How Systems Work

(DHP D292, COMP 13)

DRAFT Syllabus DRAFT

Fall 2020

Course summary

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 *policy,* i. e., how they interact with society, the economy, international security, etc.

Recommendation: A programming course, e. g., COMP 10 or COMP 11.
Note: Fletcher School students should take the graduate version of the course (DHP D292).

Learning objectives

At the end of the course, students will understand the building blocks of modern computer systems, their power an limitations. They will be able to evaluate policy goals according to whether they are feasible, effective, economical, or possible at all based on that knowledge.

Instructors

Name	Office hours	Email
Mark Sheldon	Via Zoom, times TBA	`msheldon@cs.tufts.edu`
Laurin Weissinger	Via Zoom, times TBA	`Laurin.Weissinger@tufts.edu`

Textbooks and readings

Our primary, required text is: Brian W. Kernighan, *Understanding the Digital World: What You Need to Know about Computers, the Internet, Privacy, and Security*, Princeton University Press, 2017. You will need consistent access to this text throughout the term.

Other assigned readings will be provided online.

Evaluation

There will be one online midterm and an online final exam. There will be approximately 8 weekly hands-on laboratory and homework assignments. Fletcher students will also do one biefing paper, one academic paper, and a final in-class presentation.

Accessibility

We value the particpation of all students and want to ensure equal access and support for all qualified students. We will provide reasonable accommodations to ensure each student can fully participate in the course. The Tufts office for Student Accessibility Services (`https://students.tufts.edu/student-accessibility-services`) helps us accommodate students with special needs. Students with special needs should contact the SAS office in Dowling Suite 720 by emailing accessibility@tufts.edu

or by phoning 617-627-4539 and schedule an appointment to determine appropriate accommodation. Accoommodations cannot be applied retroactively, so it is important to do this right away.

If you qualify for accommodations, it is important to give that information to us as soon as possible — within the first 2 weeks of the term or within a week of adding the course. If you receive accommodations during the term, please send us the letter right away. This helps us plan to meet accommodations and support all the students in the course.

Academic integrity

AS&E students should be familiar with their school's policies on academic integrity (`students.tufts.edu/student-affairs/student-code-conduct/academic-integrity-resources`).

Fletcher students should be familiar with the Fletcher policy (`https://sites.tufts.edu/fletcherconnect/studenthandbook/`).

We take academic integrity very seriously and will report all violations we discover. It is never acceptable to represent someone else's work as your own. This means that you must identify all quotations and provide citations for quotes and ideas that you got elsewhere. While we encourage students to discuss course ideas and problem solving strategies at a high level, we expect each student to write up their own problem solutions, programs, papers, and exams. Programs are not different from papers in this regard — you may discuss strategies in English, but then write your own program. We may use auotmated tools for plagiarism detection.

Tentative course schedule

Week	Date	Monday lec	Tue	Wednesday Lec	Friday Recitation	Readings	Assignment out	Lab
0	07 Sep	*No class*		Welcome: Ask some questions that can be reviewed at end of term. Have them put things in survey submitted by Canvas	Welcome: Policy/policies you should be able to evaluate by end of course	As We May Think by Vanevar Bush	None	
1	14 Sep	Components of computer 1 (bring hardware)		Components of computer 2 (Start data representation?)	Hardware: who produces what? (What materials are needed, how do supply chains look like, why do these matter to us, the economy, and National security?)	BWK Ch. 1; short policy paper	HW 1: Calculations, estimation, distinguishing ephemeral vs. persistant, local vs. non-local storage	None
2	21 Sep	Representing information 1 (data + interpretation = information)		Representing info	What is data, what is information? How do we understand the world, how do computers understand the world? What are the consequences of these approaches?	BWK Ch. 2; short policy paper	HW 2: Image/audio/... ?	L1: Images and/or web pages?
3	28 Sep	How CPUs work 1 (TOY ASM		How CPUs work 2 (Start algorithms?)	CPU architectures and "struggles" between manufacturers: instruction sets, licensing, and specialization.	BWK Ch. 3; short policy paper	HW 3:	L2: ASM exercise? (simulator?)
4	05 Oct	Algorithms 1		Algorithms 2	Automated data processing: AI, ML, what they can and cannot do.	BWK Ch. 4; short policy paper	HW 4:	L3:
5	12 Oct	What is software?		Software IP?	Proprietary and open source software. Do licenses matter in the real world?	BWK Ch. 5 + JS intros on web; short policy paper	None	L4:

6	19 Oct	Software systems 1		Software system:	Software dependencies and supply chains; how is the sausage made?	BWK Ch. 6; short policy paper	HW 5:	None
7	26 Oct	Programming 1		Programming 2	From fortran to rust: how have our languages developed, why are they changing, and what does that do to computing and users?	BWK Ch. 7.; short policy paper	HW 6: Write a program	L5:
8	02 Nov	Networks 1	*US Electio*	Networks 2	Network infrastructure considerations	BWK Ch. 8; short policy paper	HW 7:	L6:
9	09 Nov	Internet 1	*10 NovTufts Wednesday* Internet 2	*No class*	Names, Numbers, and Coordination: how do we allocate resources?	BWK Ch. 9; short policy paper	HW 8 ?	L7:
10	16 Nov	WWW 1		WWW 2	Data centers	BWK Ch. 10; short policy paper	?	L8:
11	23 Nov	??? flex day		*No class*	*No class*			?
12	30 Nov	Online data 1		Online data 2	The political economy of internet advertising and tracking.			
13	07 Dec	Privacy/Security 1		Privacy/Security	*Security policy issues: National, organizational, and individual*	BWK Ch. 12, Trusting Trust?; short policy paper	None	None