

# HOW SYSTEMS WORK: POLICY

Fletcher School, Tufts University — Fall Term

**This syllabus is likely to change before the 2021 session.**

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**Time:** Friday 10:30am – 11:45am    **Place:** Zoom

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**Instructor:** Laurin Weissinger, [laurin.weissinger@tufts.edu](mailto:laurin.weissinger@tufts.edu)

**Office Hours:** Monday, 11:00–13:00, Zoom

## Description and Objectives:

The course provides a technical grounding in the components of modern computer systems, their power and their fundamental limitations. We will look at:

- Hardware, the physical parts from which computers are built,
- Algorithms and software that controls modern computers (both low-level assembly language programming and high-level application programming)
- Theory and practice of information representation, i. e., how data are represented in the computer
- Networking, the mechanism by which multiple computers can communicate and work together
- **How all the above impact on policy and society, i. e., how these technical questions and systems interact with society, the economy, international security, etc.**

## Course Requirements:

1. **Attendance and Reading** – It is very important to attend each class and read the required reading. Attendance is mandatory.
2. **Briefing Paper**

A briefing paper is a short document that includes summaries of a particular issue (and potentially a suggested course of action). A briefing paper may be used by a policy specialist or an executive assistant to inform management or politicians about an issue.

The purpose of a briefing paper is to provide high-level information about a question or issue, discussing the background and context. It should be concise and pitched towards a non-expert audience. Briefing papers often include recommendations for what to do next.

A briefing paper should be under two pages and written and designed to be easy to read and absorb. Thus, briefing papers should be written clearly and without unnecessary jargon. Bullet points, lists, and charts are permissible, as they are easier to scan than dense paragraphs. Conciseness, clarity, and a good layout make readers aware of the highlights and key points; this in turn simplifies discussions, the completing of any related tasks, and related decisions.

**Topic:** Of your choice, please reach out and confirm your topic with me.

## Examples:

- Global microchip supply chains and their impact on national security

- Social media and targeted advertising
- Cybercrime: ways forward to deal with criminals.

**Deadline:** 11/22 23:59 Eastern

**Length:** 700-1100 words. The upper limit is the absolute maximum! Stay under or at two pages, e.g. if you are using graphs. Bibliography excluded; no standard referencing required (remember whom you are pitching to).

**Submission:** PDF via Canvas Assignment

**Assessment:** Standard letter grades.

### 3. Academic Paper

Fully referenced academic essay, pitched for the academic reader. Academic papers of this kind include an argument, i.e. you should be arguing for or against ‘something’.

**Topic:** Of your choice, please reach out and confirm your topic with me.

**Examples:**

- Internet Governance: current failures and a way forward.
- Infrastructure risks: Is China the problem for US critical infrastructure?

**Deadline:** 11/22 23:59 Eastern

**Length:** 2000-2400 words. The upper limit is the absolute maximum! Excludes bibliography.

**Submission:** PDF via Canvas Assignment

**Assessment:** Standard letter grades.

### 4. Class Presentation

Presentation on the weekly topic, introducing the class to the key questions and debates. We will assign people once we have a complete and final list. Please reach out to me on Wednesday before your presentations with the slides to discuss.

**Presentation Length:** 8-11 minutes.

Slides required, please provide the key points on the slides, and add a reference slide at the end. Everyone not presenting should be ready to make some notes and give feedback. This feedback will be collated and shared with the presenters.

**Assessment:** ✓+, ✓, ✓-, ✗ (A, A-, B+, I)

### 5. Grading

- 30% labs and homework — all students
- 11% briefing paper — Fletcher only
- 15% academic paper — Fletcher only
- 14% midterm — with small, Fletcher-only policy component
- 23% final — with small, Fletcher-only policy component
- 7% in-class presentation — Fletcher only

6. **Late Work** – Due to the current epidemic and the resulting hardship, uncertainty, and general inconvenience, we appreciate that learning will be difficult for some of you. If you have questions, need further explanation, or require accommodations, please reach out to us. Considering the current state of the pandemic and the world, we will do our best to help out and assist you with dealing with this unique and still novel situation for all of us.

That said, each student can have up to 4 late days, i. e., you may submit one assignment 4 days late or 4 assignments each 24 hours late. You do not need permission to use late days, but do alert us by the actual deadline that you are using them.

Again, for more severe issues, please email us.

### Course Overview:

1. Week 1: How are computers made?
2. Week 2: What are data, what is information?
3. Week 3: Data Analysis and Artificial Intelligence
4. Week 4: The Political Economy of Microprocessors: Production, Architectures, and Licenses
5. Week 5: Licensing: Closed and Open Source, Free and ‘unfree’ software
6. Week 6: The Craft, Art, and Complexities involved in making software
7. Week 7: How do programming languages evolve, what does that development mean to us?
8. Week 8: The internet, its history, and its inherent design tensions
9. Week 9: Who should govern the internet?
10. Week 10: The Management and Political Economy of Data Centers
11. Week 11: Break
12. Week 12: Internet Advertising
13. Week 13: The Digital World: Why are Complex Systems so hard?

## Class Schedule

All Readings can be downloaded directly from the Canvas Site

### Week 1: How are computers made?

- We will discuss the raw materials, resources, and global production networks that are needed to make microchips and computer technology.
- Reading:  
Chandler – How Computers are made  
Intel Corporation – From Sand to Silicon: The Making of a Microchip

### Week 2: What are data, what is information?

- We will discuss the theoretical and philosophical questions around data, information, and their representation.
- Reading:  
Jennex – Big Data, the Internet of Things  
Cooper – Data, information, knowledge and wisdom

### Week 3: Data Analysis and Artificial Intelligence

- We will discuss how can we analyze and ‘do something with’ data and information (theoretically and using computers).
- Reading:  
Whittlestone et. al. – The Role and Limits of Principles in AI Ethics  
Braga Logan – The Emperor of Strong AI Has No Clothes

### Week 4: The Political Economy of Microprocessors: Production, Architectures, and Licenses

- We will discuss the complexities of how microprocessors are made, and what role intellectual property and licenses play in the process.
- Reading:  
Shimpi – How ARM’s business model works  
Warner – Great moments in microprocessor history

### Week 5: Licensing: Closed and Open Source, Free and ‘unfree’ software

- We will discuss how licensing rules and software freedom matter to how we create and use software.
- Reading:  
The Free Software Foundation – What is free software?  
Perkins – Open Source and Capitalism

### **Week 6: The Craft, Art, and Complexities involved in making software**

- This session will focus on the socio-technical system of software production and how non-technical factors impact on code.
- Reading:
  - Clarke et al – A Complexity Theory viewpoint on the Software Development Process and Situational Context
  - The Computer History Museum – The Art of Writing Software (Video)

### **Week 7: How do programming languages evolve, what does that development mean to us?**

- We will discuss how programming languages change over time, how paradigms change, and how the new replace the old. How do these changes impact on / are influenced by the social world?
- Reading:
  - Chatley et al – The Next 7000 Programming Languages

### **Week 8: Global Systems: DNS root key rollover**

- This session will discuss the origins of the internet and the design and policy tensions that have existed since then.
- Reading:
  - DeNardis – The Internet Design Tension between Surveillance and Security
  - Leiner et. al. – A Brief History of the Internet

### **Week 9: Who should govern the internet?**

- We will discuss the struggle over who should (and who does govern) the internet.
- Reading:
  - Benkler – The Battle Over the Institutional Ecosystem in the Digital Environment

### **Week 10: The Management and Political Economy of Data Centers**

- This session will discuss the political, social, and technical relevance of data centers and associated considerations.
- Reading:
  - Google – Google container data center tour (Video) Danilak – Why Energy Is A Big And Rapidly Growing Problem For Data Centers

**Week 11: No class**

**Week 12: Internet Advertising**

- We will be discussing the impact of (targeted) advertising on internet services, the network, and society as a whole.
- Reading:  
Benzoni & Clignet – Internet Advertising

**Week 13: The Digital World: Why are Complex Systems so hard?**

- This final session will reflect on the previous sessions, discussing the implications of the layering of complex systems in digital society.
- Reading:  
Commission on Enhancing National Cybersecurity – Report on Securing and Growing the Digital Economy  
Anderson – Why Information Security is Hard