Advanced Algorithms, Homework n+1=8

TODO-Put Your Name Here

due: 23 November 2020

This homework assignment should be submitted as a single PDF file to to Gradescope.

Write a two-page paper describing to me how you have grown as a student, computer scientist, mathematician, engineer, or a researcher in this class, and more generally, in this semester. To support your argument, you should include your homework or writing samples (or excerpts from them) in an appendix as evidence (and reference them!)

If you do not feel that you've grown, explain why.

Remember, style counts. Use complete sentences.

This HW will be graded on the following scale:

- No submission (-1 point)
- Low pass (+1 point)
- Pass (+3 points)
- High Pass (+5 points)

Gosh I know the intention of this one was to get us thinking, but I really got thinking.

Commentary

It could be argued the driving force of the university system at large is a common desire for personal growth. The hope would obviously be to, even if accompanied by catastrophe, develop some aspect of yourself during each course. One thing I very recently noticed is every course I have taken from Brittany seems tailored to probe and challenge each student's goals. The first assignment at the beginning of the semester tried to get us to define what our goals for the course were - be it skills or a check mark on degreeworks(figure 1). One metric for gauging this growth, I suppose, would be to see if my answers to these preliminary questions change at all - and I do think they would. The interesting part of growth, though, is it is totally state dependent. Obviously(?) the person I was at the start of the semester is some sort of subset of who I am now, but that does not mean my goals then were inalid or wrong. Anyways, lets dive into the list of things I think I developed as a person!

1 Algorithms

The staple development. I was briefly exposed to algorithm proofs from Computational Topology, but I definitely wanted a more thorough exploration of standard techniques involved in verifying algorithms. The big ideas I learned are encompassed in the techniques used to prove correctness and termination of a wide variety of algorithms. I know I mentioned it in previous assignments, but I do like loop invariants a lot. When writing code it is so easy to start slinging out code without thinking too much about why it is right, at least for me. I can always convice myself it is correct, but pinning down the justification in a communicable way is really cool to me. Other examples include the exchange principle and stochastic expected runtime algorithms.

2 Communication

Can anybody really overstate the importance of communication. David A. once toldour class he thought the most impactful invention ever concieved by mankind was the alphabet (or language). I do think it is a kind of intimidating thought experiment to imagine life in a time where the forefront of research was developing a standard of noises that determine the conduit of thought and all meaning. In this course, though, I think it is clear I have been able to improve my communication. One of my biggest weaknesses (ONLY weaknesses ;)) has always been my ability to get people up to speed with where my mental train of thought is headed. I think my exposure to abstract math and algorithms has probably helped most in reigning in this weakness, but there were several classes where I really think I improved my proofs and reasoning. Evidence in this success is my scores on my proofs. Traditionally, I would get at least one or two junk proofs in a semester but this time around I got none!!! My impressive homework grades are a result of another of my trademark characteristics $\# - 5/5$ $\#didn't do the piazza posts$ $\#missed homework6$ $\#sleep >> not sleep$. Finally I have to note the conversation we had about how to be sure a proof is complete. The idea here was I noticed I often times find one property of a problem and run away with it. I make some conclusions based on the assumption where the property I found completely describes the problem. This is obviously not always true, however, and I think the discussion we had about restricting degrees of freedom is a good analysis tool to

have in my back pocket.

3 Writing

Every class includes writing of some sort and when I am writing for you, I do not forget my lessons... You may be wondering what I am talking about here... But let me ask you this question - How many times have you seen me start a sentence with 'This' or 'There' throughout the semester??? BOOM. The clarity has been permanently improved. Not really a direct consequence of the course, but in a sense it kind of is.

4 Student

I need no introduction to make the claim I have historically been a less than ideal student. By this I mean slacking off on both attendance and homeworks. The only way I was able to stay afloat in school was because I got lucky. The cool thing right now, though, is I think my poor student days may be over. Just in time too, because I get to graduate soon (sarcasm)! I really can't say it was anything in particular relation to this course, but it is kind of a big deal for my future. My diagnosis was poor organization/time management which can obviously be seen based on the stunning lack of piazza posts on my homework. However, you can clearly see towards the end of the semester where my attendance stopped flaking. Honestly I think this was the main thing holding me back as a person so I am kind of psyched haha.

5 Suggestions

I know one of the major things I wanted to learn about but didnt get a chance to was algorithm approximation. Talking about theoretical optimums and perturbation theory would be a super awesome course in my opinion, and I think it definitely has the potential to fall under the jurisdiction of 432.

Hopefully I have successfully hit 2 pages here. Thanks for the great course, as per usual, and have a FAN-TASTIC break/snowmester, whichever boat you managed to land on.

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Answer the following questions:

1. What is your elevator pitch? Describe yourself in 1-2 sentences.
   I am a curious guy who loves to explore things. I love math, theorycraft, and hope to discover/create something meaningful.
2. What was your favorite CS class so far, and why?
   Either CS theory with Sean or computational topology with you. I loved the class content and structure of CS theory, but I think the power of data science, especially topological data science, is unprecedented.
3. What was your least favorite CS class so far, and why?
4. Why are you interested in taking this course?
   Mainly because I want to graduate, but formally taking a class on proving properties of algorithms is no doubt on my list of important things to know.
5. What is your biggest academic or research goal for this semester (can be related to this course or not)?
   I want to work hard and contribute something meaningful to the research field.
6. What do you want to do after you graduate?
   Work a career where I can use what I learned in school to better peoples lives - I think a good candidate is medical research. I also want to be respected enough in my field to have a free pass to be as ridiculous as I deem necessary.
7. What was the most challenging aspect of your coursework last semester after the university transitioned to online?
   Staying engaged in school
8. What went well last semester for you after the university transitioned to online?
   A whole lot of freedom to schedule things when it worked best for me.

Figure 1: Homework1 goals

Chapter 4, Question 1 (Greedy Schedule). I encourage you to think through all 9 alternative schedules. However, you only need to hand in two:

1. Choose one alternate strategy that works, and prove that it works.

   Option i) Suppose we have an optimal solution that differs from our greedy algorithm. Suppose we could exchange the option in our solution x with two or more courses (in the optimal), y, z. Since they are replacing our single course, they must both conflict with x. We know our course contains no courses and ends last, meaning y, z starts before x. Thus y, z conflict with eachother as well. Then the size of our solution is equal to the size of the optimal solution.

2. Choose one alternate strategy that does not work, and give a counter-example.

   Option a) choosing the course x that ends last and discarding classes that conflict is incorrect. The easy counterexample is if x is super long and every other class is contained within x.

Figure 2: Homework 5 Example proof

Tuesday 09-25	0 / 1	0 %
Thursday 10-01	0 / 1	0 %
Tuesday 10-06	1 / 1	100 %
Thursday 10-08	1 / 1	100 %
Tuesday 10-13	0 / 1	0 %
Thursday 10-15	0 / 1	0 %
Tuesday 10-20	0 / 1	0 %
Thursday 10-22	1 / 1	100 %
Tuesday 10-27	0 / 1	0 %
Thursday 10-29	1 / 1	100 %
Thursday 11-5	2 / 1	200 %
Tuesday 11-10	1 / 1	100 %
Thursday 11-12	1 / 1	100 %
Tuesday 11-17	1 / 1	100 %

Figure 3: My attendance towards the end of the semester