# Lecture 4 Outline

**Reading:** White, §5, 6, 10, 11

*Question for the Day:* Two MIT graduate students bought a number of used hard drives on E-Bay and analyzed them. They were able to recover lots of files, including files containing very personal information (such as medical records), and in some cases even restore the operating system of the computer to which the hard drive belonged. Some of these disks had simply been discarded, but others had files deleted, or were reformatted—and still the students could recover the files! As you will see, there is a simple way to prevent this. Why do you think the original owners of the disks did not use it? What might be done to encourage people and corporations who have sensitive data such as medical records to erase their disks securely before selling them?

1. Greetings and felicitations!
2. Operating system configuration
    a. Linux/UNIX systems: based on numerous configuration files scattered throughout system
    b. Windows: uses registry; keys are are indices used to look up information
        i. HKEY_CLASSES_ROOT: how system treats files based on extension
        ii. HKEY_CURRENT_USER: individual settings for this user, such as screen color
        iii. HKEY_LOCAL_MACHINE: the hardware and software, including configuration information and past hardware
        iv. HKEY_USERS: generic information, such as about user profiles and the desktop before users log in
        v. HKEY_CURRENT_CONFIG: configuration information about the current hardware and software
3. Ideas behind transistors
    a. Review binary system, bits
    b. Transistors combine to manipulate numbers, add them, and otherwise change them
4. Transistors and RAM
    a. Writing data to RAM
    b. Reading data from RAM
5. How a computer adds
    a. AND gate
    b. OR gate
    c. XOR gate
    d. Half adder
    e. Full adder
6. How a computer knows what to do
    a. Instructions
    b. Move instructions
    c. Arithmetic instructions (add, subtract)
    d. Branching instructions
    e. Other instructions
7. How the computer does it
    a. Fetch instruction from location given by program counter
    b. Increment program counter
    c. Decode instruction into operation code (opcode), addresses, other information
    d. Execute instruction, using addresses and other information as needed
    e. Fetch next instruction and repeat
8. How a disk stores data
    a. Boot block
    b. Disk space: cylinders, tracks, sectors or blocks; sectors grouped into clusters; free list
    c. Superblock or disk map
    d. Inode table, FAT, or VFAT; file, directory attributes
    e. Directory

  f. Space for files
  g. Reading, writing files
  h. Deleting files, and erasing files securely
9. Managing disks
  a. Defragmentation
  b. Compressing files