Assignment #1

CS106E Spring 2022, Young

In this assignment we explore some of the basics of how computers work. This assignment is due next Wednesday April 13th. Please submit it on Canvas before our lecture time of 1:30pm. If you haven't submitted files on Canvas before, I'd recommend you try submitting well in advance, so you can get some help if you have problems figuring out how to submit.

For this assignment, write up the answer to each question in either a text file, PDF, or a Microsoft Word file. At the top of the file include both your name and your partner's name. If you are doing the assignment by yourself put down "partner: none" just below your name in the file.

Please show your work for problems 4, 5, 6, and 7.

Computer Capabilities

In this section and the computer networks section only, feel free to get as much help as you want from friends, Stanford Tech Desk help, or any other techies around. Note that this rule for getting help **only applies for this assignment** and only for this section and the computer networks section. I recommend you first try to find this information on your own. If you get stuck or frustrated, we've has put up a detailed set of instructions for how to find this information at:

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http://www.stanford.edu/class/cs105/assign1/
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If you are unable to find a particular piece of information, such as the actual type of processor inside your computer, write down that you were unable to determine the requested information.

For this section, feel free to use your own computer, a friend's computer, one of the computers in the Lathrop Tech Lounge, or a computer in your dorm's computer cluster.

1. Find out information on the computer processor inside the computer. Find out what kind of processor is running inside the computer and how fast it is running.

2. Find out how much main memory (or RAM memory) is inside your computer.

3. Find out how large of a Hard Disk or Solid State Drive (SSD) you have inside the computer. Find out how much of that space is still available. If you have more than one disk drive, just list the information on your main disk drive.

Working with Bits and Bytes

As we've learned, all information inside the computer is ultimately stored as bits and bytes. In this section we delve a bit more deeply into what this means.

4. With one bit we have two combinations (0 and 1) giving us a range of numbers between 0 and 1. With two bits, we have four possible bit combinations (00, 01, 10, and 11) giving us a range of numbers between 0 and 3. With three bits we have eight possible bit combinations (000, 001, 010, 011, 100, 101, 110, and 111) which can be used to represent numbers from 0 to 7.

   Write out a similar list, in order, of all the possible combinations that can be represented in four bits. What is the equivalent range of numbers in decimal?

5. Since three bits can be used to represent numbers between 0 and 7, we could use three bits to store the size of most families. Three bits wouldn't be sufficient to store the number of students in a typical discussion section as they run anywhere from 15 to 25 students and three bits can only store numbers from 0 to 7.

   How many binary digits would we need to set aside in order to store the number of students in a 55 person dorm? How many binary digits would we need to set aside in order to store the number of students in a 170 person class? How many binary digits would we need to store the total number of undergrads at Stanford (currently there are 6,366 undergrads).

Computer Music

6. Given that CD music is sampled at 44.1kHz (kilohertz) at 16 bits and is stereo, how many bytes would a 3 minute song take? (Don't forget there are 8 bits per byte). How many bytes would the same song take if we converted it to an MP3 file using an encoding rate of 128 kilobits/second – note that the MP3 encoding rate does account for both left and right stereo channels.

7. DVD-Audio provides higher quality recording than CD music. On DVD-Audio a variety of different settings are available. The highest quality provides stereo sampling at 192kHz with 24-bit samples. Assuming no compression is used (i.e., we don't perform a frequency transformation and psychoacoustic analysis as with MP3 files) how much space would a 3 minute song take using the highest quality DVD-Audio format?

Computer Images

8. Using the provided JPEG image of Hoover Tower, try resaving the image at quality levels 60, 30, and 10 using the online JPEG compression tool at http://compressjpeg.com. For each quality level, what is the new file size? What sort of compression artifacts can you see as the quality decreases?

9. We have provided JPEG and PNG versions of a photograph of Hoover Tower and an image of the Stanford University Seal. Note that the PNG version of Hoover Tower takes up significantly more memory than the JPEG version, despite being the same resolution. However, the opposite result is true for the Seal. Given what you know about the JPEG and PNG file formats, why might this be?