How Computers Work
OLLI Boulder Winter Term 2020
Facilitator: Marc Rochkind
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303-917-8608 (leave a message, as I don’t usually answer my phone, but I will call you back)

8 Weeks, Monday 9:30 – 11:30 a.m.
Starting January 13, 2020
No required books, but occasionally an article might be recommended.

It’s important to attend all the classes, as each class builds on the previous class. However, if you miss a class, I’ll spend the first few minutes of each class on review and leftover questions. Also, I’ll update the class website each week so students who miss a class can see exactly where we left off.

Additionally, I’ll stay a while after each class to provide extra help to anyone who needs it.

We all use computers, but few of us have an understanding of how they work. This course will teach the inner workings of computers, from primitive ones (easy to understand) to modern, complex ones. Computer programming will be explained from the simplest programs to the most complex (e.g., Photoshop).

This course is not training on how to use a computer or software applications (just as explaining how a car works doesn’t teach you to drive one), and it’s not about fixing your current computer problems or what computer or software to buy. It’s also not a computer programming course, although computer programming will be explained, with actual running examples. However, the underlying principles that this course covers will better equip you to use your computer more effectively, since you’ll know what is going on inside.

This course is especially intended for those without a science or engineering background. The mathematics involved are very simple. The goal isn’t to cover a lot of ground. Rather, it’s to proceed carefully enough so that each student comes away with a real understand of how computers work.

This outline is broken into 8 parts, to match the course weeks, but the exact point where each class ends will vary from week-to-week, since the pace will be set by the students. We’ll leave no one behind!

I. Digital Logic (Week 1 – Jan. 13)
   A) Binary Numbers
   B) Logical Operations
   C) Adders
      [No class Jan. 20]
II. Basic Computer Architecture (Week 2 – Jan. 27)
    A) Computer Organization (CPU, memory, I/O)
    B) Simple Machine Instructions
    C) Machine Language
    D) Simple Programs
III. IBM 701 (1953) – a real computer (Week 3 – Feb. 3)
     A) The 701 Simulator
     B) 701 Instruction Set
     C) 701 Input/Output
     D) 701 Machine Language Examples
     E) Assemblers
     F) More 701 Examples
IV. Basic System Software (Week 4 – Feb. 10)
     A) PL/0 Languages
     B) Compilers
C) Other Languages
D) Modules and Linkage Editors

V. Higher-Level System Software (Week 5 – Feb. 17)
   A) Operating Systems (UNIX/Linux, MacOS, Windows, Android)
      1. Files
      2. Programs and Processes
      3. Multiprocessing and Multiprogramming
      4. Multi-users (“time sharing”)
   B) Databases

VI. Internet (Week 6 – Feb. 24)
   A) Transport Layer, IP numbers, and TCP/IP
   B) Internet Protocols: Email, FTP, Web
   C) Servers
   D) How Email Works

VII. The World Wide Web (Week 7 – March 2)
   A) Browsers
   B) Web Sites

VIII. Applications (Week 8 – March 9)
   A) Types of Applications (desktop, mobile, web)
   B) Example: Spreadsheet
   C) Example: Photoshop
   D) Example: Amazon