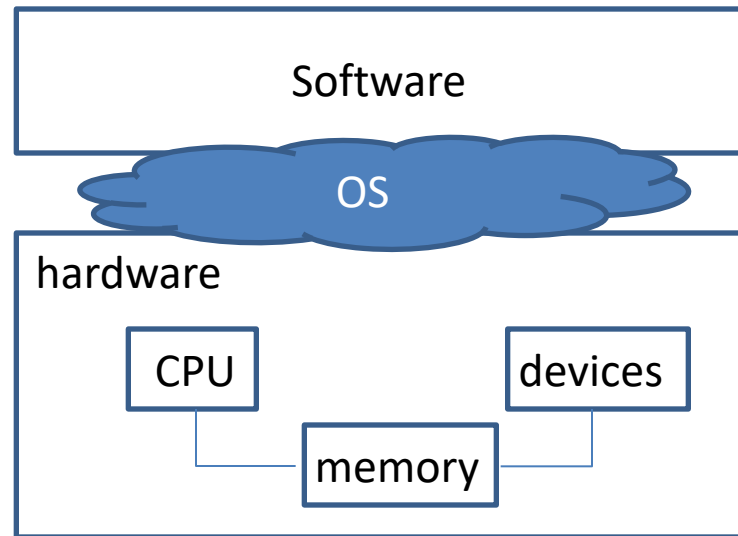


What this class is about?

- What does operating system do?

What this class is about?

- What does operating system do?



Management
Protection
Communication
Interface
A software of software

This class is about ...

- Knowledge about OS and software systems
- System research approaches
- Recent system research topics

No textbook; paper reading

OS Knowledge

- Similar w/ CS230, except that ...
- More emphasis on `research’
 - How did things come out and evolve?
 - What was the driving force
 - Why was this an important problem at that time
 - How was the problem addressed
 - The significance and impact
 - What are/were the alternative solutions?

OS research ideas/approaches

- Common themes
 - What are the criteria for a “good” system?
- Common tricks
- ...

OS research ideas/approaches

- Common themes
 - Performance
 - Complexity
 - Usability
 - Protection and security
- Common tricks
 - Caching
 - Indirection
 - Modularity/abstraction
 - Mechanism vs. policy
 - Hardware support
 - Balance/trade-off
- ...

Am I qualified to take the class?

What do you need to do?

- Paper reading
 - Get knowledge; writing tips; **taste**
 - Answer questions before class, ask questions in class
- Come to class
- Do a project
 - Proposal
 - Implementation
 - Write-up and presentation

Introduce yourself!

- Name
- Which year are you in?
- Something interesting about yourself
- What do you want to learn from this class?
- What research topic (inside and outside OS) are you interested in?

Administration

A brief overview of our schedule

- 2 lec OS (kernel) organization
- 5 lec File systems; Concurrency; Resource management
- (project proposal due)
- 1 lec Virtualization
- Midterm
- 4~5 lec File systems (local & distributed)
- 1~2 lec Distributed systems
- 2 lec Project Presentation

Things you will do (i)

- Paper reading
 - Form a reading group (2~4 people)
 - Fill a google sheet <https://tinyurl.com/cs331-spring22-signup>
 - Read the paper(s) BEFORE every class
 - Submit your paper review BEFORE every class
 - submit at <https://tinyurl.com/cs331-spring22>

Things you will do (ii)

- Come to class
 - Ask questions
 - Answer questions

- Class website

<https://www.classes.cs.uchicago.edu/archive/2022/spring/33100-1/index.html>

Things you will do (iii)

- A course project
 - Who 3~4 people group
 - When now
 - What
 - Decide topic & write project proposal (4/19)
 - Do the work
 - Final report (6/1) & group presentation (5/24, 5/26)

Things you will do (iv)

- Mid-term
 - April 28th
- Final
 - June ??

Grading

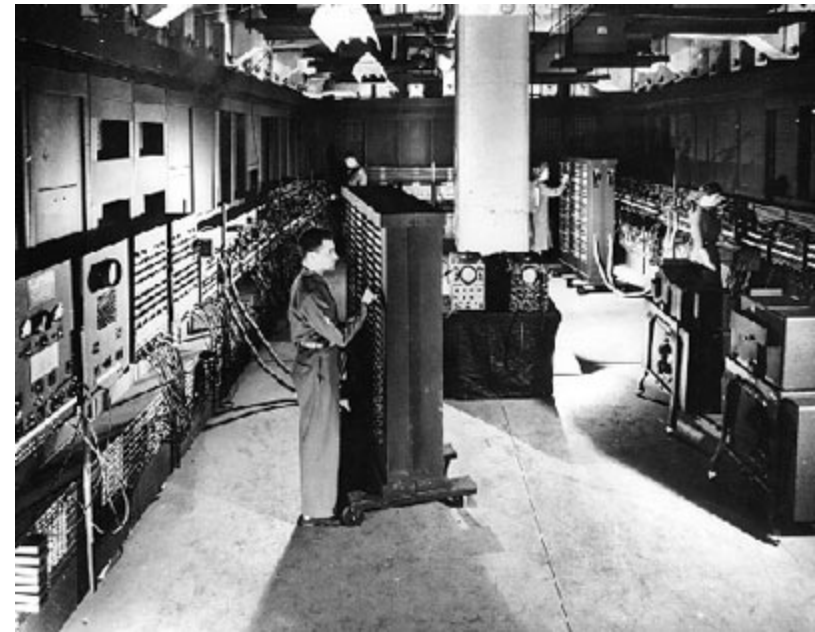
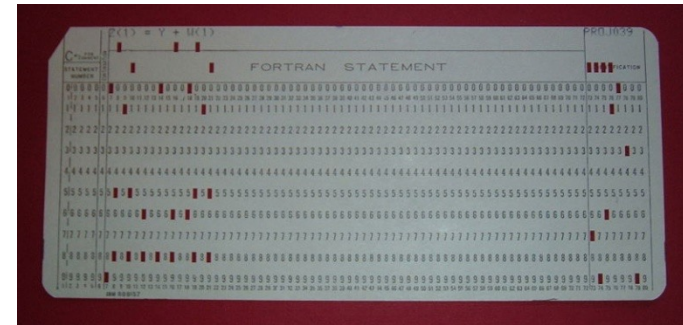
- 20% reading and class participation
- 20% mid-term
- 20% Final
- 40% course project

Summary

- Things to do
 - Form a reading group
 - Write a review for THE
 - Start thinking about project proposal
- Things to remember
 - This class is research oriented
 - System research is fun
 - Interact with your instructor 😊!

A brief history of OS (i)

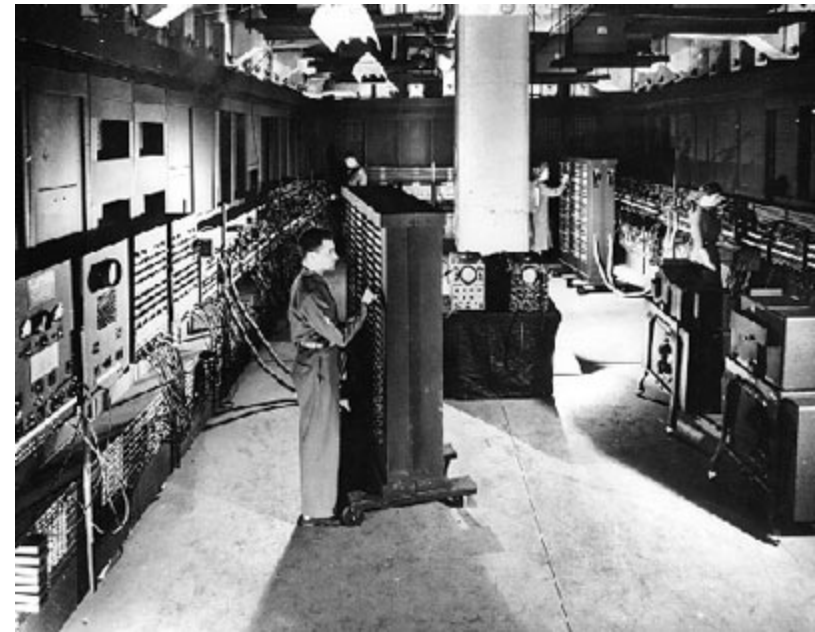
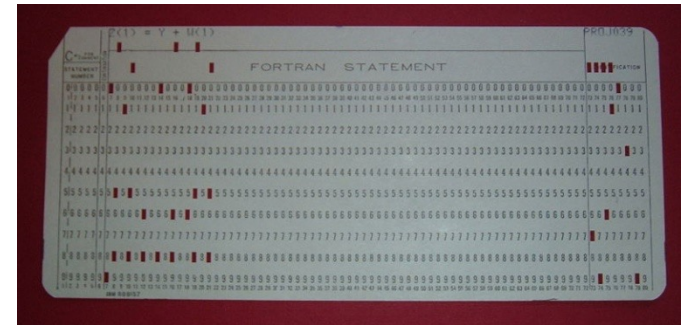
- 1st period (1940' s—1950' s)
 - Machine is very expensive
 - Most things are manual
 - Software
 - No high-level language



Q: was there OS? Why ...?

A brief history of OS (i)

- 1st period (1940' s—1950' s)
 - Machine is very expensive
 - Most things are manual
 - Software
 - Library, I/O device, compiler
 - No OS
 - Long software setup time



A brief history of OS (ii)

- 2nd period (1950' s)
 - Batching system
 - A deck of card/paper-tape at a time
 - Q: what does OS do?
 - OS is a loader
 - Handles interrupt, no scheduling
 - Magnetic tape (replaces paper tape)
 - Use separate machine to turn paper-tape to magnetic tape
 - Disk replaces magnetic tape
 - Reading to disk can go together with calculation (spooling)

UNIVAC



A brief history of OS (iii)

- 1960---1970' s
 - `advanced batch OS'
 - Virtual memory
 - Ease programming
 - Atlas [1961] a batch OS with spooling
 - Multi-programming
 - Improve CPU utility
 - THE [1968] 5-job at a time, s/w VM
 - DOS/360 [1966 IBM] 3-job at a time, no VM
 - Time-sharing OS
 - Human interaction becomes more important
 - CTSS [1962], Multics [1965~], Unix [1969]

A brief history of OS (iv)

- 1980' s
 - PC OS
 - Back to single-user and single address-space
 - Pilot [1980 Xerox]
 - PC-DOS, MS-DOS (single task)
- 1990' s--
 - PC OS goes back to old mainframe style
 - Multi-user, multi-task, protection, virtualization

Current OS research

- Complexity
- Reliability & Security
- Scalability
 - Multicore, cloud computing, edge computing
- Opportunities/challenges from new hardware/workload
 - SSD
 - Persistent memory
 - Sensors
 - Heterogeneity
 - Machine learning