ACS/Part III R209
Computer Security: Principles and Foundations

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Welcome!

- *Seminar-style* research readings module
- R209: Principles and Foundations (Michaelmas)
  - History, discourse, methodology, and themes
  - Topics include local systems, crypto/protocols, human factors, and economics
- R210: Current Research and Applications (Lent)
  - Guest conveners lead sessions on current research topics (usually current or past lab researchers)
  - E.g., censorship resistance, tamper-proof hardware…
- Ambitious scope, limited time

Prerequisites

Goal: transition from 'factual' understanding to engagement with core debates, intellectual history, methodology, evolution of the field

- Undergraduate degree in computer science
  - Or similar education/experience
  - Basic background in computer security
  - Also beneficial: OS, networking, programming languages…
- Some topics familiar, but cast as research not 'fact'
- Other topics will not yet be widely taught

Brushing up on computer security

Anderson, R. J., **Security Engineering** (2nd edition), Wiley, 2008.

Gollmann, D., **Computer Security** (3rd edition), Wiley, 2010.

McKusick, M. K., Neville-Neil, G. N., and Watson, R. N. M., **Design and Implementation of the FreeBSD Operating System** (2nd edition): *Chapter 5 – Security*, Pearson, 2014.

Seminar-style teaching (1)

- Preparation for research and development
  - Trace intellectual history
  - Study evolving vocabulary and discourse
  - Appreciate (+critique) research as published
  - Consider contemporary implications
  - Contrast with original research context
  - Discuss future research directions
- Student-led discussion is critical to this format

Seminar-style teaching (2)

Each week you will:

1. Critically read three original papers/reports

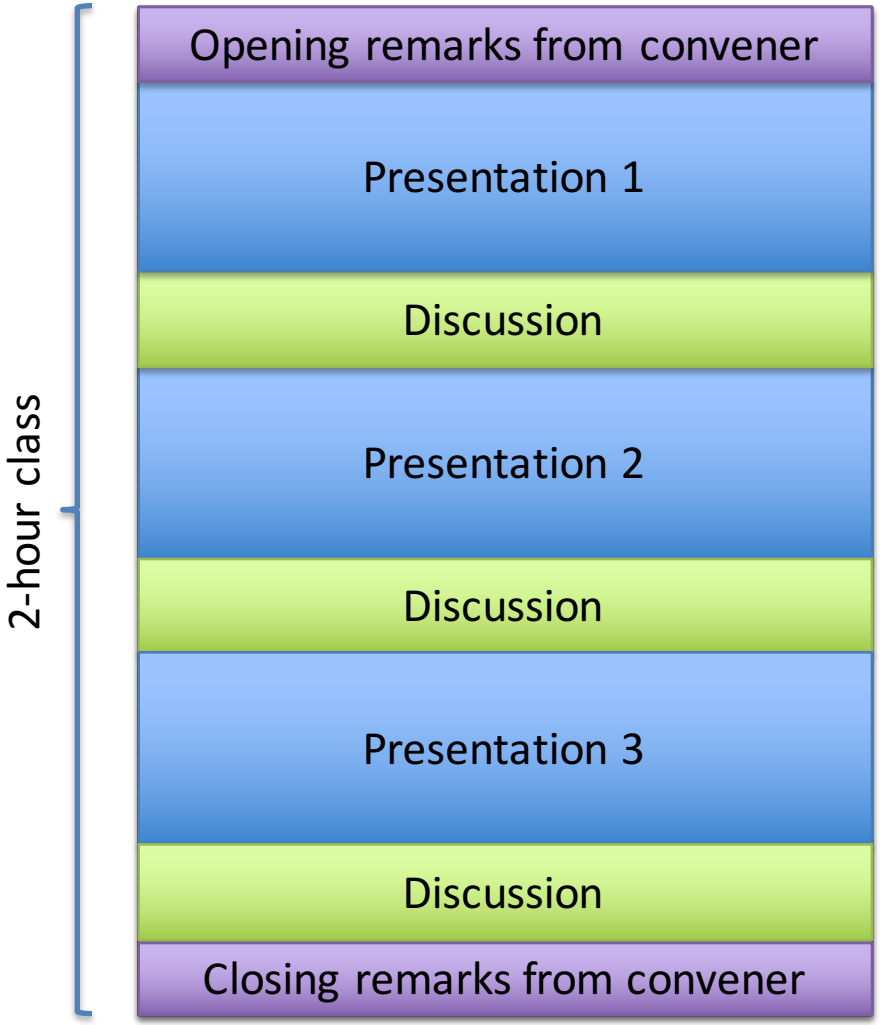
2. Submit synthesis essays across all readings

or

2. Present and lead discussion on a specific reading

3. Participate in classroom discussion of the readings

Typical class structure



- 3x 15–20-minute student presentations
- 3x 5–10-minute student-led discussions
- Discussions are cumulative: pull ideas forward as we look at later papers

Assessment

- One presentation or essay a week
  - R209: Seven total (none today)
  - R210: Eight total (hit ground running)
- Marking
  - 10 marks per assessed essay or presentation
  - Lowest mark each term will be dropped (usually the first)
  - Remaining scores scaled to a total out of 100
- Department aggressively penalizes late submissions
  - Instructors cannot grant extensions
  - Contact the graduate education office **as early as possible**

WEEKLY ESSAY

Synthesis Essays

- *Synthesis writing* reports, organizes, and interprets the work of others
  - **Not an original research paper!**
  - More a formulaic series of short answers than an essay

- Your essays will have the following sections headings:

1.	**Summaries of readings**	(1-2 para/reading)
2.	**Three common/key themes**	(1 para/theme)
3.	**Ideas in our contemporary context**	(2 para)
4.	**Brief literature review**	(2 para)
5.	**Class discussion questions**	(4 bullet points)

- All essays **must** include a bibliography
- NB: word limit (1,500) enforced; see the website for details

Notes on essay marking

- 10 divided equally across each of five sections

0	failed to submit
1-4	seriously lacking
5-6	poor or (minimally) adequate
7-8	good
9-10	exceptional

- First essay will likely have a lower mark than you hope
- If so, it will probably be dropped as the lowest

Essay Submission

- Deadline 12:00 on the Friday before we meet
- Submit on paper to the graduate education office
- E-mail as PDF to: cl-acs-r209-essays@lists.cam.ac.uk

- Bring discussion questions to class and be prepared to ask (and answer) them

- Marks/comments returned via the graduate education office; we usually e-mail them as well
- We attempt to return essays to you within two weeks, but sometimes this is not possible

Weekly Presentations

- 7 sessions, 3 talks/session, 15-20 minutes each
  - You will present at least once per term
  - No essay due for classes where you present
  - 10 marks per presentation; similar criteria to essays

- Initial presentation schedule has been e-mailed
  - If you like, you can exchange presentation slots…
  - Both students must agree; let us know in advance

Presentation Structure

- Prepare a teaching- or research-style presentation
  - ⟶ What motivated the work?
  - ⟶ What are the key ideas?
  - ⟶ How were scientific ideas evaluated?
  - ⟶ Critique the argument/evaluation
  - ⟶ Compare to related research – especially other readings
  - ⟶ Consider current-day research and applications
  - ⟶ Prepare for adversarial Q&A - defend the work

- Don’t just follow paper outline
- Slides without pictures (e.g., this one) are uninspiring!

Your Slides

- You will present with slides
  - All presentations will be on our computer
  - Slides will be in PDF format - no fancy animations
- Submit slides by e-mail no later than 12:00 on the Monday to cl-acs-r209-slides@lists.cam.ac.uk
  - Also submit on paper to graduate education office
  - Failure to prepare or submit will be heavily penalized due to disruption it will cause
- Usually presented in roughly syllabus order

Class Discussion

- Roughly half of each two-hour class is set aside for discussion
  - Bring discussion questions to class and be prepared to ask (and answer) them
- No explicit marks for participation…
  - … but presenter is rewarded for interesting discussion, so mutual benefit to participating!

READING

About the Readings

- Original research papers or early surveys
  - Highly cited and/or first appearance of key ideas
- Questions to consider (in advance)
  - Why have the authors done this work?
  - Has it aged well? Are the ideas used today?
  - How would we attack the system they propose?
  - Are they Science? Engineering? Mathematics? How does this affect the style, evaluation, etc.?
  - Why did we pick this paper and not another?
  - Is there a retrospective piece?

How to Read (a Lot)

- Read strategically
  - Plan ahead for the time it takes to read and digest papers
  - Skim in the first pass to decide what is important
  - Take notes in moderation
  - With practice, you will get much faster at reading papers
- As you read, highlight ideas that answer key questions:
  - Framing/motivation of the paper
  - Key ideas that influenced the paper / related work
  - Key contributions of the paper – and their implications
  - Evaluation approach, limitations
  - Common themes and ideas across the papers
- See Keshav's "How to Read a Paper", CCR 2007

ADMIN THINGS

Module E-mail and 'Hangers On'

- We will e-mail reading and schedule updates, clarifications, room changes, etc. there!
  - We will use your CRSid (via a class mailing list)
  - If you are not registered, but are sitting in, please e-mail robert.watson@cl.cam.ac.uk
- Recurring guests (e.g., PhD students, RAs) will be asked to present 1-2 times during the term
  - E-mail me to talk about which papers

Module Website

- Reading list, marking criteria, etc. found here:
  http://www.cl.cam.ac.uk/teaching/1516/R209/
- Beginnings of next term's website here:
  http://www.cl.cam.ac.uk/teaching/1516/R210/
- Look at the 'Materials', 'Assessment' pages
- Model, including presentations/essays/etc, remain the same for R210

How to Reach Us

robert.watson@cl.cam.ac.uk

ross.anderson@cl.cam.ac.uk

daniel.thomas@cl.cam.ac.uk

Essays: cl-acs-r209-essays@lists.cam.ac.uk

Slides: cl-acs-r209-slides@lists.cam.ac.uk

R209 Weekly Meetings

Date	Topic	Convener(s)
12 Oct	Origins and Foundation of Computer Security	Watson, Anderson
19 Oct	Adversarial Reasoning	Anderson
26 Oct	Access Control	Watson
2 Nov	Security Economics	Anderson
9 Nov	Capability Systems	Watson
16 Nov	Passwords	Stajano (guest convener)
23 Nov	Cryptographic Protocols	Anderson
2 Dec	Correctness vs. Mitigation	Thomas

R210 Weekly Meetings (last year's, but a good predictor)

Session	Topic	Convener
1	Covert and Anonymous Communications	Murdoch
2	Bootstrapping Security Relationships	Stajano
3	Mobile-System Security	Beresford
4	Censorship Resistance	Khattak
5	Psychology and Security	Anderson
6	Banking Security	Anderson
7	Vulnerability Management	Leverett
8	Hardware Security and Tamper Resistance	Skorobogatov

QUESTIONS

INTRODUCTIONS

TODAY’S READINGS