What should you expect to learn from DS 320?

Skills: Skills will be demonstrated in lectures and suggested readings, and will be practiced in homeworks, exams, and discussion sections.

1. Getting comfortable understanding and writing formal definitions and statements.

2. Creative problem solving and thinking algorithmically.

3. Writing clear and convincing arguments.

4. Domain-specific skills: Identifying algorithmic problems within applications; determining when to apply which technique; analyzing runtime.

Knowledge: Lectures will cover all methods and proof techniques that you are expected to know; suggested readings will go into further details.

5. Specific algorithmic methods.

6. Specific proof techniques.

How is this course different from CAS 330? How is it Algorithms *for Data Science*? This course will parallel a typical introduction to algorithms course—the skills and basic methods covered in one—while focusing more on methods and applications that are most relevant in data science. We will cover basics from a typical algorithms course, such as sorting, greedy, divide and conquer, dynamic programming, max flow. Within the more standard topics, some of our applications will be focused more on methods and applications relevant in Data Science, i.e. Fast Fourier Transform. The more "standard" topics will be somewhat abbreviated, and in the second-half of the course, we will foray more into concepts imperative for handling data such as multiplicative weights, linear programming, etc.

Which is most important? In my opinion, it is significantly more importantly to develop skills than to learn specific knowledge. This means, in my opinion, that your time is much better spent engaging with homework problems than on reading additional material. In my opinion, the skills are listed in decreasing order of importance, so $1 > 2 > 3 > 4$.[1] In this course, you should develop as a problem-solver. **The goal of the course is not for you to learn specific solutions to interesting problems, but to learn *how* to solve interesting problems.** This is a slight oversimplification, but hopefully makes the distinction clear.

Will I need to know lots of math? No, but you'll need to engage deeply with formal arguments and sometimes basic probability. This isn't a math class, and the goal isn't to teach you math. Some problems will require you to be creative with math, but nothing too advanced.

On the flip side, some problems may be challenging just to phrase as a math question, and you should expect to spend a little bit of effort just to figure out exactly what some problems are asking.

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[1]But this isn't universal: for instance, if you're a math major taking four classes a semester that grill 1 and 3, probably you should hope to learn most about 2 and 4.