CS 5200 Fall 2019 HW 04

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Due Friday, October 18, 2019, 11:59PM

Submit your HW as a single 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.

Problems

Problems 1–6 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. Using Euler's formula, 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.
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 $\rightarrow$ {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.