CS 5200 Spring 2018 HW 05

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Due Monday, April 23, 2018, 11:59PM

Submit your HW as follows: ontaining the following:

1. A PDF file that contains all the answers to the individual questions, all pictures, all code, and all code output. This should all be well-organized and attractively laid out. This file will contain all the grading feedback after your work is graded.

2. A ZIP file for all Python programs and input files. Also include any other files that you want considered in this Zip file.

Problems

All the problems are from the Cormen, Leiserson, Rivest, and Stein book.

1. (15 points) Do Problem 10.1 on p. 249.

2. (10 points) Do Problem 11.2-2 on p. 261.

3. (15 points) Do Problem 11.4-1 on p. 277.

4. (10 points) Do Problem 12.1-1 on p. 289.

5. (10 points) Do Problem 12.1-2 on p. 289.

6. (10 points) Do Problem 12.2-1 on p. 293.

7. (15 points) Let B be a solid such that each face is either a square, a pentagon or a hexagon. Furthermore, the solid B has no holes in it, i.e., it has genus 0. Prove that the number of squares, S, and the number of pentagons, P, in B satisfy the formula $2S + P = 12$, assuming that exactly 3 faces meet at each vertex. (Hint: Recall Euler's formula for genus 0.)

8. (15 points) Write a program that will do the following:

   (a) Find a 12 digit number, p, that you can verify is prime.
   (b) Pick a subset S, consisting of 100 integers at random from 0 to p-1 (explain how you are sure that you are picking using the uniform distribution).

(c) Let m be 200. Pick 50 random functions of the type described in Theorem 11.5 on page 267 of the book and look at the average number of collisions for each of these hash functions. In other words, if h:S → {0,...,m-1} is a hash function, let Col(h) = the number of pairs (x,y) , with x and y in S, x !=y, and h(x) = h(y). I expect you to count (a,b) and (b,a) as separate pairs, even though they really are the same pair. Once you have the values for each of the 50 functions, you can then average these values.

(d) Explain how well the result in (c) above compares with the theoretical results.