CS101: HW 2

Due: October 10, 2018

Submission Instructions: Type your answers to the following questions in a .doc or .txt file and submit on Canvas. You will also need to submit your code **in a separate file**.

Bytes Exercises

1. Why do you think computers store integers differently from how they store words? In other words, why don't we store the number 31,245 as the characters "3", "1", "2", "4", and "5" in the same way that we say that the word "hello" is made from the letters "h", "e", "l", "l", and "o"?

2. As we discussed in class, Gangam Style got so many views that the view counter "overflowed" down to a negative number. YouTube reacted by changing their view counter to be stored in 8 bytes instead of 4 bytes. Why would a company choose to use 4 bytes over 8 bytes to store integers?

3. One bit can encode 2 patterns (0 or 1). How many patterns can five bits encode? How many patterns can 2 bytes encode?

4. Your friend is considering buying a new phone and wants to store 8 hours of music (in the form of MP3 audio), 3 2-hour movies, and 250 emails. Using the estimates provided in class, should your friend buy an phone with 8GB of storage or one with 16GB of storage? How much storage will your friend have left over after loading the songs, movies, and emails?

5. Each Tweet on Twitter can have at most 280 characters, a username of at most 24 characters, and three integers (for number of likes, retweets, and comments). Assuming each integer is 8 bytes and using the conversion of 1000 instead of 1024, how many tweets can we store on a 1000MB hard drive?

6. Why might a computer be slightly wrong when subtracting two decimal numbers?

7. Binary arithmetic: What is the result of the following arithmetic problems, assuming the result is stored in six bits? Please give the binary (not decimal) result.

   (a) 010010 + 001010

   (b) 010110 + 101011

   (c) 110010 + 110110

   (d) Bonus: 110110 - 011100

Compression Exercises

8. What is a downside of using lossy compression (when compared to a lossless compression scheme)? Why would a computer scientist choose to use a lossy compression scheme over a lossless compression scheme?

9. What is a downside of using lossless compression (when compared to not using any compression scheme)? Why would a computer scientist choose to compress their data?

10. In class, we talked about several compression schemes (such as Huffman for compressing text or MP3 for compressing music). Find another compression scheme, and describe what kind of data it compresses. Is it a lossless or a lossy compression scheme?

Variable Exercises

Complete the code exercises at `http://web.stanford.edu/class/cs101/code-2-exercises.html` and submit them on Canvas **as a separate file**. You should collect all your code by clicking the "retrieve code" button at the bottom of the page, then copying and pasting the code into a new document.

11. What is the output of the following code?

```
x = 4
y = "cs101"
print(x, y);
y = "9"
print(x, y);
print("x, y");
```

Be sure to include line breaks when appropriate.

12. For this question, assume integers are stored using 4 bytes. How much memory is used to store y when y = "cs101"? When y = "9"? How much memory is used to store x at the point that x = 4?

13. Describe one situation where you should use a variable.

Below are the homework questions relating to Thursday's lecture

Digital Images

Complete the code exercises at `http://web.stanford.edu/class/cs101/image-2-exercises.html` and submit them on Canvas **as a part of the earlier code file**. You should collect all your code by clicking the "retrieve code" button at the bottom of the page, then copying and pasting the code into a the document with your variable code.

14. Why are digital images comprised of pixels? Hint: think about how a digital camera works.

15. Describe the camera specifications on your phone. What type of phone do you have? How does this compare to your first phone's specifications (use the internet to find the camera of your first phone, and please tell us what kind of phone it was)?

16. Play around with the RGB explorer: what is the secret to making shades of grey?

17. Describe how to make the colors light blue and brown.

18. What happens if you call `pixel.setRed()` with a number greater than 255? What if you call it with a number less than 0?

19. What happens if you call `image.getPixel` with a row or column that is larger than the number of rows in the image? What if you call it with a negative number?

20. What is the difference between LCD and OLED technology? Briefly describe how each one works and an advantage of each one.

21. What is the screen resolution of the computer you're using to write this pset? Give the dimensions in inches, the dimensions in pixels, and the resulting dots-per-inch. You can use the display tab in "About this Mac" or the Resolution in Control Panel if you're using Windows.