Final Exam Study Guide Computer Science 311 Fall 2019 Gardner/Rager

If you currently have an A in the course, you do not need to take the final exam. We will let you know this week whether that applies to you.

The final exam for this course is cumulative. The topics listed below are in addition to the topics listed on the study guides for the first and second midterms.

1. **Standard algorithms**: You should understand and be able to hand simulate all of the following. **In order to pass the course, you must demonstrate your understanding of the key algorithms we've covered in class this semester**:

a. Sorting algorithms: insertion sort, selection sort, heapsort, mergesort (divide-and-conquer), quicksort (divide-and-conquer)
b. Dijkstra's algorithm (Greedy)
c. Prim's algorithm (Greedy)
d. Kruskal's algorithm (Greedy)
e. Bellman-Ford (Dynamic programming)
f. Ford-Fulkerson

2. **Runtime analysis**: Given an algorithm, you should be able to describe its running time. (Describe the running time means give a convincing albeit informal argument, not merely state. We did not discuss the runtimes of all the algorithms we covered in class, but in general you should be comfortable reasoning about the running time of a given piece of pseudocode.)

3. **Algorithmic paradigms**: You should understand the three major paradigms: divide-and-conquer, greedy, and dynamic programming.
a. You should be able to give examples of these algorithms
b. Given a novel problem, you should be able to devise an algorithm. We will tell you which paradigm to use.

4. **NP-completeness**: You should know the definitions of P and NP.
a. You should be able to explain the implications of giving a polynomial time reduction from problem X to problem Y.
b. You should understand what it means for a problem to be NP-complete, and you should know what you'd need to do in order to prove that a new problem is NP-complete.